Analyzing the Performance of Alternative Institutional Arrangements for Sustaining Rural Infrastructure in Developing Countries

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ABSTRACT

This paper, which draws on principles from the new institutional economics and institutional analysis, argues that a principal underlying cause of the lack of sustained rural infrastructure investments in developing countries is the set or sets of perverse incentives facing participants in the development and operation of such facilities. The analysis examines the intermediate transaction costs of providing and producing public goods under six different institutional arrangements, each of which creates a different set of incentives for the many actors involved in the design, construction, finance, operation, maintenance, and use of rural infrastructure. By considering a full set of intermediate transaction costs and a wider array of institutional arrangements, analysts can become aware of the tradeoffs involved and may more likely identify those alternatives that yield genuine net cost reductions.

One of the more perplexing problems facing developing countries and international development agencies is sustaining investments, particularly infrastructure investments, long enough to allow the facilities to at least repay the cost of their development. It is depressingly common to find that many capital infrastructure facilities such as irrigation systems, roads, bridges, and water systems fail to generate net benefits despite ex ante projections to the contrary. Even facilities that yield positive net benefits frequently deteriorate rapidly due to insufficient maintenance.

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Analyzing the Performance

Why is it so difficult to sustain rural infrastructure in developing countries? Although the lack of appropriate maintenance is often a root cause of deteriorating infrastructure, maintenance cannot be adequately considered apart from the other activities involved in the wider process of supplying infrastructure benefits. The type and level of maintenance required is intimately related to how a facility is designed, financed, constructed, operated, and used (Uphoff 1986, 63-70). Unless facilities are designed with appropriate combinations of technical knowledge and information about local conditions, they face a greater likelihood of failing even with maintenance inputs. Infrastructure cannot be sustained without sufficient financial resources to operate and maintain it. The quality of construction also affects sustainability; facilities may be so poorly built that no level of maintenance effort is capable of overcoming the initial deficiencies. For some facilities, operational inputs in addition to maintenance are also required. Finally, inappropriate use patterns can have a major impact on sustainability (e.g., heavily loaded vehicles that ruin otherwise well-designed and constructed roads).

The multiplicity of factors associated with the sustainability of rural infrastructure means that no solitary, easily identifiable cause exists for failures. We argue, however, that there is one underlying analytic cause of all these infrastructure maladies: the set or sets of perverse incentives facing participants in the design, construction, finance, operation, maintenance, and use of infrastructure facilities. Rather than presume that the individuals involved intend to develop unsustainable infrastructure, we assume that they are rational decisionmakers trying to generate net benefits. These individuals, however, face considerable uncertainty, and some behave opportunistically. Thus they may make decisions that inadvertently or purposely either harm some members of a community or leave others much better off. When incentives are better matched to the situation, individuals make decisions that yield outcomes that are both personally and socially more rewarding. The admittedly difficult task, therefore, is to design the institutional arrangements that will produce such incentives.

Designing appropriate institutions requires the ability to analyze alternative institutional arrangements for infrastructure development. The purpose of this article is to demonstrate how such arrangements can be analyzed using conceptual tools developed by scholars working in the fields of the new institutional economics and institutional analysis (V. Ostrom, Feeny, and Pichl 1988; Adelman and Thorbecke 1989; Nicholson and Connerley 1989). Because these concepts have seldom been applied directly to the problems of rural infra-

12/J-PART, January 1993
Analyzing the Performance

structure development, particularly in less developed countries, we devote the next section to the special challenges that such an environment creates. Development administration analysts commonly presume that central governments must provide certain types of rural infrastructure. This is not particularly surprising when the analysis is limited to a comparison of two idealized forms of organization: a simple market and a single governmental hierarchy. We argue in Section 2 that it is preferable to analyze a fuller set of institutional arrangements, using a more extensive set of intermediate and overall performance criteria. Section 3 uses this more comprehensive set of performance criteria to evaluate six types of institutional arrangements for the provision and production of rural infrastructure. Because much rural infrastructure development in developing countries is characterized by donor interventions, Section 4 briefly considers how donors can influence the incentive structures affecting the sustainability of capital investments. A brief summary concludes the discussion.

PUBLIC SECTOR INTERVENTIONS RELYING ON MULTIPLE ACTORS

That infrastructure development requires a set of interrelated activities does not alone explain the complexity of the sustainability problem. Designing, constructing, financing, operating, maintaining, and ensuring proper use of infrastructure facilities are complicated by the fact that generally these activities are (1) provided for by the public sector where (2) numerous decisionmakers facing a variety of incentives must act in an uncertain environment.

Rural infrastructure facilities such as roads, irrigation, and village water systems are all distinguished by characteristics that make them unsuitable for wide-scale provision by individuals acting alone. These facilities are used by many individuals or firms and are costly to "fence off" so as to preclude potential beneficiaries from enjoying benefits without paying. Efficiency can thus be attained only through some joint provision arrangement. One obvious solution is to rely on the public sector.

Although public sector involvement in rural infrastructure development is often necessary, distinguishing between the provision and production of these facilities helps to clarify the variety of ways in which public and private sector activities can be linked (Musgrave 1959; V. Ostrom, Tiebout, and Warren 1961; Advisory Commission on Intergovernmental Relations (ACIR) 1987, 1988; V. Ostrom, Bish, and E. Ostrom 1988). In the public sector, provision refers to making decisions through

13/J-PART, January 1993
Analyzing the Performance

collective choice mechanisms concerning the kinds, quantity, and quality of services to be provided, arranging for their production and finance, and monitoring or regulating their production and use. *Production*, on the other hand, refers to "the more technical process of transforming inputs into outputs--making a product, or, in many cases, rendering a service" (ACIR 1987, 7). Once a public body has decided to "provide" a particular infrastructure facility, it must then decide whether to produce the facility itself, mandate others to produce it, encourage its production by giving financial incentives to other units of government, or contract for its production by private or other public agencies.

The nonexcludability and joint use attributes of much rural infrastructure suggest that the public sector should be responsible for provision. Sometimes infrastructure facilities are also expected to exhibit production economies of scale, particularly during the construction phase of development. Together, these attributes not only suggest that government take the lead in providing the infrastructure, they also constitute strong arguments in favor of a central government bureau taking the initiative.

A third reason often cited for highly centralized provision of rural infrastructure facilities is that this arrangement ensures that the latest scientific information will be utilized in designing and building large-scale capital structures such as dams, road networks, power plants, and so forth. In some isolated instances, local residents have such knowledge, but expertise is more commonly available to relatively few persons in developing countries, most of whom are situated in central ministries.

In summary, the conclusion that central governments must provide certain types of rural infrastructure is based on an analysis of why markets would be expected to fail to generate sufficient investment in infrastructure. Such an analysis focuses exclusively on a limited set of three problems to be solved--realizing economies of scale, utilizing modern technology, and reducing free riding--then compares two idealized forms of organization: a simple market and a single governmental hierarchy. Because markets cannot solve these problems for many types of rural infrastructure, it is presumed that a central government can. Policy prescriptions generated by such truncated analyses assign sole responsibility to a central government for providing and producing rural infrastructure facilities.

