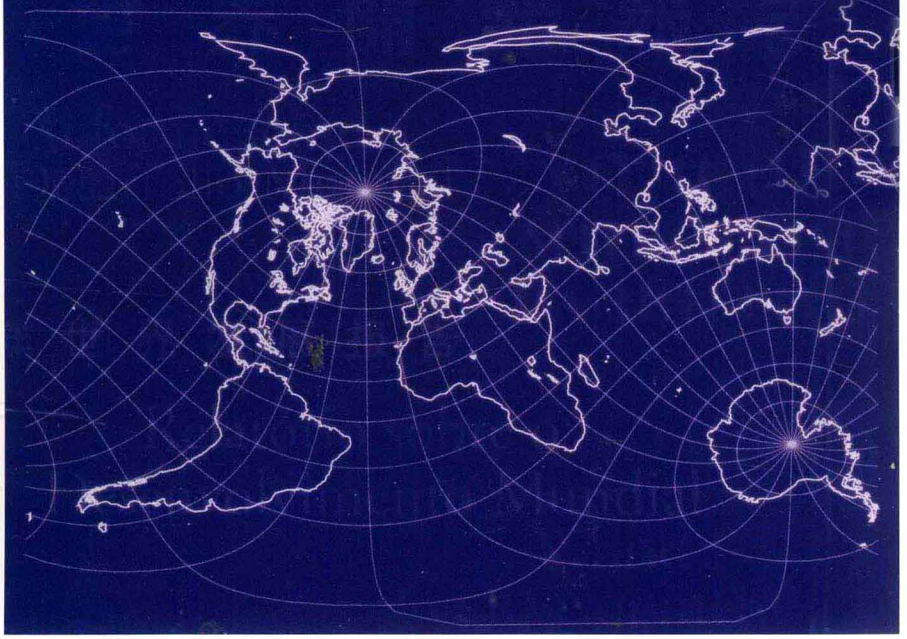
World Development Report 1994

Infrastructure for Development

WORLD DEVELOPMENT INDICATORS



World Development Report 1994

Infrastructure for Development

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Foreword

World Development Report 1994, the seventeenth in this annual series, examines the link between infrastructure and development and explores ways in which developing countries can improve both the provision and the quality of infrastructure services. Like the health and environment topics of the two previous reports in this series, infrastructure is an area in which government policy and finance have an important role to play because of its pervasive impact on economic development and human welfare.

In recent decades, developing countries have made substantial investments in infrastructure, achieving dramatic gains for households and producers by expanding their access to services such as safe water, sanitation, electric power, telecommunications, and transport. Even more infrastructure investment and expansion are needed in order to extend the reach of services—especially to people living in rural areas and to the poor.

But as this report shows, the *quantity* of investment cannot be the exclusive focus of policy. Improving the *quality* of infrastructure service also is vital. Low operating efficiency, inadequate maintenance, and lack of attention to the needs of users have all played a part in reducing the development impact of infrastructure investments in the past. Both quantity and quality improvements are essential to modernize and diversify production, help countries compete internationally, and accommodate rapid urbanization. Future success means building on lessons learned.

The report identifies the basic cause of poor past performance as inadequate institutional incentives for improving the provision of infrastructure. To promote more efficient and responsive service delivery, incentives need to be changed through commercial management, competition, and user involvement.

Commercial management—including financial autonomy, accountability, and well-defined objectives—focuses providers of infrastructure services on increasing efficiency and meeting customer demand. *Competition* provides users with choices that can better meet their needs and compels providers to become more efficient and accountable. *Involvement of users and other stakeholders* in the design, operation, and maintenance of infrastructure is also key to better performance, particularly in areas where competition is constrained.

Several trends are helping to improve the performance of infrastructure. First, innovation in technology and in the regulatory management of markets makes more diversity possible in the supply of services. Second, an evaluation of the role of government is leading to a shift from direct government provision of services to increasing private sector provision—and recent experience in many countries with public-private partnerships is highlighting new ways to increase efficiency and expand services. Third, increased concern about social and environmental sustainability has heightened public interest in infrastructure design and performance.

Differences between and within infrastructure sectors, together with major variations in country needs and capacities, mean that the detailed design and implementation of policy reform must be tailored to specific cases. But there is no question that the overall benefits from improving infrastructure are large. Roughly $200 billion is invested in the sector annually in the developing world, and the savings that would accrue from better provision and performance would be substantial. More efficient, more accessible, and less costly infrastructure services are also, of course, essential to more effective poverty reduction.

As in the past, *World Development Report 1994* includes the World Development Indicators, which offer selected social and economic statistics for 132 countries. The Report is a study by the Bank's staff, and the judgments made herein do not necessarily reflect the views of the Board of Directors or of the governments they represent.

