

LITERATURE REVIEW

Introduction

The literature review conducted for this regional technical assistance (RETA) aimed to assess the state of current knowledge on transport and energy linkages to poverty reduction. It did not question the validity of the demonstrated relationships between infrastructure investments and economic growth (Kessides 1993, World Bank 1994, Canning 1999, Yoshino and Nakahigashi 2000; see Mody [1997] for an analysis of the Asian experience), or between economic growth and poverty reduction (e.g., Dollar and Kraay 2000; see World Bank [1993] for an analysis of the Asian experience). Consequently, the review *excluded* studies that are limited to the linkage between transport and economic growth or between energy and economic growth, without an explicit poverty focus. This review focused, instead, on studies that provide empirical evidence, or at least plausible hypotheses, linking specific types of transport and energy investments to specific impacts on poverty. While this review covered qualitative as well as quantitative studies, particular attention was given to the quantitative ones, which could provide useful guidance (e.g., construction of indicators and indices) for the field research.

Although a fairly substantial literature on transport-poverty and energy-poverty linkages exists, relatively little direct, empirical evidence concerns the impact of transport and energy investments on poverty in developing countries, particularly in Asia. This is because transport and energy, like other infrastructure investments, are intermediate goods. They make possible other activities that increase the productivity and enhance the welfare of poor people, and they contribute to economic growth that may provide resources to reduce poverty. However, the linkage is not a necessary one. Other political, socioeconomic, and cultural factors are likely to be important determinants of the poverty impact of transport and energy investments.

On the basis of the literature prior to 2000 reviewed in the Stage 1 report, it was concluded that relatively little published research had addressed the relationship of

infrastructure investments to poverty reduction, although much research had focused on their relationship to growth, particularly growth in the rural economy. It was noted, however, that several ongoing studies were designed to address poverty issues more directly. Since the RETA Stage 1 report was completed in 2001, much additional work has been completed and some of it has been published. The recent literature gives more explicit attention to poverty reduction as a dependent variable.

Since the literature review was completed in 2001, ADB, as part of an overall review of its 5-year-old Poverty Reduction Strategy (PRS) (ADB 2004a), has reviewed and analyzed large amounts of data and published literature on poverty in Asia and the Pacific, the roles of growth and social development and of infrastructure in poverty reduction, the impact of the poverty reduction strategy on country-level operations and project designs, and the monitoring and evaluation of the strategy, poverty assessment reports, and country strategies and programs. The PRS Review incorporates and updates the literature review presented in this Appendix.

Poverty

The Asian Development Bank (ADB) has adopted poverty reduction as the primary goal of its development activity (ADB 1999a). It is pursuing poverty reduction in Asia and the Pacific in the context of its four other strategic objectives: promoting economic growth, human development, and sound environmental management, and improving the status of women. ADB subscribes to the Millennium Development Goals (MDGs) established in 2000 by the international development community, including a 50% reduction by the year 2015 in the proportion of the world's population living in extreme poverty.¹ Much progress has already been made, and despite occasional

¹ Extreme poverty has been defined as per capita consumption valued at less than US\$1 a day in 1993 purchasing power parity prices.

setbacks as the region's economy becomes more closely linked to the global economy, it is expected that these ambitious goals can be achieved (ADB 1999b).

Recent events have shown that progress in poverty reduction is vulnerable to external economic shocks, such as the East Asian financial crisis or the sudden liberalization of transitional economies in the Central Asian republics. Such shocks can, at least temporarily, push nonpoor households back below the poverty line. Progress in poverty reduction is also closely linked to progress in controlling population growth, in preventing and responding to natural disasters, and in controlling interpersonal, civil, and international conflict. ADB's strategy for assisting its member countries in poverty reduction rests on three pillars: promoting pro-poor, sustainable economic growth; promoting social development; and promoting good governance. All three objectives may be pursued through transport and energy projects.