14/J-PART, January 1993
**Analyzing the Performance**

The results of these efforts to centralize the public sector have been disappointing. With a few striking exceptions in East Asia, the economic health of most developing countries even after years of assistance is still fragile. Extensive reliance on central government ministries has generally stymied, instead of stimulated, efforts to find creative solutions to public problems including infrastructure development (Coward 1980; Chambers 1983; Cernea 1985; Uphoff 1986; Rondinelli 1987; Wunsch and Olowu 1990).

Analyses that conclude that only centralized government agencies can achieve economies of scale, utilize modern scientific knowledge, and solve the free-rider problem have ignored important intermediate and overall performance criteria and institutional arrangements other than markets and states. We consider the significance of additional performance criteria in the next section and then turn to a systematic analysis of alternative institutional arrangements.

**INTERMEDIATE AND OVERALL PERFORMANCE CRITERIA**

Systematic comparisons of the performance of institutional arrangements for providing and producing goods and services with diverse characteristics is a recently developed and still evolving field of inquiry.3 In the zero transaction cost environment of neoclassical economics, open and competitive markets push producers to seek combinations of land, labor, and capital that produce private goods at their lowest possible cost per unit. Similarly, consumers obtain and pay for the best mixture of goods and services obtainable given the resources available to them. Thus an open competitive market keeps production costs at as low a level as is feasible and distributes goods to those who have the highest marginal value for them. Economic efficiency is achieved. Although markets generate substantial incentives to create wealth, markets do not automatically redistribute current resources from wealthier to poorer individuals.

Inclusion of transaction costs associated with the provision and production of private goods has rendered comparative evaluations of institutional arrangements a more complex undertaking. Coordination, information, and strategic costs need to be considered, in addition to production costs. As a result of including transaction costs in the analysis, some institutional arrangements that had previously been misunderstood or considered inefficient have been evaluated more positively (Williamson 1985). When transaction cost analysis is applied to goods and services normally provided by the public sector, the task of analyzing alternative institutional arrangements becomes still more complex.

15/J-PART, January 1993

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3The work of institutional economists such as Coase and Commons can be considered the foundation for the comparative analysis of markets and firms and the work of V. Ostrom and Tiebout the foundation for comparative analysis in the public sector.
Analyzing the Performance

In Section 3 we compare several alternative institutional arrangements. Our evaluations of the different arrangements rely on the traditional criteria of efficiency, equity, and accountability as ultimate performance criteria. Assessing efficiency, accountability, and the two aspects of equity—fiscal equivalence and income redistribution—requires, however, a full examination of both benefits and costs. Only very detailed studies can derive approximate measures of these performance criteria. We believe, therefore, that it is more useful to examine a set of intermediate performance criteria, which when taken together constitute the transformation (production) and transaction costs associated with the provision and production of facilities with public goods characteristics, such as rural infrastructure.

On the production side of infrastructure development (including design, construction, operation, and maintenance), we identify the following types of costs:

TRANSFORMATION COSTS—the costs of transforming inputs into outputs (including the design, construction, operation, and maintenance of an infrastructure facility). These costs are affected directly by the characteristics of the good or service involved, the scale of production, and the type of technology adopted, including its susceptibility to breakdown.

TRANSACTION COSTS—increases in transformation costs associated with (1) coordination, (2) gathering information, and (3) strategic behavior. These costs are affected directly by the characteristics of the good or service involved, the scale of production, the technology used, and the particular rules that govern transactions.

Coordination costs are the sum of the costs of the time, capital, and personnel utilized in negotiating, monitoring, and enforcing agreements among actors. Information costs are the sum of the costs of searching for and organizing information and the costs of errors resulting from a lack of or an ineffective blend of knowledge about:

1) time and place variables, and
2) general scientific principles.

Strategic costs are the increased transformation costs that are produced when individuals use asymmetric distributions of information, power, or other resources to obtain benefits at

16/J-PART, January 1993
Analyzing the Performance

the cost of other individuals. The most common kinds of strategic costs related to production activities are:

1) shirking,
2) adverse selection,
3) moral hazard, and
4) corruption (or fraud).

Although analytically separate, transaction costs are normally recorded simply as part of the transformation or production costs of a firm. The time and personnel allocated to transacting within a production firm or bureau and across production enterprises to organize production can vary substantially from producer to producer—even those producing the same mix of outputs and using similar technologies.

Providing goods and services also involves transformation and transaction costs (Silverman 1990). These costs are ignored frequently in private sector institutional arrangements because they are borne largely by those who consume goods and services. Provision costs in the public sector are, on the other hand, substantial even though they are recorded in many different locations and are extremely difficult to identify and measure. The costs of provision include the following:

TRANSFORMATION COSTS—the costs involved in: (1) transforming citizen preferences and their willingness to pay into articulated demands for packages of publicly provided goods and services, (2) arranging to finance and produce these packages, (3) monitoring producers' performance, (4) regulating consumer use patterns, and (5) enforcing compliance with taxation and other resource mobilization measures. Transformation costs are affected directly by the characteristics of the goods and services involved, the scale of the provision unit, the technologies used in aggregating interests, arranging financing and production, monitoring producers, regulating users, and enforcing compliance.

TRANSACTION COSTS—increases in transformation costs associated with (1) coordination, (2) gathering information, and (3) strategic behavior. Transaction costs are affected directly by the characteristics of the goods and services involved, the scale of provision units, and the technologies used for interest aggregation, monitoring, regulating and policing, and the particular rules used to govern transactions.
Analyzing the Performance

Coordination costs are the sum of the costs of the time, capital, and personnel invested in negotiating, monitoring, and enforcing agreements about provision among actors.

Information costs are the sum of the costs of searching for and organizing information and the costs of errors resulting from a lack of or an ineffective blend of knowledge about:

1) time and place variables, and
2) general scientific principles.

Strategic costs are the increased transformation costs that are produced when individuals use asymmetric distribution of information, power, or other resources to obtain benefits at the cost of other individuals. The most common kinds of strategic costs related to provision activities are:

1) free riding,
2) rent seeking, and
3) corruption (or fraud).

Tradeoffs must be made between most of these costs and even within broad categories of costs. For example, the total cost of time and place information is composed of two components: the cost of errors due to insufficient local information and the cost of acquisition and use of this information (cost of search). In order to reduce the cost of errors resulting from a lack of information about time and place variables, resources must be invested in obtaining better information about local conditions. If one could accurately estimate both the cost of error and the cost of search, it would be possible to make an optimal investment in information search (i.e., to acquire information until the marginal cost just equaled the marginal benefits of reduced error). Because participants in infrastructure development rarely have access to such complete cost information, we cannot assume that optimal investments are made. Instead, we assume that the level and shape of the total costs of time and place information vary across physical domains and institutional arrangements. Thus farmers with many years of experience in irrigating lands from a river acquire intimate knowledge about variations in river flow and about the soil types present in their fields. This time and place information is acquired as a by-product of other activities. When these farmers undertake design, construction, and maintenance activities, the total cost of time and place information is low because both the cost of error due to the lack of place-specific information and the cost of information acquisition are relatively low.