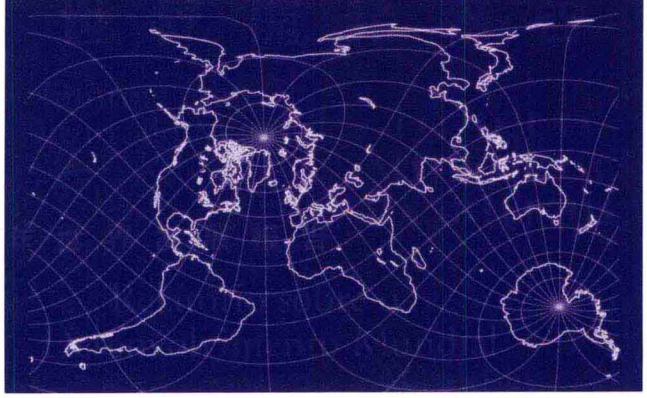
Lewis T. Preston
President
The World Bank

May 31, 1994

This Report has been prepared by a team led by Gregory K. Ingram and comprising John Besant-Jones, Antonio Estache, Christine Kessides, Peter Lanjouw, Ashoka Mody, and Lant Pritchett. Valuable contributions and advice were provided by Esra Bennathan, Koji Kashiwaya, Miguel Kiguel, Lyn Squire, and Paulo Vieira Da Cunha. Assisting the team were Ritu Basu, Leslie Citroen, Marianne Fay, Christine Kerr, Kavita Mathur, Dambisa Moyo, and Sarbajit Sinha. The work was carried out under the general direction of Michael Bruno.

Many others inside and outside the Bank provided helpful comments and contributions (see the Bibliographical note). The International Economics Department contributed to the data appendix and was responsible for the World Development Indicators. The production staff for the Report included Ann Beasley, Kathryn Kline Dahl, Stephanie Gerard, Audrey K. Heiligman, Cathe Kocak, Jeffrey N. Lecksell, Nancy Levine, Deirdre T. Murphy, Hugh Nees, Kathy Rosen, Walton Rosenquist, David Theis, and Michael Treadway. The support staff was headed by Rhoda Blade-Charest and then Rebecca Sugui and included Laitan Alli, Michael Geller, and Paul Holtz. Bruce Ross-Larson provided editorial advice and assistance. Trinidad S. Angeles served as administrative assistant. Anthony Rowley was the principal editor.

Preparation of the Report was greatly aided by background papers and by contributions from participants in consultation meetings, both of which were supported in part by the Policy and Human Resources Development Fund financed by the Japanese government. The names of participants in the consultation meetings are listed in the Bibliographical note.



Definitions and data notes

Selected terms used in this Report

BOT (build–operate–transfer). A form of concession usually referring to totally new projects. Typically in a BOT, a private party (or consortium) agrees to finance, construct, operate, and maintain a facility for a specified period and then transfer the facility to a government or other public authority. Variations include BOOT (build–own–operate–transfer) and BOO (build–own–operate); in the last case, the contract accords the right to construct and operate the facility, but the facility is not transferred back to the public sector.

Concession. An arrangement whereby a private party leases assets for service provision from a public authority for an extended period and has responsibility for financing specified new fixed investments during the period; these new assets then revert to the public sector at expiration of the contract.

Contestability. The vulnerability of an activity to competition from new entrants in a market. The key criterion for contestability is that costs of entering a market be recoverable (e.g., through a sale of assets).

Corporatization. The transformation of a state-owned enterprise or agency into a legal entity subject to company law, including formal separation of ownership and management responsibilities, for example, through a board of directors or other body.

Economies of scale. A characteristic of a production technology whereby unit costs decline with increasing output over a large range. Economies of scale are a major source of natural monopoly.

Leasing. An arrangement whereby a private party (lessee) contracts with a public authority for the right to operate a facility (and the right to a flow of revenues from providing a specific service) for a specified period of time. The facility continues to be owned by the public authority. Unlike in a concession, the lessee does not have responsibility for investments in fixed assets. (A lease may sometimes be called a "service concession," and a BOT is sometimes called a "public works concession.")

Management contract. An arrangement whereby a private contractor assumes responsibility for a full range of operation and maintenance functions, with authority to make day-to-day management decisions. Compensation may be based partially on services rendered (as for service contracts) and partially on performance achieved (as in profit sharing).

Natural monopoly. An economic activity that is most efficiently carried out by a single producer.

Parastatal (also *public* or *state enterprise*). An organization engaged in productive activity that is owned and controlled in majority by the state.

Performance agreement. An agreement negotiated between the government and the public manager of a public utility or a government department. It usually defines explicit commercial goals (such as degree of cost recovery) and may define noncommercial goals (such as increases of services to poor neighborhoods). Its main purpose is to increase the accountability of both the government and the public managers by sharpening and clarifying the goals of public entities.

