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The IAD Framework in Action: Understanding the Source of the Design Principles in Elinor Ostrom's Governing the Commons

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The Institutional Analysis and Development (IAD) framework should be understood as a starting point for analysis of complex policy situations. This framework, which is most closely associated with the work of Elinor Ostrom, a corecipient of the 2009 Nobel Memorial Prize in Economic Sciences, has been shaped by contributions from many of her large community of collaborators. This framework has undergone a series of transformations, and even after Ostrom's untimely death in 2012, it continues to undergo significant changes, transformations, and extensions to new topics (see Kiser and Ostrom 1982; Ostrom 1989, 2007, 2010, 2011; Oakerson 1992; Ostrom, Gardner, and Walker 1994; Ostrom and Ostrom 2004; McGinnis 2011a; Cole, Epstein, and McGinnis 2014).

This chapter is based on notes that I distributed to graduate students in my seminars on Institutional Analysis and Development in previous years. These notes are intended to serve as a guideline to anyone first trying to apply the abstract concepts and analytical tools included in this framework to a detailed study of some specific policy problem or concern.

Overview of Steps in Analysis

1. Decide if your primary concern is *explanation of a puzzle* (why does outcome X occur in cases like Y, but not in cases like Z?) or *policy analysis* (what is likely to happen if current policy A would

- be replaced by policy B? What would need to be done in order to implement B?).
2. Summarize two to three plausible *alternative explanations* for why this outcome occurs, or why your preferred outcome has not been realized; express each explanation as a *dynamic process*.
 3. *Identify the focal action situation(s)*, the one (or a few) arena(s) of interaction that you consider to be most critical in one or more of these alternative explanations.
 4. *Systematically examine categories of the IAD framework* to identify and highlight the most critical (1) actors in positions, (2) rules-in-use, (3) attributes of relevant communities, (4) types of goods involved and biophysical dynamics, (5) evaluative criteria, and (6) feedback loops and sources of learning in these focal action situations.
 5. *Follow the information flow* in each of these focal action situations. What sources of information are available to which actors under which circumstances, and what might prevent them from using that information to change the outcomes that result?
 6. *Locate adjacent action situations* that determine the contextual categories of the focal action situation, that is, outcomes of adjacent situations in which collective actors are constructed and individual incentives shaped, rules are written and collective procedures established, norms are internalized and other community attributes are determined, goods are produced and inputs for production are extracted from resource systems (that may need replenishment), and where evaluation, learning, and feedback processes occur.
 7. *Select those adjacent action situations* that are critical for distinguishing among alternative explanations, and repeat steps 4 and 5 (and if necessary, step 6) for those action situations.
 8. *Compare and contrast the ways these linked and nested action situations are interrelated in the processes emphasized by each of your alternative explanations*. Do the same actors write, implement, and enforce rules? How do outcomes of other action situations shape processes of information flow and evaluation in the focal action situation(s)? Which incentives or values of actors are reinforced or undermined by outcomes of these action situations?
 9. *Identify the most critical steps for more detailed analysis*, by isolating components of adjacent action situations that determine the context currently in place in the focal action situation(s), and that if changed would result in fundamental changes in outcomes. But remember that if you change one contextual factor in one action

situation, then you must also incorporate all relevant changes in closely related action situations. (Ceteris paribus is more complicated in institutional analysis!)

10. Draw upon principles of research design or evaluative research to *select cases* for further analysis by whatever *methods* are best suited to that purpose. *Follow relevant conventions when writing up your conclusions*; DO NOT describe this process of discovery in detail.

Example of Application to Community-Based Management of Resource Commons, as Exemplified in Elinor Ostrom's *Governing the Commons*

Ironically, Elinor Ostrom makes only a passing reference to the IAD framework in her best-known and her most highly influential book, *Governing the Commons* (1990). In later books, especially *Understanding Institutional Diversity* (2005), she dove into the details of this framework as an analytical perspective, but since *Governing the Commons* was designed (successfully!) to reach a wide and diverse audience of scholars, practitioners, and non-specialists, the analytical apparatus that provided the foundation for the conclusions she summarizes in that book remain hidden from the reader. But those of us who had the good fortune to get to know her closely can see the influence of the IAD framework permeating throughout her writings, in this book and elsewhere.

