The Institutional Analysis and Development Framework and the Commons

Elinor Ostrom

RESPONSE

THE INSTITUTIONAL ANALYSIS AND DEVELOPMENT FRAMEWORK AND THE COMMONS

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Let me commend Michael Madison, Brett Frischmann, and Katherine Strandburg for writing such an interesting and useful article on the study of commons in cultural environments. We have tried to develop a useful framework for analyzing a wide variety of questions. Their adoption of a modified form of our Institutional Analysis and Development (IAD) framework for this important set of questions reassures us that we met our goal. Charlotte Hess and I organized a conference and coedited a book that examined some aspects of the knowledge commons using the IAD framework.[1] We have learned that aspects of cultural environments can be thought of as "cultural commons" because cultural products (e.g., new knowledge or software) are often available to many users who do not have to pay the producer in order to use those products.[2] Many important questions related to the study of cultural commons await a careful institutional analysis.

The IAD framework has a long history that may be interesting to the readers of this issue. Larry Kiser was a visiting scholar at the Workshop in Political Theory and Policy Analysis at Indiana University (Workshop) during the early 1980s, when we were engaged in extensive discussions about how to conduct institutional studies. Roger Parks, Gordon Whitaker, and other colleagues had just completed the fieldwork for an extensive series of studies related to the organization

1 *See* UNDERSTANDING KNOWLEDGE AS A COMMONS: FROM THEORY TO PRACTICE (Charlotte Hess & Elinor Ostrom eds., 2007) [hereinafter UNDERSTANDING KNOWLEDGE].

2 *See, e.g.*, Charlotte Hess & Elinor Ostrom, *Introduction: An Overview of the Knowledge Commons, in* UNDERSTANDING KNOWLEDGE, *supra* note 1, at 3–4, 13–20.

and performance of police agencies in U.S. metropolitan areas.[3] Public-administration scholars assumed that most public services benefitted from economies of scale and should be produced by one government serving a metropolitan area.[4] Reform efforts sought to consolidate schools in the United States.[5] Proposals in the late 1960s advocated consolidating most police departments in the metropolitan areas of the United States.[6]

Given our skepticism regarding the theory used to support these proposals (and the lack of empirical studies), we conducted studies of police department performance in Indianapolis, Chicago, St. Louis, and in eighty U.S. metropolitan areas.[7] Our data and analyses showed that the most effective systems of governance for police services used small- to medium-sized police departments to provide direct services, such as patrols and 911 response, and larger departments to provide indirect services, such as training, forensics, and radio communications.[8] When large police departments provided both direct and indirect services to metropolitan areas, those areas did not realize any gains in performance or lower costs.[9]

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[3]   *See generally* ELINOR OSTROM, ROGER B. PARKS & GORDON P. WHITAKER, PATTERNS OF METROPOLITAN POLICING (1978) (presenting an overview of the organization of police services in metropolitan America) [hereinafter METROPOLITAN POLICING]; Elinor Ostrom & Roger B. Parks, *Neither Gargantua nor the Land of Lilliputs: Conjectures on Mixed Systems of Metropolitan Organization, in* POLYCENTRICITY AND LOCAL PUBLIC ECONOMIES: READINGS FROM THE WORKSHOP IN POLITICAL THEORY AND POLICY ANALYSIS 284 (Michael D. McGinnis ed., 1999) [hereinafter POLYCENTRICITY] (arguing that complex solutions to the complex problems inherent in urban police organizations are likely more effective than the simple solutions advocated by many social scientists); Elinor Ostrom, Roger B. Parks & Gordon P. Whitaker, *Do We Really Want to Consolidate Urban Police Forces? A Reappraisal of Some Old Assertions,* 33 PUB. ADMIN. REV. 423 (1973) (presenting data and analysis showing that aggregating police services may not always be preferable to decentralizing such services).

[4]   *See, e.g.,* AMOS H. HAWLEY & BASIL G. ZIMMER, THE METROPOLITAN COMMUNITY: ITS PEOPLE AND GOVERNMENT 3 (1970) ("Given the diagnosis the treatment seems just as apparent: consolidate the many political units under a single, over-arching municipal government.").