Service contract (or *contracting out*). An arrangement with the private sector to perform particular operating or maintenance functions for a fixed period and for specified compensation.

Country groups

For operational and analytical purposes the World Bank's main criterion for classifying economies is gross national product (GNP) per capita. Every economy is classified as low-income, middle-income (subdivided into lower-middle and upper-middle), or high-income. Other analytical groups, based on geographic regions, exports, and levels of external debt, are also used.

Because of changes in GNP per capita, the country composition of each income group may change from one edition of *World Development Report* to the next. Once the classification is fixed for any edition, all the historical and projected data presented are based on the same country grouping. The country groups used in this edition are defined as follows.

- *Low-income economies* are those with a GNP per capita of $675 or less in 1992.
- *Middle-income economies* are those with a GNP per capita of more than $675 but less than $8,356 in 1992. A further division, at GNP per capita of $2,695 in 1992, is made between lower-middle-income and upper-middle-income economies.
- *High-income economies* are those with a GNP per capita of $8,356 or more in 1992.
- *World* comprises all economies, including economies with sparse data and those with less than 1 million population; these are not shown separately in the main tables but are presented in Table 1a in the technical notes to the World Development Indicators (WDI).

Low-income and middle-income economies are sometimes referred to as developing economies. The use of the term is convenient; it is not intended to imply that all economies in the group are experiencing similar development or that other economies have reached a preferred or final stage of development. Classification by income does not necessarily reflect development status. (In the WDI, high-income economies classified as developing by the United Nations or regarded as developing by their authorities are identified by the symbol †). The use of the term "countries" to refer to economies implies no judgment by the Bank about the legal or other status of a territory.

For some analytical purposes, other overlapping classifications that are based predominantly on exports or external debt are used, in addition to incomes or geographic groups. Countries with sparse data and those with less than 1 million population, although not shown separately, are included in group aggregates.

The table "Classification of economies" at the end of the WDI lists countries by the WDI's income, regional, and analytical classifications.

Data notes

- *Billion* is 1,000 million.
- *Trillion* is 1,000 billion.
- *Tons* are metric tons, equal to 1,000 kilograms, or 2,204.6 pounds.
- *Dollars* are current U.S. dollars unless otherwise specified.
- *Growth rates* are based on constant price data and, unless otherwise noted, have been computed with the use of the least-squares method. See the technical notes to the WDI for details of this method.
- *The symbol* / in dates, as in "1990/91," means that the period of time may be less than two years but straddles two calendar years and refers to a crop year, a survey year, or a fiscal year.
- *The symbol* .. in tables means not available.
- *The symbol* — in tables means not applicable. (In the WDI, a blank is used to mean not applicable.)
- *The number* 0 or 0.0 in tables and figures means zero or a quantity less than half the unit shown and not known more precisely.

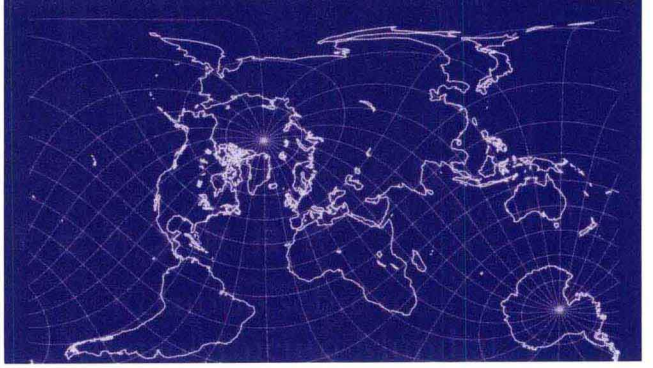
The cutoff date for all data in the World Development Indicators is April 29, 1994.

Historical data in this Report may differ from those in previous editions because of continual updating as better data become available, because of a change to a new base year for constant price data, or because of changes in country composition in income and analytical groups.

Economic and demographic terms are defined in the technical notes to the WDI.

Acronyms and initials

AGETIPs	Agences d'Exécution des Travaux d'Intérêt Public
BOT	Build-operate-transfer
DAC	Development Assistance Committee
GDP	Gross domestic product
GNP	Gross national product
IPP	Independent power project
NGO	Nongovernmental organization
NTC	National Telecommunications Commission
OECD	Organization for Economic Cooperation and Development (Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States)
USAID	United States Agency for International Development



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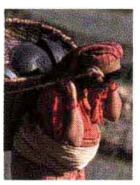

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Overview

Developing countries invest $200 billion a year in new infrastructure—4 percent of their national output and a fifth of their total investment. The result has been a dramatic increase in infrastructure services—for transport, power, water, sanitation, telecommunications, and irrigation. During the past fifteen years, the share of households with access to clean water has increased by half, and power production and telephone lines per capita have doubled. Such increases do much to raise productivity and improve living standards.