It's safe to say that scholars who are selected for Nobel prizes tend to see more deeply into the core foundations of the things they study, and the thought processes they have used to arrive at their unique insights are infused with a heavy dose of creativity and subtlety. This makes it impossible for others to fully understand how they arrived at their conclusions, even once we have come to understand the implications of their discoveries.

Ostrom identified a set of eight Design Principles that she described as characterizing those instances of community-based resource management regimes that managed to stand the test of time, proving resilient to the many vagaries of environmental, political, and demographic shocks and transformations. Even she found it difficult to express how she managed to arrive at these insights, which she always framed as not being the end point of analysis, but instead as a set of conjectures that needed to be subjected to further analysis, elaboration, and revisions.

Below I suggest a way in which these design principles can be understood as emerging from Ostrom's engagement with the complexity of her case studies, with her thought processes being shaped, in a fundamental sense, by the categories and relationships expressed in the form of the IAD framework. I am not claiming that this is the actual process through which she reasoned her way to these conclusions, and any effort to make such a demonstration would have to be undertaken by an expert in intellectual history or biography. But I am confident that these principles can be understood as emerging, in a natural sense, from the repeated application of the foundational principles of the IAD framework.

The remainder of this chapter consists of my effort to illustrate how we might understand the conclusions that Elinor Ostrom articulated in *Governing the Commons*, if we go through the exercise of implementing the steps stated above in the context of the case materials that formed the empirical foundation for her research on this topic. I present this exercise in the form of observations and interpretations of the implications of each of the ten steps identified above as the steps needed to fully implement an institutional analysis along the lines of the IAD framework, properly understood.

Before diving into these steps, however, I feel it necessary to reassure any reader who might be intimidated by the magnitude of the analytical task summarized here to remember that this particular research project was so comprehensive and influential as to merit the highest forms of praise (as signified by her Nobel). Even those of us who do not pretend to be able to operate at that same level can make effective use of at least some of the steps identified here, as we strive to make our own contributions to the existing store of knowledge on important policy matters.

1. Decide if your primary concern is *explanation of a puzzle* (why does outcome X occur in cases like Y, but not cases like Z?) or *policy analysis* (what is likely to happen if current policy A would be replaced by policy B? What would need to be done in order to implement B?).

Research Puzzle: Garrett Hardin concluded that all commons are doomed to exhaustion, unless managed by a central authority or divided up into private parcels, yet many such commons persist for very long periods of time. How can that happen?

Policy Concern: What can be done to improve the sustainability of common-pool resources? Can similarly successful processes occur in different ways under diverse ownership schemes and governance arrangements?

Note: Elinor Ostrom was a firm believer in the importance of research design as the foundation for good research in the social sciences. She routinely taught our introductory graduate seminar for first-year students as a review of alternative forms of research design, and this example has inspired me to make it clear that students interested in either primarily academic research or in more practical policy analysis can feel equally welcome in applying this form of institutional analysis. The Workshop in Political Theory and Policy Analysis that Elinor and Vincent Ostrom established at Indiana University in 1973 was widely known for its unique ability to combine scientific rigor and policy relevance within the scope of each of its many research programs. Few of us will be able to be equally successful in both academic and policy arenas of discourse, but I am convinced that the IAD framework can help clarify and deepen our lines of argument in either context.

2. Summarize two to three plausible *alternative explanations* for why this outcome occurs, or why your preferred outcome has not been realized; express each explanation as a *dynamic process*.
 - A. *Hardin's tragedy of the commons explanation* (1968) is based on the presumptions that (1) individual resource users will extract more resources in order to maximize their own returns, but (2) any such resource is limited and must be replenished by processes that are themselves limited, and that (3) if no one takes responsibility for matching the overall level of extraction to the carrying capacity of that resource, then the result will be overuse and collapse of the resource. However, this tragic outcome can be avoided if the common resources are privatized or managed by a central authority. In effect, Hardin distinguishes among three alternative governance models:
 1. *Tragedy of the (open access) commons*: Resource levels are determined by exogenous forces, and since no one has taken responsibility to replenish resources or maintain relevant infrastructure, eventually any uncoordinated efforts will prove to be insufficient to avoid collapse.
 2. *Privatized commons*: Individual property owners manage and maintain their own private property in a cost-efficient manner, but need not be concerned about anything beyond that. In this model, the commons will become a market.