[5]   *See* BASIL G. ZIMMER & AMOS H. HAWLEY, METROPOLITAN AREA SCHOOLS: RESISTANCE TO DISTRICT REORGANIZATION 27–29 (1968); David L. Kirp & David K. Cohen, *Education and Metropolitanism, in* METROPOLITANIZATION AND PUBLIC SERVICES 29, 29–30 (Lowdon Wingo ed., 1972).

[6]   *See, e.g.,* PRESIDENT'S COMM'N ON LAW ENFORCEMENT AND ADMIN. OF JUSTICE, THE CHALLENGE OF CRIME IN A FREE SOCIETY 119–23 (1967).

[7]   *See* METROPOLITAN POLICING, *supra* note 3, at 7–22; *see also* James C. McDavid, *Interjurisdictional Cooperation Among Police Departments in the St. Louis Metropolitan Area,* 4 PUBLIUS 35, 41–58 (1974); Elinor Ostrom & Gordon P. Whitaker, *Community Control and Governmental Responsiveness: The Case of Police in Black Neighborhoods, in* IMPROVING THE QUALITY OF URBAN MANAGEMENT 303, 317–34 (Willis D. Hawley & David Rogers eds., 1974).

[8]   *See* METROPOLITAN POLICING, *supra* note 3, at xxxi–xxxv.

[9]   *See* Elinor Ostrom, Roger B. Parks & Gordon P. Whitaker, *Policing: Is There a System?, in* 5 SAGE YEARBOOKS IN POLITICS & PUBLIC POLICY: THE POLICY CYCLE 111, 124–43 (Judith V. May & Aaron B. Wildavsky eds., 1978).

Discussions at the Workshop centered on how to establish a better theoretical underpinning for analyzing institutional arrangements, an underpinning that could serve all of the different policy areas that our colleagues had studied—including water resources[10] and local roads[11]—and account for the importance of polycentric institutional arrangements for many services.[12] Larry Kiser and I drafted a paper on *The Three Worlds of Action: A Metatheoretical Synthesis of Institutional Approaches.*[13] This paper was our effort to identify the differences among actions at an operational level (such as calling on a local police department or taking water from the tap), at a collective-choice level (such as making policies regarding speed limits on local roads), or at a constitutional level (such as revising constitutional provisions about the authority of municipalities to make collective-choice decisions).

In that era—and still today—a major challenge was just to provide a coherent definition of the term "institution."[14] Political scientists, economists, lawyers, and sociologists tended to use the term "institution" imprecisely by using it to refer to local buildings (like a jail), to organizations (such as the members of a city council), and to formal laws.[15] Rules that groups of individuals evolve for themselves, such as those developed in the early days of writing open source software and discussed by Madison et al.,[16] de Laat,[17] Markus,[18] and O'Mahony,[19] are a challenge for scholars to understand and model.[20]

In our first published effort to lay out a framework, Larry Kiser and I initially identified a set of variables that would characterize an action situation related to any type of service provision or production

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10   *See* Vincent Ostrom & Elinor Ostrom, *Legal and Political Conditions of Water Resource Development,* 48 LAND ECON. 1, 5–8 (1972).

11   *See* Ronald Oakerson, *Erosion of Public Goods: The Case of Coal-Haul Roads in Eastern Kentucky,* 2 RES. IN PUB. POL'Y ANALYSIS & MGMT. 73–102 (1981).

12   *See* Vincent Ostrom, *Polycentricity (Part 1),* in POLYCENTRICITY, *supra* note 3, at 52, 69–73; Vincent Ostrom, *Polycentricity (Part 2),* in POLYCENTRICITY, *supra* note 3, at 119, 126–32.

13   *See* Larry L. Kiser & Elinor Ostrom, *The Three Worlds of Action: A Metatheoretical Synthesis of Institutional Approaches,* in STRATEGIES OF POLITICAL INQUIRY 179 (Elinor Ostrom ed., 1982).

14   *See id.* at 190–95; *see also* AVNER GREIF, INSTITUTIONS AND THE PATH TO THE MODERN ECONOMY: LESSONS FROM MEDIEVAL TRADE 3–28 (2006) (discussing the evolution and contested nature of institutional analysis in economics and political science).