These accomplishments are no reason for complacency, however. One billion people in the developing world still lack access to clean water—and nearly 2 billion lack adequate sanitation. In rural areas especially, women and children often spend long hours fetching water. Already-inadequate transport networks are deteriorating rapidly in many countries. Electric power has yet to reach 2 billion people, and in many countries unreliable power constrains output. The demands for telecommunications to modernize production and enhance international competitiveness far outstrip existing capacity. On top of all this, population growth and urbanization are increasing the demand for infrastructure.

Coping with infrastructure's future challenges involves much more than a simple numbers game of drawing up inventories of infrastructure stocks and plotting needed investments on the basis of past patterns. It involves tackling inefficiency and waste—both in investment and in delivering services—and responding more effectively to user demand. On average, 40 percent of the power-generating capacity in developing countries is unavailable for production, twice the rate in the best-performing power sectors in low-, middle-, and high-income countries. Half the labor in African and Latin American railways is estimated to be redundant. And in Africa and elsewhere, costly investments in road construction have been wasted for lack of maintenance.

This poor performance provides strong reasons for doing things differently—in more effective, less wasteful ways. In short, the concern needs to broaden from increasing the *quantity* of infrastructure stocks to improving the *quality* of infrastructure services. Fortunately, the time is ripe for change. In recent years, there has been a revolution in thinking about who should be responsible for providing infrastructure stocks and services, and how these services should be delivered to the user.

Against this background, *World Development Report 1994* considers new ways of meeting public needs for services from infrastructure (as defined in Box 1)—ways that are more efficient, more user-responsive, more environment-friendly, and more resourceful in using both the public and private sectors. The report reaches two broad conclusions:

- Because past investments in infrastructure have not had the development impact expected, it is essential to improve the effectiveness of investments and the efficiency of service provision.
- Innovations in the means of delivering infrastructure services—along with new technologies—point to solutions that can improve performance.

This Report marshals evidence in support of these conclusions—identifying causes of failure and examining alternative approaches. The main messages and policy options are summarized in Box 2.

Box 1 What is infrastructure?

This Report focuses on *economic infrastructure* and includes services from:

- Public utilities—power, telecommunications, piped water supply, sanitation and sewerage, solid waste collection and disposal, and piped gas.
- Public works—roads and major dam and canal works for irrigation and drainage.
- Other transport sectors—urban and interurban railways, urban transport, ports and waterways, and airports.

Infrastructure is an umbrella term for many activities referred to as "social overhead capital" by such development economists as Paul Rosenstein-Rodan, Ragnar Nurkse, and Albert Hirschman. Neither term is precisely defined, but both encompass activities that share technical features (such as economies of scale) and economic features (such as spillovers from users to nonusers).

Infrastructure's role and record

The adequacy of infrastructure helps determine one country's success and another's failure—in diversifying production, expanding trade, coping with population growth, reducing poverty, or improving environmental conditions. Good infrastructure raises productivity and lowers production costs, but it has to expand fast enough to accommodate growth. The precise linkages between infrastructure and development are still open to debate. However, infrastructure capacity grows step for step with economic output—a 1 percent increase in the stock of infrastructure is associated with a 1 percent increase in gross domestic product (GDP) across all countries (Figure 1). And as countries develop, infrastructure must adapt to support changing patterns of demand, as the shares of power, roads, and telecommunications in the total stock of infrastructure in-

Box 2 Main messages of *World Development Report 1994*

Infrastructure can deliver major benefits in economic growth, poverty alleviation, and environmental sustainability—but only when it provides services that respond to effective demand and does so efficiently. Service is the goal and the measure of development in infrastructure. Major investments have been made in infrastructure stocks, but in too many developing countries these assets are not generating the quantity or the quality of services demanded. The costs of this waste—in forgone economic growth and lost opportunities for poverty reduction and environmental improvement—are high and unacceptable.