3. *Centrally managed commons*: Rules for use and maintenance of resources are set and enforced by external actors, and local herders respond to those incentives, provided they are adequately enforced. If these managers are sufficiently competent, the resource should be sustainable (if that is their goal).
 - B. Ostrom (1990) demonstrates that communities of resource users can, in some circumstances, devise and enforce rules limiting their own extraction levels and maintenance activities, and that these efforts may be successful in maintaining sustainable access to that resource over long periods of time. However, in other circumstances, Hardin's tragic conclusion may well apply. In effect, Ostrom adds a fourth possible model of resource management, namely,
 4. *User-managed commons*: All (or most) of the rules for use and maintenance of resources are set and/or enforced by local users, and under certain conditions this arrangement may turn out to be sustainable.
3. *Identify the focal (or core) action situation(s)*, the one (or a few) arena(s) of interaction that you consider to be most critical in one or more of these alternative explanations.
 - A. *Appropriation* of resource, combined with its natural renewal or replenishment.
 - B. *Maintenance* of resource, including artificial replenishment and any infrastructural improvements.
 - C. *Rule-making*, the collective process of formulating rules and procedures for individual participation in appropriation and maintenance activities.
 - D. *Monitoring* of how closely actual appropriation and maintenance activities satisfy applicable rules and procedures, *and sanctioning* rule violators.

Other related action situations are considered below, but these four are the most fundamental ones for this setting. The first two—appropriation and maintenance—might be assigned an even more importance than the other two, because there is no need for monitoring and sanctioning if there are no rules, and because appropriation and maintenance may occur in the

total absence of rules. However, for all practical purposes, it is not possible to imagine an entirely ruleless social setting, especially if rules are allowed to be informal in nature.

Note: Ostrom, Gardner, and Walker (1994) clearly differentiate between the appropriation and provision dilemmas in their game models of common-pool resource (CPR) situations. They use the term “provision” to encompass all replenishment and maintenance activities because this part of the CPR situation corresponds to a public good, at least for members of the user group. When they move to setting up experimental versions of this generic model, they, as the experimenters, make the rules that the participants must follow, as well as any rules concerning how those participants may select different types of monitoring and sanctioning regimes. Even in this very abstracted version of a generic CPR situation, all four of these action situations are deeply interconnected.

4. *Systematically examine categories of the IAD framework* to identify and highlight the most critical (1) actors in positions, (2) rules-in-use, (3) attributes of relevant communities, (4) types of goods involved and biophysical dynamics, (5) evaluative criteria, and (6) feedback loops and sources of learning in these focal action situations.
 - A. *Appropriation*: Actors (users) may extract resource units from common-pool resource system for personal use (consumption, exchange, or production), and each of them may or may not follow rules on level, time, and technology of extraction, may or may not be closely connected to each other in a tight community, and may or may not be able to observe information on quality and quantity of resource available for use.
 - B. *Maintenance*: Actors (users and/or others) may or may not contribute time, money, and/or effort to collective activities to replenish resource and/or to construct and maintain infrastructure for resource extraction, may or may not follow rules on level, time, and technology of effort, may or may not be closely connected to each other in a tight community, and may or may not be able to observe information on quality and quantity of resource available for use.
 - C. *Rule-making*: External authorities and/or local actors may or may not participate in formulating formal or informal specifications of who has legitimate access to resource system, as well as limitations on level, time, and technology of extraction.

Rule-makers may or may not be the same people as those who appropriate or maintain resources, and are generally not able to directly observe compliance with the rules they have written.

- D. *Monitoring and sanctioning*: Those actors who can directly or indirectly observe appropriation and maintenance activities and determine if relevant rules have been violated and then decide whether to impose sanctions on rule violators, may or may not be same people as those who appropriate or maintain resources or who write these rules.