15   *See* GREIF, *supra* note 14.

16   *See* Michael J. Madison, Brett M. Frischmann & Katherine J. Strandburg, *Constructing Commons in the Cultural Environment,* 95 CORNELL L. REV. 657, 661 (2010).

17   *See* Paul B. de Laat, *Governance of Open Source Software: State of the Art,* 11 J. MGMT. & GOVERNANCE 165, 166–72 (2007).

18   *See* M. Lynne Markus, *The Governance of Free/Open Source Software Projects: Monolithic, Multidimensional, or Configurational?,* 11 J. MGMT. & GOVERNANCE 151, 154–58 (2007).

19   *See* Siobhán O'Mahony, *The Governance of Open Source Initiatives: What Does It Mean to Be Community Managed?,* 11 J. MGMT. & GOVERNANCE 139, 144–48 (2007).

20   *See* Vincent Ostrom, *Artisanship and Artifact,* 40 PUB. ADMIN. REV. 309, 312–14 (1980).

at any of the three levels of analysis.[21] Game theory was a powerful tool that enabled scholars to develop mathematical models of specific situations and predict the expected behavior of rational individuals in such well-specified situations. To identify the relevant structural elements of a game and predict outcomes, the theorist had to posit the

1. number of actors;
2. positions they held (e.g., row or column player);
3. amount of information available to an actor;
4. set of actions that actors could take at specific nodes in a decision tree;
5. set of functions that mapped actors and actions at decision nodes into intermediate or final outcomes;
6. outcomes that actors jointly affected; and
7. benefits and costs assigned to actions and outcomes.[22]

We proposed that the working parts of a game are best conceptualized as the universal working parts of an "action situation."[23] The added advantage of relying on game theory to specify the working parts of an action situation was the ability to rely on years of game theorists' research to analyze different situations using these same components. Further, this reliance assured that the working parts of an action situation could be the same for a framework, a theory, or a model.

Using the basic components of a game provided an excellent foundation for building a common method to analyze different action situations. No similar foundation existed for understanding the diversity of structures for action situations that had the same "name" in the literature, such as a bureaucracy, an election, or a legislature. Most institutional theorists started their analyses by specifying the current structure of the situation they wanted to analyze. They might have examined development over time within a market or a bureaucracy, but they rarely analyzed the rules and other factors that affected the initial structure of a situation. Political scientists, by contrast, understood that electoral laws broadly affected the likelihood of two-party or multiparty organization and the strategies of individuals seeking election. The two groups frequently argued, however, about what was the "best" way to model all electoral behavior (or behavior within legislatures or bureaucracies) as if there were only *one* structure!

Thus, the next important step in developing the IAD framework was to develop a common language for examining the underlying

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21 *See* Kiser & Ostrom, *supra* note 13, at 184–205.

22 *See* Elinor Ostrom, *An Agenda for the Study of Institutions*, 48 PUB. CHOICE 3, 17 (1986).

23 *See, e.g., id.*

structure of diverse action situations. From earlier work on the nature of goods,[24] we concluded that part of the underlying structure came from the nature of the goods involved or the biophysical world. From fieldwork related to groundwater[25] and policing,[26] we discovered that another important part of the underlying structure came from the community background of those participating. In addition to the biophysical and community foundation for an action situation, an understanding of the relationship between the rules that affect a situation and the resulting outcomes generated by participants is also important. If an action situation has seven working parts, then logically seven types of rules could affect the action situation. In my presidential address to the Public Choice Society, I outlined the following types of rules:

1. Boundary rules that specify how actors are to be chosen to enter or leave a situation

2. Position rules that specify a set of positions and how many actors hold each one

3. Information rules that specify channels of communication among actors and what information must, may, or must not be shared

4. Authority rules that specify which actions are assigned to a position at a node

5. Aggregation rules (such as majority or unanimity rules) that specify how the decisions of actors at a node are to be mapped to intermediate or final outcomes