On the other hand, it is far more costly for employees of national ministries to acquire time and place information. For

18/J-PART, January 1993
Analyzing the Performance

them this type of information cannot be obtained as a by-product of day-to-day activities unless these officials are assigned to a particular location for a long period of time (something that rarely happens) and are highly motivated to seek it out. Consequently, we can assume that the costs of error due to a lack of time and place information are higher. We anticipate that the cost of acquiring relevant scientific information would be lower in a professionally staffed government bureaucracy than in a farmer-managed irrigation system. Total information costs in any particular situation may or may not be greater for the bureaucracy; it will depend on the specific circumstances.

The presumption that tradeoffs between intermediate costs are required is an essential component of comparative institutional analysis. It is never possible to reduce all costs to zero. If one institutional arrangement has lower costs with regard to one intermediate criteria, it is apt to have higher costs elsewhere. The key question is whether the differences simply offset one another or whether a net gain is achieved.

ANALYZING INSTITUTIONAL ARRANGEMENTS

Although all societies make use of a rich array of institutional arrangements, an extremely sparse vocabulary is available to describe these arrangements. As soon as one departs from the usual market versus state or centralization versus decentralization dichotomies, one finds few well-accepted terms to describe the variety of institutions that currently operate—sometimes quite successfully—to sustain rural infrastructure. Considering such a limited set of institutions severely handicaps the analyses of social problems as well as efforts to design and redesign institutions.

In analyzing an institutional arrangement, one must investigate who is involved, what their stakes and resources are, and how they are linked to one another and to outcomes. Specifically, the types of actions that actors can take, the type of information available to them, how actions lead to outcomes, and how rewards and punishments are allocated in light of the outcomes achieved and the actions taken all require identification. Then the analyst predicts the actions and aggregated outcomes that are most likely given the structure of the incentives. When the predicted actions and outcomes are verified in an empirical setting, the analyst has provided an initial explanation for what is being observed. The welfare outcomes can then be evaluated using various intermediate and overall performance criteria (Kiser and E. Ostrom 1982; E. Ostrom 1986).

19/J-PART, January 1993
Analyzing the Performance

In the remainder of this section, we illustrate how six institutional arrangements—a simple market, a differentiated market, a user group, a centralized government bureau, a decentralized government bureau, and a polycentric governing structure—would be expected to perform in the provision and production of specific types of private and public infrastructure.

Simple Versus Differentiated Markets

In order to demonstrate the application of the analysis of intermediate transaction costs and overall performance criteria, it is useful to compare two types of markets for private goods. We call these simple and differentiated markets (Malone 1987). Exhibit 1 illustrates a simple market institutional arrangement for the processes of providing and producing infrastructure. Each individual citizen consumer is responsible for provision, and each must seek out the producers (designers, builders, operators, and maintainers) necessary for each infrastructure project he or she wants undertaken. Infrastructure financing is accomplished through a series of quid pro quo exchanges between citizen consumers and the various artisans concerned. Similarly, the demand for various types of infrastructure design, construction, operation, and maintenance activity is articulated directly by citizen consumers to the producer involved.

Exhibit 1
A Simple Market for Infrastructure Development

Key:  
c = citizen-consumers  
d = designers  
b = builders  
o = operators-maintainers

20/J-PART, January 1993
Analyzing the Performance

The rules underlying such a market are quite simple. All artisans and citizen consumers are permitted to be buyers or sellers at their own initiative. No one is allowed to take the property of others without mutual agreement on acceptable terms of exchange. Monitors to enforce property rights and arenas in which conflicts about property rights can be resolved are essential to the operation of the market and to holding the various parties accountable.

If the only institutional arrangement available were a simple market, information asymmetries would reduce the number of beneficial trades actually transacted to provide and produce a private investment. In a differentiated market, instead of each consumer negotiating personally with numerous artisans, consumers may choose from a smaller number of construction firms that employ artisans on longer-term contracts, monitor their performances, and attempt to build reputations for high performance. Some consumers may be able to choose from a full array of potential producers and financial institutions; others may face a more limited set. We assume sufficient competition among producers and financial institutions such that no one has a monopoly position. In addition to firms, some independent artisans continue to offer services as well. Some consumers also may obtain loans from financial institutions after they have established credit-worthiness and sufficient property to secure the loan.

Exhibit 2
A Differentiated Market for Infrastructure Development

Key:
- c = citizen-consumers
- $ = financial institutions (banks, credit rings, etc.)
- m = quality monitor
- F = construction firms
- d = designers
- b = builders
- o = operators-maintainers

21/J-PART, January 1993
Analyzing the Performance

The financial institutions, in turn, have strong incentives to inspect the construction to ensure that quality standards are met. In any particular setting, numerous rules will specify the conditions under which individuals can secure credit, create a new firm, monitor the performance of contractors, and so forth. Here (see Exhibit 2) we present highly simplified situations and rule structures in order to illustrate a mode of analysis rather than the more detailed assessment necessary to analyze a specific problem.

Transformation costs involved in a differentiated market are likely to be lower than those in a simple market because firms can capture economies of scale unavailable to individual craftsmen. Coordination costs are likely to be lower in the differentiated market because the number of potential linkages involved in completing a project is lower. Individuals involved in either a simple or a differentiated market would have access to accurate time and place information conveyed through the medium of prices. One could surmise, however, that artisans operating in a simple market are less likely to have access to the latest scientific information than are firms operating in a differentiated market because firms can more easily afford to invest in the acquisition of technical information. Costs associated with adverse selection, moral hazard, producer fraud, and shirking problems are apt to be higher in the simple market than in the differentiated market where counteracting institutions have been devised specifically to cope with these problems.

On the provision side for a purely private good, transformation costs are low for both simple and differentiated markets because each decision unit decides for itself what type and how much of a good is desired. Coordination costs will be lower in a differentiated market because the number of producers with whom one would need to communicate has been reduced. Obtaining information about specific preferences involves few costs in either case. Without intermediate organizations on the provision side, such as consumers' unions, individuals may not have access to scientific information in either case. Free riding, rent seeking, and public corruption are not problems in either a simple or a differentiated market for a purely private good.

The total level of benefits achieved in the simple market is likely to be less than in the differentiated market because many potentially beneficial transactions would not be completed without the help of the counteracting institutions involved in the differentiated market. Thus the differentiated market for a private good is likely to be more efficient. In both types of

22/J-PART, January 1993
Analyzing the Performance

markets (for private goods), those who pay the costs are the primary beneficiaries of the investment and no redistribution is likely to occur. The addition of banks, firms, and monitors in a differentiated market is apt to increase the overall accountability of all participants in provision and production transactions.

Nongovernmental Institutional Arrangements For Infrastructure Development

Now let us consider how three alternative non-governmental institutional arrangements would perform in the provision and production of a jointly consumed infrastructure. For the purpose of exposition, we discuss the example of a small-scale irrigation system that benefits a group of citizen consumers. We contrast the simple market and the differentiated market with a user group to which all using the irrigation system belong. A simplified representation of such an institutional arrangement is presented in Exhibit 3.