Notes:

- *Evaluative processes* (involving individuals, organizations, or informal groups) can take place in any of these settings, and evaluations may occur before, during, or after the making and implementation of any of the key decisions being made in each of those action situations. For some cases, these evaluations can be treated as if they take place in separate action situations, while in other cases the evaluation step is too closely associated with decision-making or implementation for such separation to be analytically useful.
 - In some situations, the same set of actors may play dominant roles in all four of the core action situations. In such an “idealized” situation of a *user group* as a *self-governing community*, those who appropriate resources are also responsible for replenishing or maintaining that resource, as well as making and enforcing rules on both appropriation and maintenance, and on the way these rules are written and outcomes evaluated. Such “perfect isolation” is hard to imagine in most sectors of a modern political economy, but many of the cases considered in *Governing the Commons* provide a reasonable approximation to this convergence of the actor sets active in all four of these core action situations.
5. *Follow the information flow* in each of these focal action situations. What sources of information are available to which actors under which circumstances, and what might prevent them from using that information to change the outcomes that result?
- *Evaluation* requires access to information, which may or may not be available to local actors or external rule-makers in a timely fashion.

- Information may or may not be available in a *timely* manner. Appropriators and those involved in maintenance activities should be able to observe short-term variation in resource availability, but some changes may occur more quickly or more abruptly than they can monitor and evaluate incoming information. Also, actors may not have extensive records on longer-term trends or on the system's viability as a whole; systemic conditions and resource availability may change more quickly than they can adjust their behavior.
 - Rules tend to change more slowly than the individual choices of appropriators and those involved in maintenance. This disjuncture may lead to significant lags between the emergence of new challenges and the community's eventual response.
6. *Locate adjacent (or supplemental) action situations* that determine the contextual categories of the focal action situation, that is, outcomes of adjacent situations in which collective actors are constructed and individual incentives shaped, rules are written and collective procedures established, norms are internalized and other community attributes are determined, goods are produced and inputs for production are extracted from resource systems (that may need replenishment), and where evaluation, learning, and feedback processes occur.

Note: The term “adjacent action situations” is drawn from McGinnis (2011b), but the basic idea that there would be multiple action situations operating simultaneously was included in the IAD framework from the very beginning (see, e.g., Ostrom 1986, 1989).

- *Constitutive processes*: One important function not explicitly identified in the list above is the *construction of collective actors* who have the authority to act, or whose members act as if they have such authority. In constitutive processes, formal organizations or more informal groups capable of making a common decision are designed and/or established and responsibility is allocated to occupants of specified “positions” for actions related to appropriation, maintenance, rule-making, monitoring, sanctioning, and evaluation. This process of constitutional choice can also set limits on the types of rule changes that are acceptable, and who can participate in making such changes. These processes are typically dominated

by legally defined formal authorities, with rules on what constitutes a viable organization set by both legal strictures and widespread social expectations.

- *Dispute resolution*: Action situations in which disputes among any of the actor types engaged in focal action situations are brought to some resolution. The criteria taken into account in arriving at some resolution may vary widely across situations. Actors directly involved in dispute resolution may include authorities specially designated with responsibilities for arbitration, adjudication, and so forth, as well as other authorities or social leaders who resolve disputes as part of their other roles. An especially relevant concern is whether or not these “dispute deciders” take into account the interests of the community as a whole in their evaluation of disputes arriving at disputes, or if they rely exclusively on arguments made on behalf of the parties most directly involved in that dispute.
- *Knowledge*: New scientific knowledge is typically generated by researchers not directly involved in focal activities. However, indigenous communities have access to substantial bodies of local knowledge that may or may not be consistent with current scientific findings. Either (or both) systems of knowledge may be drawn upon in evaluative settings. Scientific experts are often most influential in the rule-making process through which formal authorities set standards or impose limitations.
- *Market conditions*: Resource units extracted from a common pool may be used as inputs to production processes, consumed directly, and/or exchanged for other resources or rights. The economic value of resource units may vary widely, depending on trends in any of the markets to which these resources are connected, including markets that may be distant from the place of extraction. Consumer demand plays a critical role in all markets, but so do the decisions of producers and intermediaries.
- *Political regime changes*: Victories by new leaders or political parties or regimes may result in fundamental changes in the rules governing the types of organizations or informal groups that are authorized or allowed to make decisions regarding appropriation, maintenance, rule-making, monitoring, sanctioning, and forming new collective entities. All this may all be subject to more fundamental laws or rules determined in more formal governance settings, such as provincial or national government agencies or

international treaties. This setting tends to be dominated by public officials in normal times, but there are also situations of a more revolutionary character in which non-traditional actors wrest power through illegal means.