The causes of past poor performance, and the source of improved performance, lie in the incentives facing providers. To ensure efficient, responsive delivery of infrastructure services, incentives need to be changed through the application of three instruments—commercial management, competition, and stakeholder involvement. The roles of government and the private sector must be transformed as well. Technological innovation and experiments with alternative ways of providing infrastructure indicate the following principles for reform:

- *Manage infrastructure like a business, not a bureaucracy.* The provision of infrastructure needs to be conceived and run as a service industry that responds to customer demand. Poor performers typically have a confusion of objectives, little financial autonomy or financial discipline, and no "bottom line" measured by customer satisfaction. The high willingness to pay for most infrastructure services, even by the poor, provides greater opportunity for user charges. Private sector involvement in management, financing, or ownership will in most cases be needed to ensure a commercial orientation in infrastructure.
- *Introduce competition—directly if feasible, indirectly if not.* Competition gives consumers choices for better meeting their demands and puts pressure on suppliers to be efficient and accountable to users. Competition can be introduced directly, by liberalizing entry into activities that have no technological barriers, and indirectly, through competitive bidding for the right to provide exclusive service where natural monopoly conditions exist and by liberalizing the supply of service substitutes.
- *Give users and other stakeholders a strong voice and real responsibility.* Where infrastructure activities involve important external effects, for good or bad, or where market discipline is insufficient to ensure accountability to users and other affected groups, governments need to address their concerns through other means. Users and other stakeholders should be represented in the planning and regulation of infrastructure services, and in some cases they should take major initiatives in design, operation, and financing.

Public-private partnerships in financing have promise. Private sector involvement in the financing of new capacity is growing. The lessons of this experience are that governments should start with simpler projects and gain experience, investors' returns should be linked to project performance, and any government guarantees needed should be carefully scrutinized.

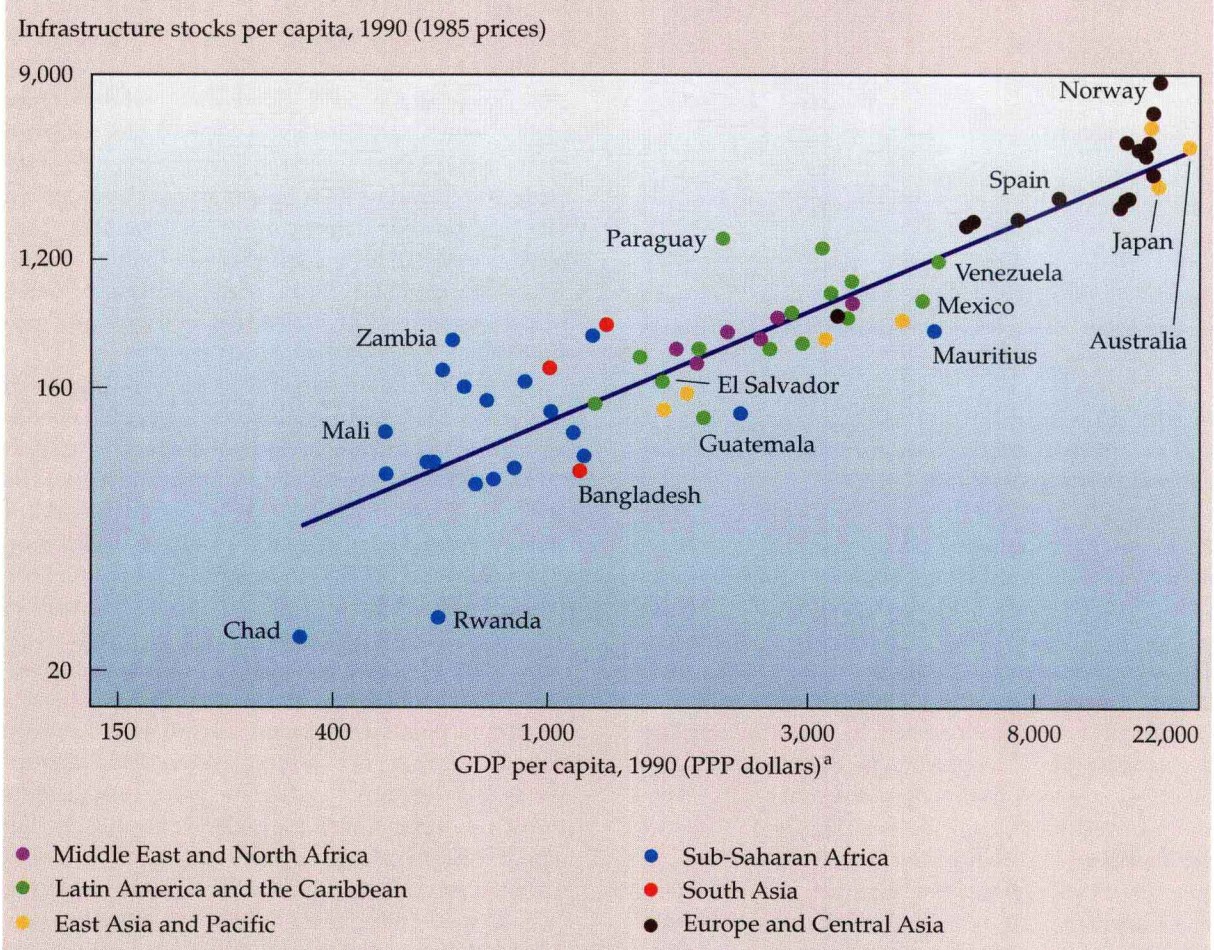
Governments will have a continuing, if changed, role in infrastructure. In addition to taking steps to improve the performance of infrastructure provision under their direct control, governments are responsible for creating policy and regulatory frameworks that safeguard the interests of the poor, improve environmental conditions, and coordinate cross-sectoral interactions—whether services are produced by public or private providers. Governments also are responsible for developing legal and regulatory frameworks to support private involvement in the provision of infrastructure services.

crease relative to those of such basic services as water and irrigation (Figure 2).