The PRS Review arrived at several findings that will affect the PRS and how it is carried out. Among these findings that affect the conclusions of this study:

- Implementation of the PRS has led to a sharper focus on poverty in ADB's policy dialogue with its developing member countries (DMCs);
- Significant changes have occurred in project design in terms of pro-poor targeting and monitoring;
- In the period 2000–2003, ADB increased the share of transport and energy operations within total ADB lending and technical assistance; and
- It is recommended that ADB focus on sectors and subsectors that particularly help the poor—e.g., in infrastructure sectors, the suggested areas of focus included rural roads, rural electrification, small and medium-sized enterprises, water supply, and sanitation.

Definition of Poverty

ADB defines poverty as “a deprivation of essential assets and opportunities to which every human is entitled” (ADB 1999b). “Essential assets and opportunities” are further defined as “access to basic education and primary health services... the right to sustain themselves by their labor [i.e., access to employment opportunities], and... having some protection from external shocks [i.e., access to social protection],” and, importantly, “[a right to] participate in making the decisions that shape their lives.” This leads to a definition of poverty indicators that includes basic education, health care, nutritional levels, water and sanitation, income, employment, and wages. These

are “tangible” indicators that lend themselves to measurement, and the ADB strategy proposes that they serve also as proxy measures for the “intangible” elements of empowerment and participation. In practice, ADB country assistance strategies are based on the definitions of poverty that are used by its DMCs. Thus, the income levels corresponding to the “poverty line” differ from one country to another.

The concept of measurable, income-based or asset-based poverty can be further specified in terms of *extent* (percentage of the population below the poverty line), *depth* (mean distance of poverty incomes from the poverty line), and *severity* (square of the mean distance below the poverty line). In addition, measures of absolute deprivation (for example, incomes insufficient for adequate caloric intake) can be complemented with measures of relative deprivation or social inequity (e.g., the Gini index). In the Asian context, where significant progress has been made in absolute poverty reduction, social inequity has become an increasingly important dimension of the poverty problem as perceived both by developing countries and by development finance institutions.

The ADB definition fits well with the work on poverty and human development carried out by the United Nations Development Programme (UNDP) over the past decade (UNDP 1990 *et seq.*). UNDP defined a “human development index” combining measures of longevity, literacy, and infant mortality, complementing the income-oriented measures used by the World Bank. More recently, UNDP has added a stronger emphasis on improved governance and participation by the poor as key factors in overcoming poverty (UNDP 2000).

Amartya Sen has been a seminal thinker in shifting the development discourse to poverty alleviation in the broader sense. He defines development as freedom, and freedom as a set of capabilities that enable individuals to lead lives that are valuable in their own terms. Thus, in his view, poverty may be defined as capability deprivation (Sen 2000). Low income levels are thus seen as an indicator and an instrument of poverty rather than as a defining characteristic. Sen points out that the relationship between income and levels of capability varies between communities and even between households and individuals, depending on demographic, social, environmental, and cultural factors. The experience of poverty depends as much on one's perception of oneself in relation to others as it does on conditions of absolute material deprivation. This insight explains why income inequality may be an even more important determinant of perceived poverty than income levels that are insufficient to meet basic human needs.

The World Bank has also recognized the changing thinking about poverty. Its current view of poverty, based partly on the results of extensive consultations with poor people around the world, is given in the 2000/2001 *World Development Report* (World Bank 2001). This report defines the three pillars of poverty reduction as *promoting opportunity* (access to resources, services, and productive employment), *enhancing security* (reducing vulnerability to shocks), and *facilitating empowerment* (increasing the participation of poor people in decision making). The report defines the key indicators of poverty as income or consumption levels in relation to a pre-defined poverty line (national or international), measures of inequality, absolute and relative deprivation with respect to health care and education, exposure to risk, and perceptions of voicelessness and powerlessness.