Exhibit 3
User Group Organization for Infrastructure Development

Key: c = citizen-consumers
UG = user group
$ = financial institutions (banks, credit rings, etc.)
m = quality monitor
F = construction firms
d = designers
b = builders
o = operators-maintainers

23/J-PART, January 1993
Analyzing the Performance

The production side of the user group structure remains essentially the same as for the differentiated market, assuming that user groups are not limited to a simple market structure. The major change between Exhibits 2 and 3 is the organization of the citizen consumers themselves (the provision side). The following type of rule structure is assumed to underlie this situation.\(^5\) A group of farmers decides to construct an irrigation system that will serve only those citizen consumers who initially buy shares in the enterprise or those who later purchase shares offered by the user group. Shareowners are assigned a weighted vote equal to the number of shares they own. User group officials are chosen from among the members of the user group using some voting rule. When water is obtained it is distributed according to the number of shares owned. Each shareholder must contribute a proportionate share of resources, commodities, and/or funds, to the user group each year. These resources are used to pay persons to operate the control works and to guard the canal so that water is distributed according to an agreed-upon formula. Each shareholder is also responsible for contributing a defined share of labor when the user group collectively cleans out the canals and undertakes any routine or emergency repair work on the irrigation system.

Assuming that the construction and operation of a small irrigation system are within the technical competence of local designers, builders, and operators, any of the three sets of institutional arrangements described above could be used to provide and produce such a system. In general, the differentiated market performs better than the simple market, and the user group structure built on top of the differentiated market has the potential to perform better still. All of the intermediate costs on the production side remain the same for a differentiated market and for such a user organization.

The principal advantage of the user group arrangement is a reduction in the costs of free riding. If the user group is able to exclude noncontributors from using irrigation water and is able to monitor and enforce the required contribution of money, commodity, and labor inputs in conformance with the rules, the user group arrangement will be able to prevent free riding; the two types of market arrangements will not. The incentive to free ride, particularly in the provision of maintenance activities, is weak when a user group is effectively organized. The members of a user group are able to monitor each other’s activities closely as a by-product of other routine activities. The absence of a member who fails to join the

\(^5\)This description of a user group rule configuration is a simplified version of the rules used in many such groups located in Nepal and the Philippines. See Siy (1982), Martin and Yoder (1983), Bagadion and Korten (1985), Coward (1985), E. Ostrom (1992), and Tang (1992).

24/J-PART, January 1993
Analyzing the Performance

others in cleaning out the channels is easily noticed. His or her reputation as a reliable member of the community is affected adversely. Although overt sanctions are used in user groups to reduce free riding, the reduction in this behavior largely results from the low cost to all members of information about each other’s activities and the importance of a good personal reputation in such settings.

Transformation costs on the provision side must increase for a user group as contrasted to a simple or differentiated market. Farmers now must discuss their preferences and reach a common agreement about design and operating characteristics and maintenance strategies. If the farmers have similar interests, coordination costs will remain relatively low. Coordination costs always will be higher where consumers act jointly than where they act individually. How much higher the costs are depends on the homogeneity of the community involved and the rules it uses to aggregate preferences.

Both rent seeking and corruption should be low when a user group organizes provision. The resources used to build the facility come from the group that benefits rather than from a public treasury to which others contribute. Given this congruence between those who own the input resources and those who enjoy the benefits of a facility, it is unlikely that a group would overinvest in new facilities. In fact, underinvestment due to uncertainty about benefits and costs is more likely than overinvestment. Underinvestment may occur also if the resources directly available to the user group are insufficient to undertake the investment and credit is not available.

Once collective provision is organized, some individuals may invest in rent seeking activities to obtain a disproportionate share of benefits. If leaders have a disproportionate say in how benefits are allocated, even local institutions may offer opportunities for rent seeking. Corruption is reduced substantially where user groups do not mobilize large amounts of cash. A farmer has more control over how group resources are used if the farmer personally contributes required maintenance labor rather than giving an official cash to hire laborers to maintain the facility. Although a farmer can use crops to bribe irrigation officials to deliver more than the authorized amount of water to his gate, an illegal payoff in crops is far more likely to be noticed, and therefore less likely to happen, where operation and maintenance crews are composed of local farmers.

25/J-PART, January 1993
Analyzing the Performance

Exhibit 4 contains a summary of these intermediate costs as well as our assessment of how these three arrangements compare on overall performance criteria. In the upper panel of the exhibit we show how we would expect the intermediate costs of production and provision to vary under the three institutional arrangements. An L, M, or H in each row indicates whether the associated costs or performance levels would be low, medium, or high. In this and in subsequent exhibits, an L should be interpreted as positive because it represents our judgment that an intermediate cost will be comparatively low. As suggested above, the differentiated market provides several important advantages over a simple market. Specifically, transformation, coordination, and scientific information costs, on the production side, as well as costs due to adverse selection, moral hazard, fraud, or shirking should all be less for the differentiated market than for the simple market.

Exhibit 4
A Centralized National Government for Infrastructure Development

Key:  c = citizen-consumers
       G = central government
       Si = sectoral ministry (e.g., irrigation, agriculture)
       DB, CB, OB = design, construction, and operating bureaus within each sector ministry
       d = designers
       b = builders
       o = operators-maintainers

26/J-PART, January 1993
Analyzing the Performance

We anticipate no difference in production costs between the differentiated market and the user group. On the provision side, however, transformation and coordination costs will be greater for the user group than for either of the two private market arrangements. The principal gain on the provision side is the lower cost of combating free riding realized by the user group. The user group, however, generates higher transformation costs and coordination costs than the differentiated market.

In the lower panel of Exhibit 4, we use four overall performance criteria—efficiency, fiscal equivalence, income redistribution, and accountability—to evaluate the expected outcomes under the three institutional arrangements. An entry of "1" denotes the highest level of performance, whereas a "3" denotes the lowest. Important differences between the user group and either type of market arrangement emerge from the analysis. Given the potential for free riding where facilities with public goods characteristics are involved, an adequate supply of potential benefits cannot be achieved until some form of collective provision is established with effective sanctions against those who do not contribute. Where free riding occurs, fiscal equivalence has not been achieved; instead, some sort of redistribution is taking place. It is the free riders, not necessarily the poorest members of a community, who are the beneficiaries of the redistribution.

Most user groups make some provision for temporarily reducing the responsibilities for operating and maintaining a system of households in distress. Differentiated market institutions increase accountability on the production side. User groups that maintain open records concerning who contributes how much labor and other resources and how monetary resources are spent increase accountability on the provision side. They can take advantage also of the more accountable production side arrangements of the differentiated market.

Centralized Government Hierarchy For Infrastructure Development

The inability of individuals relying strictly on market institutions to overcome free riding has led many analysts to recommend that a central government bureau take responsibility for the provision of jointly used infrastructure facilities. This policy prescription frequently is made without distinguishing between large- and small-scale facilities. Let us now consider the problem of designing, constructing, operating, maintaining, and using large-scale infrastructure facilities by examining a fourth type of simplified institutional arrangement: that of a central government bureau. A diagram of this type of institutional arrangement is shown in Exhibit 5.