- *Cultural and demographic change*: Driven primarily by exogenous changes in livelihoods and cultural trends, these are unlikely to be directly manipulable by any actors, especially in the short term. In some settings, these changes may reflect subtle influences on local practices driven by longer-term tendencies driven by globalization. Religious and ethnic differences can often be used to greatly intensify the emotional flavor of otherwise mundane conflicts over access to resources.
7. *Select those adjacent action situations* that are critical for distinguishing among alternative explanations, and repeat steps 4 and 5 (and if necessary, step 6) for those action situations.
 - Analysis of many, especially smaller-scale, common-pool resource extraction regimes can be completed with little or no explicit reference to any of these supplemental action situations adjacent to the focal action situations. This was the case for most of the studies reviewed by Ostrom. The exception was the Southern California groundwater example examined in chapter 6 (see discussion below).
 8. *Compare and contrast the ways these linked and nested action situations are interrelated in the processes emphasized by each of your alternative explanations.* Do the same actors write, implement, and enforce rules? How do outcomes of other action situations shape processes of information flow and evaluation in the focal action situation(s)? Which incentives or values of actors are reinforced or undermined by outcomes of these action situations?
 - In *Hardin's tragedy of the (open-access) commons*, only the appropriation and natural replenishment action situations are explicitly considered. He does not allow for effort directed toward resource maintenance or rule-making, and thus there is no need for monitoring or sanctioning. Individual appropriators may monitor resource conditions, but will often respond to lowered returns by increasing their extraction levels.

- 1) Hardin made reference to exogenous forces such as market pressures or demographic changes that would be included in some of these supplemental action situations.
 - 2) Ostrom admitted that some common-pool resource systems do fall victim to the tragedy of the commons dynamic identified by Hardin. Her analysis of the four core action situations helps clarify what would be needed for either of his policy proposals to be able to successfully cope with these challenges.
- In a *centrally managed commons*, the rule-making function is undertaken by official authorities, who may write rules regarding both appropriation and maintenance. These rules are likely to be based on the recommendations of outside experts instead of those familiar with local conditions. Special monitors may be hired, which raises the problem of making sure they have the right incentives to monitor and punish rule violations, rather than accepting bribes or other inducements to overlook violations.
 - 1) *Any central authority* would need regular access to real-time accurate information on the extent to which resource users follow the rules enacted by this authority. Ostrom's findings suggest that *local monitors* would be needed to make externally imposed rules be effective.
 - 2) Central authorities are likely to be highly dependent on non-local experts for advice on setting quotas and other limits and for implementation of most monitoring and enforcement activities.
 - In a *privatized commons*, appropriation and maintenance activities would be undertaken by each private owner separately, perhaps in conjunction with other owner/users. Exchange of extracted resources would be governed by contract law and other provisions of market regulation.
 - 1) Responsibility for monitoring and sanctioning would typically fall upon police and courts.
 - 2) Externally driven market dynamics would be an especially important consideration for this case.
 - After extensive efforts to estimate regression and other statistical models, Ostrom concluded that all of the long and enduring institutions in her cases satisfied eight *design principles*, that is,

(1) clear resource and social boundaries, (2) broad participation in writing rules, (3) these rules were both appropriate for local conditions and had consequences that balanced costs and benefits in a way that was deemed fair by participants, (4) behavior was regularly monitored, (5) graduated sanctions were imposed for rule violations, (6) easily accessible and reasonably costly procedures were available for disputes to be resolved, (7) different tasks could be organized by multiple teams, and (8) higher authorities conveyed at least a minimal level of autonomy to local communities in the making and enforcement of rules.

- In most of the cases of long and enduring institutions for *community-based management* of common-pool resources discussed in Ostrom's *Governing the Commons*, essentially *the same set of actors is directly involved in all four focal action situations*.

Note: Don't overlook chapter 6 of *Governing the Commons*, in which Elinor Ostrom returns to the case study that was her doctoral dissertation (Ostrom 1965).