The kind of infrastructure put in place also determines whether growth does all that it can to reduce poverty. Most of the poor are in rural areas, and the growth of farm productivity and nonfarm rural employment is linked closely to infrastructure provision. An important ingredient in China's success with rural enterprise has been a minimum package of transport, telecommunications, and power at the village level. Rural enterprises in China now employ more than 100 million people (18 percent of the labor force) and produce more than a third of national output.

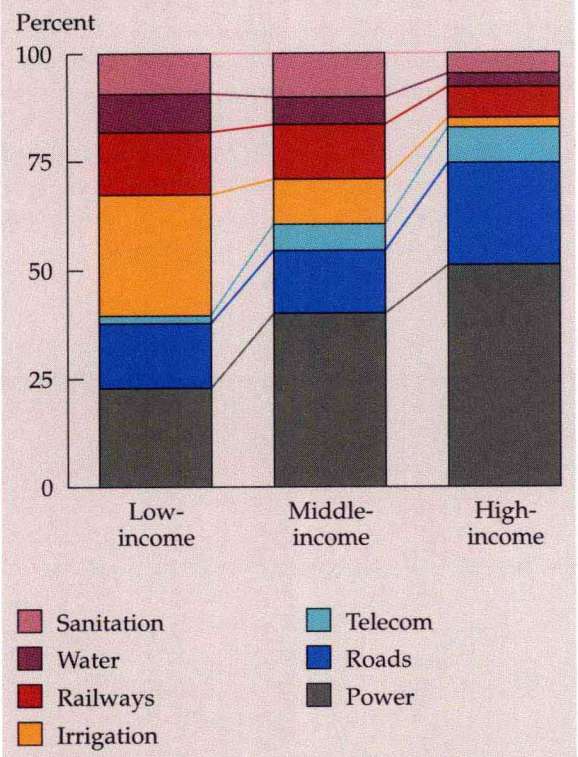
Infrastructure services that help the poor also contribute to environmental sustainability. Clean water and sanitation, nonpolluting sources of power, safe disposal of solid waste, and better management of traffic in urban areas provide environmental benefits for all income groups. The urban poor often benefit most directly from good infrastructure services because the poor are concentrated in settlements subject to unsanitary conditions, hazardous emissions, and accident risks. And in many

Figure 1 As a country's income grows, the amount of infrastructure increases.



Note: Axes are logarithmic; infrastructure includes roads, rail, power, irrigation, and telephones.
a. Purchasing power parity (PPP) dollars are valued in Summers and Heston 1985 international prices.
Source: Ingram and Fay, background paper; Summers and Heston 1991.

Figure 2 The composition of infrastructure changes with country income level.



Source: Ingram and Fay, background paper.

rapidly growing cities, infrastructure expansion is lagging behind population growth, causing local environments to deteriorate.

In developing countries, governments own, operate, and finance nearly all infrastructure, primarily because its production characteristics and the public interest involved were thought to require monopoly—and hence government—provision. The record of success and failure in infrastructure is largely a story of government's performance.

Infrastructure's past growth has in some respects been spectacular. The percentage of households and businesses served has increased dramatically, especially in telephones and power (Figure 3). The per capita provision of infrastructure services has increased in all regions; the greatest improvements have been in East Asia and the smallest in Sub-Saharan Africa, reflecting the strong association between economic growth and infrastructure.