27/J-PART, January 1993
Analyzing the Performance

Exhibit 5
A Polycentric Arrangement for Infrastructure Development

Key:  
c = citizen-consumers  
G = national government  
Si = sectoral ministry (e.g., irrigation, transportation)  
DB, CB, OB = design, construction, and operating bureaus within each sectoral ministry  
d = designers  
b = builders  
o = operators-maintainers  
$ = financial institutions (banks, credit rings, etc.)  
m = quality monitor  
F = construction firms

The organization of both sides of the provision-production nexus is radically different from that of the three institutional arrangements already considered. On the provision side, instead of a small set of citizen consumers acting independently or collectively, numerous citizen consumers residing throughout an entire nation face a constrained set of choices. At periodic intervals, these citizen consumers select a set of full-time officials. Between elections, groups of citizen consumers can try to influence those officials to use their authority to obtain desired benefits for their supporters. On the production side, another set of full-time officials is organized in a specialized production department within a ministry organized along sectoral lines.

Both sets of officials are employed full time, and their future careers depend on pleasing those who help them retain and/or advance their positions. The incentives facing both sets of officials in a central government bureau can lead to a
Analyzing the Performance

Exhibit 6
The Comparative Performance of Three Institutional Arrangements Related to the Provision and Production of Small-Scale Irrigation Systems

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<th>Simple Market</th>
<th>Differentiated Market</th>
<th>User Group</th>
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<tbody>
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<td><strong>Intermediate Production Costs</strong></td>
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<td>Transformation costs</td>
<td>M*</td>
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<td><strong>Strategic costs</strong></td>
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<td>Shifting</td>
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<td>Adverse Selection</td>
<td>M</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>Moral Hazard</td>
<td>M</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>Corruption</td>
<td>M</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td><strong>Intermediate Provision Costs</strong></td>
<td>L</td>
<td>L</td>
<td>L+</td>
</tr>
<tr>
<td>Transformation costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transaction costs</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Coordination costs</td>
<td>H</td>
<td>M</td>
<td>L+ or M</td>
</tr>
<tr>
<td>Information costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time and place</td>
<td>M</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>Scientific</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td><strong>Strategic costs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free Riding</td>
<td>H</td>
<td>H</td>
<td>L</td>
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<tr>
<td>Rent Seeking</td>
<td>L</td>
<td>L</td>
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<td>Corruption</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td><strong>Overall Performance Criteria</strong></td>
<td>3**</td>
<td>3</td>
<td>2 or 1</td>
</tr>
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<td>Efficiency</td>
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<td></td>
</tr>
<tr>
<td>Fiscal Equivalence</td>
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<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Redistribution</td>
<td>2 to 1</td>
<td>2 to 1</td>
<td>3</td>
</tr>
<tr>
<td>Accountability</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Key: *L = low, M = medium, H = high (L is most desirable)
**1 = high, 2 = medium, 3 = low (1 is most desirable)

29/J-PART, January 1993
Analyzing the Performance

compounding of perverse consequences regarding decisions about the infrastructure facilities to be designed and construct-
ed and the investments to be made in operation and mainte-
nance activities. To focus our discussion, we will examine the
incentives involved in the construction and the operation and
maintenance (O&M) of a large-scale irrigation system (Coward
Exhibit 6 contains our anticipated performance results for a
central government bureau engaged in both the construction
and the O&M of such a system.

Anticipated Performance On The Production Side

Whether a national bureau contracts with private enterprises to
construct large-scale irrigation systems or constructs them with
its own personnel, we assume that it is able to capture econo-
 mies of scale. Thus we presume that the transformation costs
of construction will be low. It is more difficult to justify the
assumption that the transformation costs of operation and
maintenance will, for the same reason, also be low. Neverthe-
less, we adopt this second assumption as well in order to focus
attention on transaction costs.

We expect the cost of coordinating production activities to
be higher than in our earlier examples because lower-level
bureaucrats in a centralized agency must obtain the permission
of more senior officers before proceeding with many tasks.
Efforts to enhance the accountability of government agencies,
which frequently require that all stages of an infrastructure
project be reviewed by various officials, also increase coordina-
tion costs substantially.

The cost of securing the relevant time and place informa-
tion would be high in most central bureaus for both construc-
tion and O&M activities. Design engineers would find it
difficult to acquire accurate information about all pertinent
local conditions from available maps and other data. Obtain-
ing local information relevant to maintenance is even more
difficult for a central bureau. Minor failures in an irrigation
system can occur anywhere, at any time; maintenance person-
nel located at some distance from a site may not know when a
failure occurs. By the time information about a problem is
obtained by repair crews, a minor repair job may have grown
into a major reconstruction project. As hypothesized above,
the cost of securing scientific information should be relatively
low for employees of a government bureau.

We expect the problem of shirking to be higher in a
government bureau than in private markets or user groups.

30/J-PART, January 1993
Analyzing the Performance

Even with the best intentions, civil servants frequently find themselves in situations where demands on their time and energy force them to restrict severely the time they spend supervising projects. One way to reduce project monitoring time is to undertake a smaller number of larger projects, whether or not this results in higher or lower costs of producing infrastructure facilities. Regardless of whether the bias toward supervising a few large projects is attributed to shirking, high coordination costs, or a combination of both, overall efficiency can be reduced when small, productive projects are rejected in favor of large projects.

We also expect shirking to be higher in operations and maintenance divisions than in design and construction divisions. All employees are likely to find some tasks more fulfilling than others; most engineers gain greater satisfaction from designing and constructing systems than from overseeing their maintenance. Similarly, bureaucratic rewards may favor those who engage in highly visible design and construction projects rather than those who organize effective routine maintenance regimes. Finally, because it is difficult to monitor how maintenance engineers or their staffs spend their time, fewer bureaucratic punishments can be administered to those who spend time on personal tasks rather than on maintenance. Thus, although internal and external incentives can counteract shirking in construction, few internal or external incentives counteract shirking in O&M.

Both construction and O&M activities provide opportunities for corruption. In general, the amount of money in illegal side-payments that is available to an official is determined by how much money is spent through any given post as well as how much can be raised from outside the budget, often directly from farmers (Wade 1984, 1985; Jagannathan 1987). Persons who hold positions in the higher reaches of the ministry hierarchy, where responsibility for high cost construction projects is often lodged, tend to profit more from construction projects than do persons at lower levels. Lower level officials may, however, profit from the letting of contracts paid for through the O&M budget and by extracting resources directly from farmers. The difference in the quantity and quality of crops that can be grown with the aid of a regular supply of water and those that can be grown with an irregular supply means that many farmers are perfectly willing to pay a regular fee to a lower-level irrigation official to ensure the predictable delivery of water to their fields.