- Technically, this case does not fit the technical definition of a simple common-pool resource, but can be more accurately described as *local public goods*. This suggests that the design principles may apply more generally than only to situations in which some group asserts collective ownership over a specific set of resources.
- *The example of groundwater governance in Southern California involved a diverse array of organizational actors at multiple levels of aggregation. Critical contributions were made by actors operating in constitutive, judicial, scientific processes (occurring in adjacent or supplemental action situations!)*
 - Scientific experts in *USGS* clarified the danger of saltwater incursion, and the consequent need for concerted action to avoid this outcome. These efforts greatly facilitated local cooperation.
 - A new law empowered groups to establish new entities, with taxing authority, and allowed to run programs like freshwater infusion.
 - *Users used courts to impose constraints on themselves, by setting up special water districts, which restricted use and levied taxes, and resolved disputes over details.*

- Raymond Basin actors negotiated agreement based on *mutual prescription* (proportional cutbacks), holdouts challenged in court, lost, appealed, lost again.
 - West Basin Water Association established, sued in 1945, city of Hawthorne as holdout, decided upon proportional cutbacks, and courts forced holdouts to comply.
 - Combined West-Central Basins District Authority formed to limit pumping, replenish water levels, inject freshwater barrier.
 - *Watermaster* played critical role in all legal agreements—source of information and dispute resolution, but not enforcement or sanctioning.
 - *In sum, new institutions were built by an incremental, sequential, self-transforming process of learning and joint discussions, within a supportive regime of state law (home-rule). Scientific experts and courts often play critical roles in clarifying details and in establishing and enforcing complex agreements for water use and replenishment. Finding the right balance of small- and large-scale operations is critical.*
9. *Identify the most critical steps for more detailed analysis, by isolating components of adjacent action situations that determine the context currently in place in the focal action situation(s), and that if changed would result in fundamental changes in outcomes. But remember if you change one contextual factor in one action situation, then you must also incorporate all relevant changes in closely related action situations. (Ceteris paribus is more complicated in institutional analysis!)*
- *Monitoring* turned out to play a surprisingly important role in much of Ostrom's analysis. This means that *evaluation of any policy reform cannot be complete without careful consideration of the means though which these new rules will be monitored, and who will be responsible for conducting and overseeing this monitoring.*
 - 1) When locally constructed irrigation systems are replaced by large-scale and more technically advanced systems, the *lack of direct community involvement* in constructing and maintaining this system can undermine any sense of community ownership of that system, and thereby lead to poor perfor-

mance of technical systems, compared to smaller-scale systems requiring regular repair and maintenance.

- 2) Policies to restrict resource extraction in *protected areas* tended to be effective if and only if local citizens were given meaningful incentives to directly participate in the monitoring of these restrictions. This result remained relevant for different kinds of governance arrangements, suggesting that processes of monitoring may be more consequential than organizational form or the particular status of parks or protected areas.
- It may be useful to more carefully investigate interconnections between pairs or triples of core or supplemental action situations. Specifically, processes of *resource extraction and replenishment/maintenance* are very closely related, and it may be critical that the same actors are involved in both sets of activities. Otherwise, it is difficult to give those involved in the former activities the appropriate incentives to complete the latter. For example, in some cases of irrigation systems, those farmers located at the head end of the system were much less dependent on the system's maintenance than were those at the tail end of the system, and this kind of *asymmetry* must be taken into consideration in the design and operation of a sustainable irrigation system.
 - *Each of these design principles can be interpreted as attributes of one or more of the core and supplemental action situations identified above.* In effect, then, these design principles imply conditions on the operation of the focal action situations as well as a few of the adjacent action situations noted above.
 - 1) clear boundaries would have to occur as a consequence of constitutive processes;
 - 2) not all forms of rule-making will include wide participation;
 - 3) appropriation and maintenance rules need to be congruent with local conditions and values;
 - 4) monitoring should be done by monitors responsible to the core users;
 - 5) sanctioning should be applied in a graduated fashion;
 - 6) evaluative processes for the resolution of disputes should be widely available and at a reasonable cost in time and effort;