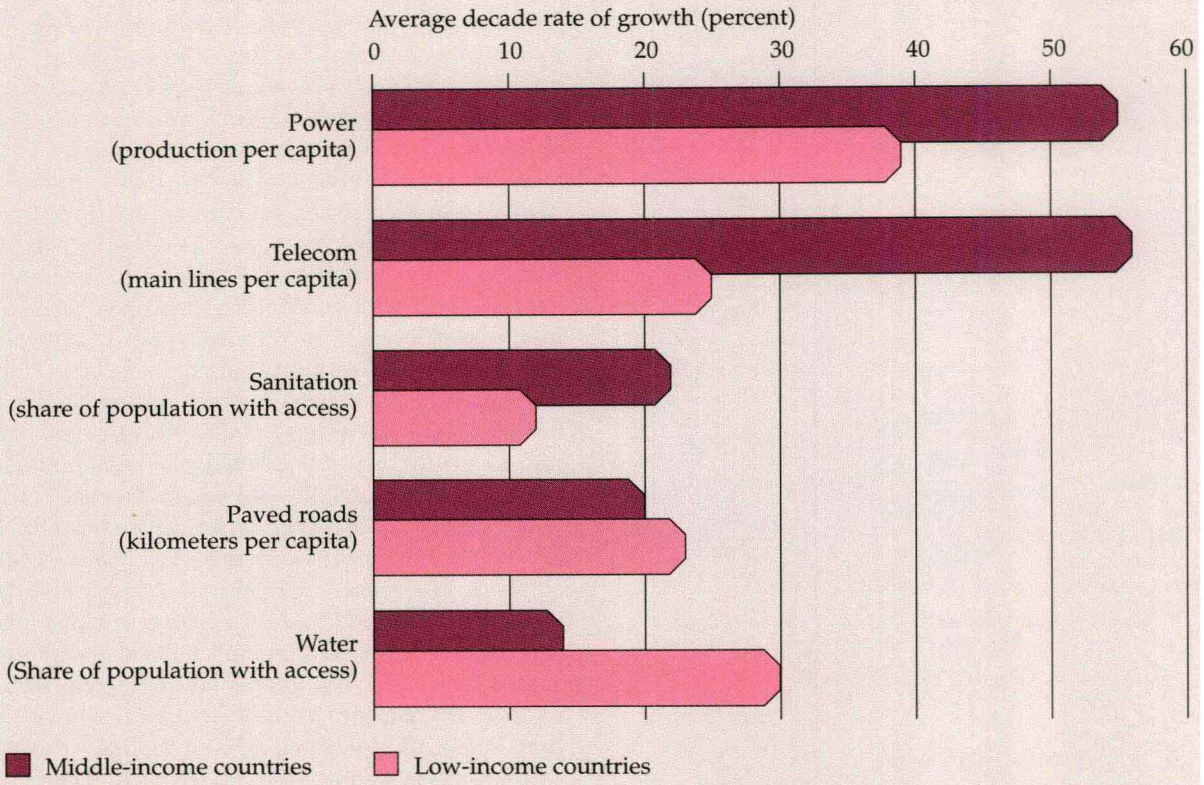
In other important respects, however, the performance has been disappointing. Infrastructure investments have often been misallocated—too much to new investment, not enough to maintenance; too much to low-priority projects, not enough to essential services. The delivery of services has been hampered by technical inefficiency and outright waste. And too few investment and delivery decisions have been attentive to meeting the varied demands of different user groups, or to the consequences for the environment.

Inadequate maintenance has been an almost universal (and costly) failure of infrastructure providers in developing countries. For example, a well-maintained paved road surface should last for ten to fifteen years before needing resurfacing, but lack of maintenance can lead to severe deterioration in half that time. The rates of return from World Bank–assisted road maintenance projects are nearly twice those of road construction projects. Timely maintenance expenditures of $12 billion would have saved road reconstruction costs of $45 billion in Africa in the past decade. On average, inadequate maintenance means that power systems in developing countries have only 60 percent of their generating capacity available at a given time, whereas best practice would achieve levels over 80 percent. And it means that water supply systems deliver an average of 70 percent of their output to users, compared with best-practice delivery rates of 85 percent. Poor maintenance can also reduce service quality and increase the costs for users, some of whom install backup generators or water storage tanks and private wells.

Failings in maintenance are often compounded by ill-advised spending cuts. Curbing capital spending is justified during periods of budgetary austerity, but reducing maintenance spending is a false economy. Such cuts have to be compensated for later by much larger expenditures on rehabilitation or replacement. Because inadequate maintenance shortens the useful life of infrastructure facilities and reduces the capacity available to provide services, more has to be invested to produce those services. Donor objectives (such as seeking contracts for capital-goods supply or consultancy services) may also play a part in the preference for new investment over maintenance. In many low-income countries, donor financing underwrites nearly half of all public investment in infrastructure.

Project investments misallocated by many countries have created inappropriate infrastructure or provided services at the wrong standard. Demands of users for services of varying quality and affordability go unmet even when users are willing and able to pay for them. Low-income communities are not

Figure 3 Infrastructure has expanded tremendously in recent decades.