31/J-PART, January 1993
Analyzing the Performance

The incentives that public officials face must be understood in the context of the generally low salaries they receive, their limited career advancement opportunities, their poor working conditions, and the opportunities (both legal and illegal) available to them in different types of work assignments. Most government employees prefer to live in the capital of their country, where they and their families can obtain better health services and education. Their own career opportunities may be enhanced by working where they can be observed by superiors, rather than by working in the countryside. This leads to a strong preference for work associated with the design and construction of large infrastructure systems that generate many employment positions in the central bureau. Indeed, they are once assigned to the countryside, many officials continue to maintain a household in the capital city for school-age children and devote considerable time trying to get reassigned to the capital.

The working conditions of officials assigned to an O&M division in the countryside are also more difficult than those of officials working in the capital. The commitment of governments of many developing countries to use public funds to reduce unemployment, combined with the extreme budgetary constraints of these countries, has resulted in bureau budgets that are almost totally committed to salaries. It is hardly surprising that public officials responsible for infrastructure O&M are unable to supervise these processes properly where they lack the funds necessary to enable them simply to visit facilities in their jurisdiction on a regular basis.

Given low salaries and the high cost of keeping two households, the incentive to search out opportunities to earn extra funds while in the countryside is also understandable. Relatively few opportunities arise from investments of time and energy to maintain an existing system. The opportunities for additional income arise where goods and services can be withheld from potential beneficiaries unless side payments are made, or where the processes of awarding contracts and/or certifying contractor performance are organized so that officials can demand side payments from contractors (Jagannathan 1987; Loft 1989).

This is not to say that all administrative officials in central government bureaus are corrupt shirkers. Many devoted public officials everywhere resist the temptations afforded by the systems in which they find themselves. This analysis does suggest, however, that the bureaucratic arrangements found in highly centralized governments produce incentives for officials that enhance the opportunities for corruption and shirking; at

32/J-PART, January 1993
Analyzing the Performance

The same time they generate few counteracting pressures that discourage these practices. Furthermore, once shirking and corruption are well established, those who attempt to fight the problem from within are vulnerable to retaliation by their peers and their superiors. Consequently, corrupt behavior occurs frequently in both construction and O&M.

Anticipated Performance On The Provision Side

Here we examine the transformation of preferences and willingness to pay into specific activities involved in infrastructure development and the monitoring and enforcement of procedures regulating operation and use. Assuming a competitive, democratic selection process, each adult citizen consumer participates in the election of national officials who run on platforms representing their promised positions regarding future investments of public funds. One cannot presume, however, that a national electoral outcome is a clear articulation of majority preferences about the proposed investments and allocations to be made from a central treasury. More realistically, the outcome is the selection of a set of actors who will each try to obtain as much as possible for the group he or she must please in order to stay in office. Even if this behavior were not endemic, the problems of aggregating the preferences of heterogeneous populations mean that the outcome of a national election cannot provide a reliable indication of the most preferred set of public policies to be pursued.8

The costs of obtaining time and place and scientific information are high when provision is organized by one very large unit. Citizens located in one setting cannot know much about what is needed elsewhere, and officials know little about the preferences of citizens other than those who are highly motivated and organized to obtain disproportionate benefits. Moreover, gaining reliable, scientifically grounded information about the effectiveness of various policies is very costly when policies must be adopted for an entire country before any experimentation in smaller jurisdictions has occurred.

Many taxes levied in developing countries are collected by the central government and placed in a general fund from which most expenditures are allocated. The general fund becomes a "common pool" for all central government officials. Because the funds are seldom earmarked for particular public sector activities, all elected officials are motivated to obtain as much of the general fund as possible for projects that benefit

8Whether the central government is elected or not is not crucial to the analysis and does not affect our conclusions. The officials within a military government, or any other form of nonelected government, are still faced with the problem of allocating scarce resources to different districts and groups in a society. Whether they stay in office and improve their positions depends on satisfying these relevant groups.
Analyzing the Performance

their constituents. When selecting projects to be funded, each official weighs the observable benefits of specific projects more than the costs. Many benefits are visible and can be directed toward specific sets of supporters; costs are relatively hidden and can be spread across all taxpayers. Some form of logrolling among elected officials will occur depending on the specific set of rules used to make central government decisions. Absent strong institutional constraints on logrolling, it is highly likely that this activity will lead to substantial overinvestments in some types of public projects and major underinvestments in others (Weingast, Shepsle, and Johnson 1981).

The greatest advantage of governmental provision over private provision is presumed to be a government’s capacity to prevent free riding. Yet even this is not always the case. For example, the actual revenue collected from farmers in many developing countries falls far short of covering the O&M costs of government-run irrigation systems, let alone contributing to capital costs. In Bangladesh, farmers contribute only 13 percent of the costs of O&M; in Thailand, only 26 percent (Repetto 1986, 5). It is difficult to interpret the repeated findings that farmers do not contribute required fees. The likelihood that farmers will comply with government imposed taxes or fees depends on many factors, including whether perceived benefits are at least as great as the required assessment. Obviously, governments in many developing countries have managed to solve neither shirking problems on the production side nor free riding problems on the provision side.

Anticipated Overall Performance

In regard to our overall performance criteria, efficiency varies from low to high across projects, and fiscal equivalence is rarely achieved. Given the difficulties outlined above in regard to intermediate criteria, it is not surprising that central government agencies in most countries cannot be expected to perform at a high level with regard to any of the four overall performance criteria arrayed in the lower panel of Exhibit 6.9 Whether the poor are subsidized to some extent by the wealthy is almost impossible to determine without detailed analysis. But all too frequently, careful analyses have instead shown redistribution to be in the opposite direction (Akin, Birdsall, and de Ferranti 1987, 27).

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9The National Irrigation Agencies in South Korea and Taiwan are among the better performing central government agencies with regard to both construction and O&M. USAID investments in Korean irrigation projects have resulted in well-engineered projects, completed close to schedule and resulting in predicted increases in crop yields. Steinberg et al. (1980) argue, however, that the investment in large-scale irrigation, as compared to other potential investment, cannot be considered efficient given the highly subsidized price for rice. In Taiwan, farmers are well organized at several levels and are much more involved as key participants in managing irrigation systems than they are in most countries where a centralized government agency plays a major role. See Levine (1980).
Analyzing the Performance

DOES ADMINISTRATIVE DECENTRALIZATION IMPROVE THE PERFORMANCE OF CENTRALIZED GOVERNMENTS?

The problems discussed above have inspired policies to relocate ministry personnel to the field and to deconcentrate decisionmaking authority in order to give employees working in regional or subregional offices a greater role in deciding the character of infrastructure development and maintenance. In some instances, local representative councils also have been created to serve as advisory bodies for ministry employees. In those cases in which law-making authority is exercised by councils, ministries often retain administrative veto power over legislation adopted. Because local councils are not intended to be independent governments with law-making or law-enforcing authority, structural changes associated with administrative decentralization are essentially changes in the production side of the original, centralized government bureau with little change in provision arrangements. Employees are merely shifted geographically from headquarters locations to field locations.