6. Scope rules that specify the outcomes that could be affected

7. Payoff rules that specify how benefits and costs are to be distributed to actors in positions[27]

Open source software (OSS) projects have developed a variety of these rules to solve collective-action and coordination problems. As Markus concludes in her analysis of the governance of OSS projects, the participants in creating and using new software have devised many different rules to try to solve two problems that repeatedly occur in OSS projects: collective-action problems (e.g., overcoming incentives not to participate and instead to let others do the hard work of developing software that one can then use) and coordination problems (achieving a high-quality product that is produced by multiple individ-

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24   *See, e.g.*, Vincent Ostrom & Elinor Ostrom, *Public Goods and Public Choices, in* ALTERNATIVES FOR DELIVERING PUBLIC SERVICES: TOWARD IMPROVED PERFORMANCE 7, 9–18 (E.S. Savas ed., 1977).

25   *See* Ostrom & Ostrom, *supra* note 10, at 6–9.

26   *See* METROPOLITAN POLICING, *supra* note 3, at xxix.

27   *See* Ostrom, *supra* note 22, at 19.

uals working independently in separate locations).[28] As in the governance of common pool resources, none of the specific rules that participants create in particular projects appear to best solve these problems, but Markus calls for new research to examine rule structures, incentives, and outcomes more closely.

Madison, Frischmann, and Strandburg suggest that scholars interested in cultural commons may find the IAD framework sufficiently useful for analyzing cultural commons in contrast to analyzing patterns of interactions and outcomes related to common pool resources.[29] They point out an important difference that will make the analysis of the rules affecting an action situation more significant: "[U]nlike commons in the natural-resource environment, cultural-commons arrangements usually must create a governance structure within which participants not only share existing resources but also engage in *producing* those resources."[30] These scholars also point out that this difference leads to a much "more intertwined set of exogenous variables."[31] I think it also leads to more difficult legal relationships between those who produce knowledge and those who use the knowledge that others produce.

A recent report about the possibility of scholars breaking embargo rules on the use of data produced by someone else illustrates this challenge.[32] Laura Bierut, a psychiatrist at Washington University in St. Louis, discovered that another researcher had broken an embargo and published a major scientific paper in the *Proceedings of the National Academy of Sciences* (*PNAS*) in late August based on data that Professor Bierut had collected.[33] Bierut and her colleagues at Washington University in St. Louis had followed the rules regarding depositing data in the National Institute of Health's database of genotypes and phenotypes (dbGaP). Because their research was funded by a National Institutes of Health (NIH) grant as part of the Study of Addiction: Genetics and Environment project, they had to deposit data very quickly after verifying their accuracy and relevance. The database "was established in 2006 to facilitate sharing of the oceans of genetic data generated by federal grantees. Other scientists can submit papers based on the material after an embargo period of 9 to 12 months so those who generated the data can have first crack at analyzing them."[34] In this instance, the embargo expired one month after *PNAS*

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[28]   *See* Markus, *supra* note 18, at 155–60.
[29]   *See* Madison, Frischmann & Strandburg, *supra* note 16, at 681.
[30]   *Id.*
[31]   *Id.*
[32]   *See* Constance Holden, *Paper Retracted Following Genome Data Breach*, 325 SCIENCE 1486 (2009).
[33]   *See id.*
[34]   *Id.*

published the article and six months after the researcher submitted the paper.

Laura Bierut sent e-mails to *PNAS*, to NIH officials, and to Yale University—the academic home of the author of the paper that broke the embargo. Officials at NIH indicated that they were "working with all parties to figure out how the breach occurred—and how to ensure it won't happen again."[35] Although Laura Bierut indicated both satisfaction with the rapid response to the infraction and agreement with the basic NIH policy, other scholars were not so supportive.[36] Michael Miller, a psychologist at the University of California, Santa Barbara, pointed out that "[o]ther teams can start working with the data almost as soon as the group that collected the data."[37] This arrangement enables researchers who are not spending time collecting data to devote all of their time to analyzing data that other researchers collect and then publish right at the end of the embargo period. Nicholas Martin, a behavioral geneticist at the Queensland Institute for Medical Research in Brisbane, Australia, points out that "[t]he relatively short embargo periods 'leave . . . the gate open for predators with no investment in the data to do quick-and-dirty analyses that pick the eyes out of the data without looking at any of the subtleties.'"[38]