- 7) constitutive processes should be able to be carried out relatively easily, thus generating multiple limited-task teams; and
 - 8) the organizations that emerge from constitutive processes need to be recognized as legitimate by higher authorities.
- Subsequent research has highlighted other contributing factors that were also present in most of the cases examined by Ostrom, specifically, of *leadership*, *a shared concern for long-term outcomes*, *access to timely information*, and *trust and reciprocity norms*. These additional requirements can be grounded in core and supplementary processes if
 - 1) effective leadership is demonstrated in all action situations, a condition that could be described as distributed leadership;
 - 2) long-term concerns are incorporated in dispute resolution and other evaluative processes;
 - 3) information is available in a timely fashion for all monitoring and evaluative processes; and
 - 4) trust and reciprocity norms are reinforced by participation in most or all of these processes.
 - Many of the conditions in Ostrom's list of eight design principles tend to be more easily realized in *tightly-knit communities of users whose livelihoods are critically dependent on the continued availability of particular resources* than they can be in larger and more technically complex sectors of a modern political economy. It may well be that these unusual cases enabled Ostrom to identify these underlying patterns, which might have been more difficult to isolate in more complex settings.
 - 1) For example, in close-knit dependent communities, it may be very difficult for rule violations to remain unnoticed, and social exclusion can be a powerful disincentive to continuing to commit these violations. Members of resource-dependent groups tend to automatically adopt the long-term perspective and leadership/stewardship imperatives that Hardin presumed could only be provided by market discipline or dispassionate social planners.
 - 2) Extension of these conditions to highly technical systems cannot be assumed to be easily accomplished. Instead, each design principle (or facilitating condition) would need to be

explicitly interpreted in terms of specific aspects of that particular policy sector. For example, natural leaders are likely to emerge from the dense social interactions of tightly-knit communities, and these interactions can be effective generators of trust and reciprocity norms. In other policy sectors, identification of leaders and development of basic trust among competing stakeholders may prove to be very difficult and contentious tasks.

- These correspondences suggest that the Design Principles may turn out to be only the tip of the iceberg. *Each core action situation is associated with one or more of the design principles, but only some of the supplemental processes are covered in that list.* This implies that some characteristics of core or supplemental processes might also be stipulated as having important effects on sustainability. Further investigation into these processes may provide a tentative guide for identification of other critical factors.
10. Draw upon principles of research design or evaluative research to *select cases* for further analysis by whatever *methods* are best suited to that purpose. *Follow relevant conventions when writing up your conclusions*; DO NOT describe this process of discovery in detail.
- Ostrom's analysis was based on *multiple methods*: a systematic comparison of existing case studies, supplemented by new field research as well as innovative use of game models and laboratory experiments (see Poteete, Janssen, and Ostrom 2010). But, as noted above, the set of case studies considered was dominated by relatively small, resource-dependent communities.
 - *Governing the Commons* is located within a broader research program that occupied Elinor Ostrom throughout her long and distinguished career, and that this research program has by no means reached the end of its productive life. Researchers working in this tradition continue to make important new contributions, related to the following factors.
 - The strongest evidence comes from studies with clear research designs allowed for direct comparisons between similar cases. Among the best examples are:

- Comparisons of agency- and farmer-managed irrigation systems in Nepal (Lam 1998).
 - Comparisons of protected forests in similar ecological settings but managed under different types of property rights (Chhatre and Agrawal 2008).
 - Remote images of the boundaries of protected areas, some of which show sharp demarcations between ecological conditions under different regimes and other boundaries that are more difficult to see (Ostrom and Nagendra 2006).
 - Different combinations of biophysical conditions, cultural predilections, and rules-in-use will construct fundamentally different settings for all of the key processes of appropriation, maintenance, rule-making, and monitoring and sanctioning, as well as the supplemental action situations identified above.
- All focal and supplemental action situations are *dynamic*, and the feedback processes most critical for each remain a promising subject for future analysis. In particular, more attention could be devoted to understanding processes of *learning* at the individual, group, and organizational levels and their interactions. Of particular importance is consideration of the *time scales* at which endogenous changes and exogenous shocks operate in dynamic resource systems.
 - Any investigation of all relevant *threats to sustainability* posed by changes in any of these adjacent action situations would have to be more elaborate. Each of these supplementary action situations are driven by dynamic forces unrelated to local changes. Prices for natural resources are notoriously dependent on the vagaries of distant market forces, national political authorities often have the power and the incentive to ignore or displace locally formulated arrangements, previously isolated regions may, through no fault of their own, become enmeshed in processes of multi-national business expansion or geopolitical competition among global powers, and the multifaceted phenomenon of globalization can disrupt long-established traditions of social, cultural, economic, and political arrangements.
 - When analyzing proposals to cope with the complexities of *global climate change*, Ostrom (2012) emphasized that many different positive and negative externalities can be realized at all levels of aggregation from neighborhoods to the world as a whole. Thus,

groups at all levels need to be involved in devising and monitoring practices that can contribute to this overall effort. A full representation of the detailed structure of such a multilevel and polycentric package of policy proposals remains a topic for future research.