The dispersal of administrative offices inevitably places a larger number of officials in closer physical contact with residents of communities where infrastructure developments will occur and with members of local councils. The time and effort required of officials who wish to learn more about local circumstances is thereby reduced. Administrative reorganization could be expected to improve the performance of an official who is assigned to the same area in which he was raised and in which the principal economic interests of the official or his immediate family are located. It would, in this case, be in the interest of the official to provide infrastructure facilities that benefit him. Such facilities, however, might or might not be considered appropriate by the membership of a local advisory council or by most residents of the jurisdiction. In fact, many developing countries routinely post employees outside their home areas in order to deter officials from using their positions to promote their own economic interests or those of local, traditional leaders within their jurisdictions.

Administrative reorganization does not, however, substantially alter the nature of the career tracks within the ministries. Lower level officials are still concerned about how their performances are assessed by senior officers responsible for promotions and disciplinary action. Reorganization does not alter the fact that the best schools and hospitals are located in the capital city. It also may not alter the information that officials bring to bear on their decisionmaking.

35/J-PART, January 1993
Analyzing the Performance

Although the village where a new road or irrigation system is to be built is located nearby, an official still must make some effort to learn something about the area. If the official is convinced that local people know nothing of consequence about economic development or knows that senior officials strongly prefer a particular course of action, the proximity of a village may not result in improved information about village circumstances. Members of a local council with connections to senior officials or political leaders are in a position to make local level public service employees take their views into account. They may not, however, have the interests of others at heart when they exert their influence but, rather, act to advance their own interests. Thus patron client links between public officials at different levels and between local and national political leaders, and not a local consensus, may determine the allocation of funds among projects.

Although some decentralization projects have involved temporary shifts of some joint authority to local level officials and to the citizens involved in a project—often a project funded by an international donor—few such shifts have been retained after the end of the projects. Most decentralization efforts have involved little more than shifting personnel from headquarters to field locations (Cheema and Rondinelli 1983; Mawhood 1983; Olowu 1990). If time and place information is not taken more seriously than before decentralization, the policy is unlikely to affect the intermediate costs involved in either the construction or maintenance of a large-scale irrigation system. The performance of decentralized agencies is thus likely to be similar to that of centralized agencies, unless major structural changes are made to assure considerable joint autonomy and responsibility for lower-level officials and the citizens they serve.

Polycentric Institutional Arrangements

Although they were designed to reduce the costs of acquiring time and place information or the costs of errors due to a lack of this information, most administrative decentralization efforts have failed to accomplish these objectives. Administrative decentralization has failed also to reduce the high costs of strategic behavior—shirking, corruption, and rent seeking. An analysis of the structure of authority relationships makes it clear that centralized and administratively decentralized arrangements are virtually identical. Both are unicentric systems (i.e., they rely on long hierarchical chains of command with a single, ultimate center of authority).

36/J-PART, January 1993
Analyzing the Performance

A substantial reduction in time and place information and strategic costs requires a change in the basic structure of authority. Polycentric systems would appear to provide this type of change (V. Ostrom 1989). A polycentric governing structure offers citizens the opportunity to organize not one but many governing authorities, each of which operates independently within a circumscribed scope of authority. The scope of authority of different governments in a polycentric system can vary enormously. Some could be general purpose authorities providing a wide array of public services whereas others may be special purpose authorities that provide for, operate, and maintain a single facility. Every government is a provision unit. Each must decide whether to organize its own production bureaus or contract with other public bureaus or private firms that produce a particular good or service. Exhibit 7 illustrates some of the potential diversity of relationships between citizens and governments and between governments in such a system.

Periodic elections provide voters with the opportunity to select governing officials they believe will supply them with appropriate goods and services. The fact that principal officials are elected means that an official in one jurisdiction does not function as a superior to officials in other jurisdictions and thus does not control their career paths. Hierarchical relationships will exist within any one jurisdiction, but the long chains of such relationships associated with loss of information and control will not. Disputes between locally elected officials must be settled in courts or other institutional arenas that enjoy substantial independence, not by a senior bureaucrat. (For a classic analysis of nonbureaucratic control see Tocqueville 1945, I, ch. 5.)

Anticipated Performance On Intermediate Criteria

Polycentric institutional arrangements sacrifice few of the advantages of centralized governing systems and generate additional advantages of their own. Governing authorities can still penalize free riders. The opportunity to contract with larger jurisdictions or with private firms provides a convenient way of purchasing scientific expertise as it is needed. The elections by which local authorities are selected, if competitive, provide a means of aggregating time and place information that is imperfect but superior to a reliance on advisory councils. Once elected, officials face strong incentives to keep at least a majority of their constituents happy in order to secure their reelection. Retaining popularity requires that officials keep themselves well informed about changing preferences. Local candidates obviously also possess considerable local information.

37/J-PART, January 1993
## Analyzing the Performance

Exhibit 7

The Performance of a Central Government Bureau Related to the Construction and O&M of a Large-Scale Irrigation System

<table>
<thead>
<tr>
<th>Intermediate Production Costs</th>
<th>Construction</th>
<th>Operation &amp; Maintenance</th>
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</thead>
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<tr>
<td>Transformation costs</td>
<td>L*</td>
<td>L</td>
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<tr>
<td>Coordination costs</td>
<td>M to H</td>
<td>M to H</td>
</tr>
<tr>
<td>Information costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time and place</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Scientific</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>Strategic costs</td>
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<td></td>
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<tr>
<td>Shirking</td>
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<td>H</td>
</tr>
<tr>
<td>Adverse Selection</td>
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<td>L</td>
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<td>Moral Hazard</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>Corruption</td>
<td>H</td>
<td>H</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intermediate Provision Costs</th>
<th>Construction</th>
<th>Operation &amp; Maintenance</th>
</tr>
</thead>
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<td>Coordination costs</td>
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<td>Information costs</td>
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<td>Scientific</td>
<td>H</td>
<td>H</td>
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<tr>
<td>Strategic costs</td>
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</tr>
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<td>Free Riding</td>
<td>L to M</td>
<td>L to H</td>
</tr>
<tr>
<td>Rent Seeking</td>
<td>H</td>
<td>L</td>
</tr>
<tr>
<td>Corruption</td>
<td>H</td>
<td>L</td>
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</table>

<table>
<thead>
<tr>
<th>Overall Performance Criteria</th>
<th>Construction</th>
<th>Operation &amp; Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency</td>
<td>3 to 1**</td>
<td>3 to 2</td>
</tr>
<tr>
<td>Fiscal Equivalence</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Redistribution</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Accountability</td>
<td>3 to 2</td>
<td>3 to 2</td>
</tr>
</tbody>
</table>

Key: *L = low, M = medium, H = high (L is most desirable)
**1 = high, 2 = medium, 3 = low (1 is most desirable)
Analyzing the Performance

The fact that local officials are elected also reduces strategic costs because officials know that citizens who wish to remove corrupt or lazy officials need not rely on the cooperation of senior administrators. In addition, larger numbers of officials operating independently in a larger number of jurisdictions reduce the likelihood that any one of them can gain monopoly control over important public goods or services.