This incident opens a very interesting set of questions for scholars who wish to pursue future research on the institutional structure and outcomes that scientific communities achieve and how rules affect the linked action situations of producing new and accurate information and of analyzing the data for publication. Scholars who wish to pursue the questions Madison, Frischmann, and Strandburg raise could analyze the obligations that NIH and other U.S. government-funding agencies impose on researchers who receive government grants to make their data available to others. Rules related to the production of generally accessible data include the following:

- Who must deposit their data?
- How soon after production and authentication of data do researchers have to deposit the data?
- How long should the embargo last?
- How should conformance to the rules be monitored?
- How many researchers are involved in producing and analyzing the particular kind of data?
- Should an infraction be made public in order to tarnish the reputation of the infringer?

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[35]   *Id.* at 1487.
[36]   *Id.*
[37]   *Id.*
[38]   *Id.* (alteration in original).

Researchers interested in the software-development aspects of cultural commons could follow the lead of scholars such as Schweik,[39] Markus,[40] and O'Mahony,[41] who are addressing the governance questions related to production and use of OSS. The incentives in this cultural commons differ from the incentives in the cultural commons associated with the discovery and publication of new scientific facts and relationships. Teams of open source software developers tend to be relatively small, frequently involving fewer than five programmers.[42] A few, however, involve more than 100 programmers.[43] Norms govern many of the day-to-day activities of the software developers, rather than public rules or rules fixed in the software-development tools themselves, i.e., the biophysical world affecting the action situation. Schweik has studied these interesting questions: whether nonprofit foundations federate governance arrangements that create differences in incentives and outcomes[44] and whether teams of both volunteer and paid programmers change project governance, as well as incentives and outcomes.[45] Further, he is exploring whether open source hosting sites, such as http://sourceforge.net/, operate somewhat as "matchmakers" for connecting developers with common needs and interests.[46] Programmers live in widely diverse locations and may not learn of others' interests and capabilities by just going to meetings. Open source hosting sites may enable computer scientists interested in particular types of projects to find a small group of other programmers—who may live in distant locations—with whom to collaborate on a project.

Thus, many interesting questions exist about how various ways of "constructing commons in cultural environments" generate productive or adverse incentives for participants. Madison, Frischmann, and Strandburg have opened a large and productive research agenda for

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39   *See* Charles M. Schweik, *An Institutional Analysis Approach to Studying* Libre *Software 'Commons'*, 6 UPGRADE: THE EUR. J. FOR THE INFORMATICS PROF. 17, 17, 19–20 (2005); Charles M. Schweik & Robert English, *Tragedy of the FOSS Commons? Investigating the Institutional Designs of Free/Libre and Open Source Software Projects*, 12 FIRST MONDAY 2 (2007), http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1619/1534.

40   *See* Markus, *supra* note 18, at 155–56.

41   *See* O'Mahony, *supra* note 19, at 144–48.

42   *See* Schweik & English, *supra* note 39 ("[A]s of April 2005, more than 90 percent of the projects listed on Sourceforge.net still involve less than five developers.").

43   *See* Email from Charles M. Schweik, Associate Professor, Univ. Mass. Amherst, to author (Oct. 7, 2009) (on file with author).

44   *See* Michael P. Hamel & Charles M. Schweik, *Open Source Collaboration: Two Cases in the U.S. Public Sector*, 14 FIRST MONDAY 1 (2009), http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2313/2065.

45   *See* Charles M. Schweik et al., *Factors Leading to Success or Abandonment of Open Source Commons: An Empirical Analysis of Sourceforge.net Projects*, 2008 FREE AND OPEN SOURCE SOFTWARE FOR GEOSPATIAL (FOSS4G) CONF. 108, 111, *available at* http://www.osgeo.org/ocs/index.php/foss4g/2008/paper/viewFile/135/55.

46   *See id.* at 115.

scholars from many disciplines who are interested in how governance arrangements in diverse cultural commons affect outcomes.