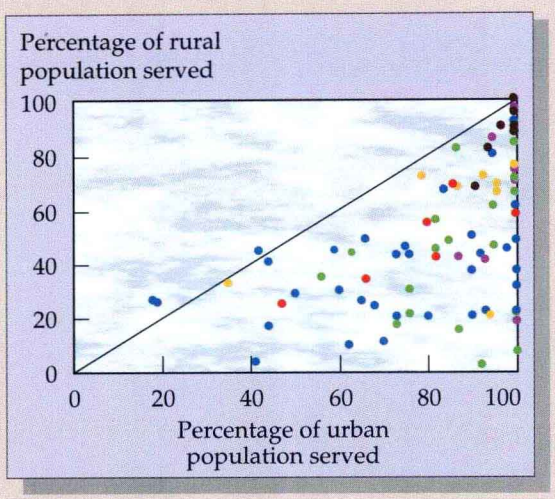
Note: Based on telecom, sanitation, and water data for 1975–90, and road and power data for 1960–90.
Source: Appendix tables A.1 and A.2.

offered suitable transport and sanitation options that provide services they value and can afford. Premature investments in capacity—especially in water supply, railways, power, ports, and irrigation—have often absorbed resources that could otherwise have been devoted to maintenance, modernization, or improvements in service quality. Because many infrastructure investments are immobile and serve local markets, excess capacity cannot serve other markets—and it remains underused. In some cases, large public projects have been overambitious, placing a costly burden on the economy.

Waste and inefficiency claim a large share of resources that could be used for delivering infrastructure services. A review of power utilities in fifty-one developing countries showed that technical efficiency has actually declined over the past twenty years. Older power plants consume between 18 and 44 percent more fuel per kilowatt-hour than do plants in power systems operating at best-practice levels—and have transmission and distribution losses two to four times greater. Port facilities in developing countries, on average, move cargo from ship to shore at only 40 percent the speed of the most efficient ports. Labor misallocations present another source of inefficiency. Overstaffing is far too common in many activities, especially railways, while others, such as road maintenance, warrant greater use of labor-based methods.

These failings in investment and operating efficiency are not compensated for by success in addressing poverty or environmental concerns—for here, too, the infrastructure record is weak. Badly designed and managed infrastructure is a major source of environmental degradation in both urban and rural areas. The poor often consume fewer infrastructure services and pay higher prices than do the nonpoor. For example, households obtaining water from vendors pay much more than those households connected to water systems. In most

Figure 4 Urban populations have better access to safe drinking water than rural populations.



Source: Appendix table A.2.

countries, rural areas receive fewer infrastructure services than do urban areas (with the obvious exception of irrigation), even in such essential services as drinking water (Figure 4). But countries that have made concerted efforts to provide infrastructure in rural areas—for example, Indonesia and Malaysia—have succeeded in reducing poverty dramatically.

Given this mixed performance, improvements in investment and operation are required as a matter of urgency. In addition, the demands on infrastructure are growing. More competitive global trade requires more reliable and sophisticated transport, power, and telecommunications. Governments facing increased fiscal stringency can no longer sustain open-ended financing of infrastructure. And societies today hold infrastructure to higher environmental standards, as evidenced by sections of *Agenda 21*, the primary policy document agreed to by countries at the 1992 United Nations Conference on Environment and Development.

Diagnosing the causes of poor performance

The problems of insufficient maintenance, misallocated investment, unresponsiveness to users, and technical inefficiencies present daunting challenges for future reforms—challenges compounded by new demands and constrained resources. The solutions lie in the successes and failures of policy and in the lessons from recent policy experiments.

There is great variation both within and across countries in the efficiency of providing infrastructure services. Moreover, good performance by a country in one infrastructure sector is not necessarily associated with good performance in other sectors. Some developing countries—and not always the richer ones—perform at high levels. Côte d'Ivoire meets the 85 percent best-practice standard in water supply, while in Manila only about 50 percent of treated water is delivered to customers. In railways, the availability of locomotives is high where maintenance is good: at any given time, India has 90 percent of its locomotives available. Availability is low where maintenance is neglected: 50 percent in Romania and 35 percent in Colombia, compared with a developing country average of about 70 percent. For telephones, call completion rates are 99 percent in the best-performing countries, 70 percent in the average developing country, and far lower in some. These findings indicate that the performance of infrastructure derives not from general conditions of economic growth and development but from the institutional environment, which often varies across sectors within individual countries.

Therefore, to understand what accounts for good performance—and bad—requires understanding the institutional arrangements for providing infrastructure services and the incentives governing their delivery. This Report identifies three reasons for poor performance.

First, the delivery of infrastructure services usually takes place in a market structure with one dominating characteristic: the absence of competition. Most infrastructure services in the developing world are provided by centrally managed monopolistic public enterprises or government departments. Almost all irrigation, water supply, sanitation, and transport infrastructure is provided in this manner. Until a few years ago, telephone services in most countries were the responsibility of a state-owned post, telephone, and telegraph enterprise. The bulk of power has also been provided by a public monopoly. As a result, the pressure that competition can exert on all parties to perform at maximum efficiency has been lacking.