Coordination costs among authorities in different jurisdictions could increase because authorities can refuse to go along with proposals made by others. Conflict over different policies between independent units is, however, likely to be more open than conflict that regularly takes place within bureaus. How much coordination costs actually rise depends on whether relationships are structured so as to encourage mutually productive or zero sum interaction. Furthermore, if coordination costs rise considerably but result in the refinement of a policy that in turn produces an improved outcome, the increased coordination costs may still be well worth the price.

Anticipated Overall Performance

If local jurisdictions are able to exert more control over the design of their own infrastructure investments, one would expect the level of benefits generated by these investments to rise. The overall efficiency of polycentric arrangements would then depend on the ability of local jurisdictions to contain costs. For that reason, special purpose and general purpose jurisdictions must have substantial independence over matters that determine administrative costs. Redistribution decisions must be considered carefully so that resource transfers do not discourage local efforts to economize.

The existence of multiple governments with some independent taxing authority makes fiscal equivalence much easier to achieve in a polycentric system. Redistribution of resources among jurisdictions can be achieved through the agency of overarching jurisdictions where public support for redistribution exists. Citizens aware of the threat to productive relationships that severe inequalities pose could be expected to view some types of redistribution as good investments. The accountability of elected officials to majority opinion can be expected to be high, due to the ease of removing unresponsive officials. The accountability of officials to minorities would depend heavily on the skill with which jurisdictional boundaries are drawn, how the system of judicial appeal is constituted, and the accessibility of judicial remedies. Indeed, the maintenance of a polycentric arrangement requires a high level of investment in adjudication services and in the education of a citizenry in the use of these services for the purpose of defending rights.

39/J-PART, January 1993
Analyzing the Performance

THE ROLE OF DONOR AGENCIES

An analysis of institutional arrangements for infrastructure development in the developing world would be incomplete without considering the impact of donor agencies on incentives. Anyone observing donor-financed infrastructure projects in operation is struck by the number of extremely hard working, highly motivated individuals, employed in both host governments and donor agencies, whose principal goal is clearly to improve the well-being of poor people. Yet assessments of projects designed by donor and host government staff repeatedly show that many of the projects increased or reinforced the already high concentration of public authority in the recipient country, were poorly designed given local circumstances, generated few economic benefits for the target population, and produced inappropriately large debt burdens (Asher 1970; Hayter 1971; Wall 1973). How is it possible for highly motivated, hard-working people, who sincerely want to improve conditions in the recipient countries, to be involved repeatedly in the design and implementation of projects that do not accomplish these goals?

This question has been the subject of several careful studies (Nelson 1968; Tendler 1975), and we cannot fully address it here. By identifying the incentives facing actors in the donor agencies as they relate to public officials and private enterprises in the host countries, one can suggest how these consequences could be generated. Some of these incentives are present in most large-scale bureaucratic agencies. Others are unique to the foreign aid domain or even to particular donor agencies, such as the U.S. Agency for International Development (USAID).

USAID, like other bilateral donors, faces the apparently contradictory problems of creating a reliable constituency in support of foreign assistance, while seeking appropriate ways to spend the large amount of foreign aid money mandated by Congress. The legislative mandate to allocate a proportion of foreign assistance to the purchases of equipment made in the United States was an important initial source of considerable bias toward very large and capital-intensive projects. The notorious need to "move money" faced by all government agencies in which next year's funding depends on the agency's ability to spend this year's budget has reinforced this bias and discouraged labor-intensive projects and those using small-scale and locally manufactured equipment. The difficulty of coping with a gushing "pipeline" has recently been exacerbated by policies designed to reduce agency staff. Fewer people are now available to spend more money.

40/J-PART, January 1993
Analyzing the Performance

Fear of external criticism about lack of control and corrupt practices also leads donor agencies to favor project designs that appear to give project monitors greater control over what is happening. This usually means funding a few large projects rather than several small ones. The concern for monitoring performance, particularly to reduce corruption, requires project performance criteria that can be measured easily. Concern about accountability, added to the universal difficulty of measuring public service output, is likely to lead to a focus on project inputs, rather than on outputs (Connerley et al. 1989; Fitzcharles and Connerley 1990).

Similar preferences of both donor and host government agencies for projects that are easy to monitor and equipment intensive generate incentives for personnel that are similar and probably reinforcing. The types of projects that receive the most funding by external donors can thus be explained by the nature of the incentives inside donor agencies and host governments without resorting to conspiracy theories.

SUMMARY AND CONCLUSIONS

In this article we have illustrated how theoretical principles drawn from the new institutional economics and institutional analysis can be used to analyze the incentives generated by alternative institutional arrangements for the supply of rural infrastructure in developing countries. The new institutional economists have demonstrated the value of systematically examining the intermediate costs of transacting in an uncertain environment. However, most of them have analyzed only transactions in private goods.

Our comparative institutional analysis examined the intermediate transaction costs of providing and producing public goods. We considered the costs of coordination, information gathering (both scientific and time and place information), and various strategic behaviors especially associated with public institutional arrangements. This required an assessment of the costs of the types of strategic behavior potentially involved in both public good provision--free riding, rent seeking, and corruption--and public good production--shirking, adverse selection, moral hazard, and corruption. Most of these costs have received very little attention in current analyses of infrastructure deterioration (U.S. General Accounting Office 1983).

We then used relative measures of intermediate transaction costs to compare the performance of six institutional

41/J-PART, January 1993

10For major exceptions, see Ascher and Healy (1990), Chambers (1988), and Repetto (1986).
Analyzing the Performance

arrangements for the supply of public infrastructure. In light of the more complete set of intermediate performance measures utilized here, the unintended consequences of current institutional arrangements for infrastructure development can be seen to be expected outcomes given the incentives of the various participants. We conclude that if greater attention is not given to a fuller range of transaction costs and a more diverse set of institutional arrangements, projects will continue to be planned, financed, and constructed in ways that generate unintended consequences such as high levels of corruption, overinvestment in large-scale projects, and underinvestment in smaller projects and in operations and maintenance.

Recognition of a wider array of transaction costs does not imply that there are cost free ways of reducing them, however. In order to reduce the cost of errors due to a lack of information, costs must be incurred to obtain more information. Institutional reforms aimed at reducing the costs of one type of strategic behavior, such as free riding, can create improved opportunities for other types of strategic behavior, such as rent seeking or fraud. When searching for a superior institutional design, the analyst attempts to guard against excessive costs of one type without expending more resources or opening the possibility for even worse problems of a different order.

Given the constrained sets of both performance criteria (production economies, access to technical knowledge, and control of free riding) and institutional arrangements (markets and central government bureaucracies, which characterize much current analysis), the tendency to presume that the need for public sector involvement requires a reliance on central government bureaus is understandable. Widening the set of intermediate performance criteria to be examined, however, reveals the necessary tradeoffs that a reliance on this particular arrangement entails. And enlarging the set of institutional arrangements to be considered increases the probability of identifying alternative arrangements that yield genuine net cost reductions.

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42/J-PART, January 1993
Analyzing the Performance

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