Treating the Design Principles and IAD as an Inexhaustible Source of Useful Questions

I would like to conclude this chapter by highlighting one of my most gratifying moments as a scholar, which was triggered by reading little more than a passing reference to a personal communication I made to Elinor Ostrom, as a comment on a draft of one of her papers. The paper in question ended up making it into the final chapter of Ostrom's most extended presentation of her foundational theoretical perspective in *Understanding Institutional Diversity*. I would like to quote Elinor Ostrom in some detail on our exchange on this topic.

At a recent colloquium where the design principles were discussed, Mike McGinnis made an interesting observation drawing broadly on the work of Herbert Simon. He noted that Simon has repeatedly stressed the complexity of designing humanly engineered systems whether they be computers, road networks, or institutional arrangements. In *The Sciences of the Artificial* (1981), Simon specifically argues that no humanly designed, complex system can be fully planned to achieve optimal performance. Rather, he stressed that all complex systems must be built up from simpler components. Simon does point out that where one begins a search to improve the performance of a complex system, however, makes a substantial difference in the quality and speed of the search process (see also H. Simon, 1972, 1995, 1999).

My own conclusion related to the impossibility of doing a *complete* analysis of a complex, adaptive system is, of course, strongly influenced by the work of Simon, as well as our research on coupled social-ecological systems. So, one way of thinking about the practical implications of the design principles is as a beginning point for conducting a broad search for appropriate means of solving problems. One can translate the design principles into a series of questions that could be asked when thinking about improving the sustainability of a common-pool resource system. For local appropriators, a rough translation of the first six design principles into a set of initial questions would be:

1. How can we better define the boundaries of this resource, and of the individuals who are using it, so as to make clear who is authorized to harvest and where harvesting is authorized?
2. How can we clarify the relationship between the benefits received and the contributions to the costs of sustaining this system?
3. How can we enhance the participation of those involved in making key decisions about this system?
4. Who is monitoring this system and do they face appropriate incentives given the challenge of monitoring?
5. What are the sanctions we are authorizing and can they be adjusted so that someone who makes an error or a small rule infraction is sufficiently warned so as to ensure longer-term compliance without our trying to impose unrealistic sanctions?
6. What local and regional mechanisms exist to resolve conflicts arising over the use of this resource?

The seventh and eighth principles are targeted at a higher level of governance. They could be translated as:

7. Are there functional and creative efforts by local appropriators to craft effective stewardship mechanisms for local resources that should be recognized?
8. How do we create a multiple-layer, polycentric system that can be dynamic, adaptive, and effective over time?

These are not, of course, the only questions appropriators and officials should ask in an effective design process, but they can be thought of as a good beginning. (Ostrom 2005, 270–71; original emphasis)

I am proud to report that these questions had their origins in a memo I wrote to Elinor Ostrom in the form of comments on an earlier version of the analysis she presents in this book. She changed the detailed wording of some of the questions I sent her, but I fondly remember her expression of gratitude for helping her come up with a better way to encapsulate this part of the complex argument she was trying to make. When she and Vincent Ostrom were alive, we exchanged those kinds of memos on a routine basis, and I sorely miss those exchanges.

Finally, I leave it as an exercise for the reader to translate these questions into forms best suited for application to the factors they deem most important for understanding the research puzzle or policy concern that

serves as the focus on their own work. I hope the steps outlined in this chapter will prove as helpful in their work as they have been in mine.

Note

An earlier (and much shorter) version of this chapter was prepared for distribution to graduate students in Political Science Y673, dated August 25, 2012, and posted on the author's personal website. It has not been previously published in print. This version was revised on July 4, 2016.

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