Recently, development analysts have started to distinguish between transient poverty, structural poverty, and chronic poverty (see, e.g., Hulme and Shepherd 2003). Transient poverty is often the result of sudden shocks such as wars, financial crises, or natural disasters. It affects people who have the basic elements of human and social capital to rebuild their lives, given emergency assistance. Transient poverty is also experienced from time to time by people living close to the poverty line, who may be periodically pushed into poverty by seasonal changes or life cycle events. Structural poverty, by contrast, is basically due to lack of opportunity. It affects people who are disconnected from the wider economy and society and is often geographically focused (Datt and Ravallion 2002, Jalan and Ravallion 2002). The provision of infrastructure and services is critical to overcoming structural poverty. In the absence of intervention, however, structural poverty may be perpetuated for generations.

Chronic poverty may be due to a number of disabling factors at the individual or household level, including dependency (children and the aged); gender, caste or indigenous minority status; and physical or mental disability. The determinants of transient poverty have been shown to be different from those of chronic poverty (Jalan and Ravallion 2002). Chronic poverty thus requires a different treatment in terms of government expenditure (e.g., targeted services, social safety nets, direct income transfers). More attention is now being given to distinguishing between different types of poverty and designing appropriate development interventions for each one.

Poverty in Asia and the Pacific²

Global goals for poverty reduction cannot be achieved without significant progress in Asia, which still accounts for about two thirds of the world's population living in extreme poverty. Generally, the countries of Asia and the Pacific have made significant progress in poverty reduction over the past 20–30 years. Their development strategies have focused on promoting broadly-based economic growth, including major infrastructure investments, and creating an attractive environment for private, employment-generating investment. The “green revolution” in agriculture played an important part in achieving significant and sustained growth in Asia. Growth provided fiscal resources that were redirected toward social programs, including major investments in education and health care services, and in social safety nets. These programs have accomplished a great deal in terms of bringing down poverty levels.

However, recent events have shown that progress in poverty reduction can be masked by the effects of crises or shocks, temporarily increasing poverty and placing a significant strain on government resources. Such events are often geographically specific (natural disasters, local conflicts). In these cases, programs to help the newly poor can be geographically targeted, and infrastructure services can play an important role in delivering relief. In other situations, such as the Asian financial crisis, the effects are felt throughout society in the form of reduced resources for poverty reduction. In these cases, priority needs to be given to ensuring that the benefits of past infrastructure investments are not lost through neglected maintenance, and that services continue to be provided to as many people as possible under fiscal constraints.

While the poverty of the past has been largely rural, and while rural areas remain poorer than urban areas, an important part of the solution to structural poverty has involved rural-urban migration. The effects of this migration are not well understood. On the one hand, it may contribute to growing disparities between rural and urban areas, as the better-off rural people become more closely linked to the urban world, while poorer people become relatively more isolated in rural areas. Alternatively, it may help reduce rural poverty if poor rural people are successful in finding urban employment, and especially if they recycle their earnings into rural savings or investments. Rural-urban migration promotes both the growth of markets for both rural and urban products and the redistribution of re-

² This section is largely based on Cook (2001).

sources through intrahousehold transfers and extended community support groups. The effects of rural-urban migration on the formation and maintenance of social capital are also not well understood. It has been observed that infrastructure investments, which facilitate personal mobility and migration, may have negative effects on “bonding” social capital within a community, but positive effects on “bridging” social capital linking poor communities to each other and to the rest of society.³

Urban poverty has not figured largely in the assessment of poverty in Asia and the Pacific. However, pockets of severe poverty certainly exist in Asia’s urban centers. While rural-urban migration may continue to reduce rural poverty, urban poverty is likely to grow in the future. In contrast to the rural poor, the urban poor suffer the negative side-effects of uncontrolled urban growth: air and water pollution; high costs of food, housing, water and energy; poor sanitation; and problems in delivering adequate health and education services to poor urban areas. In pure welfare terms, households with comparable incomes may be worse off in urban areas than in rural areas, where many resources (water, fuel) may still be obtained “free” from common property resources. In thinking about strategies for poverty reduction in the future, it will be necessary to anticipate a shift in relative importance from rural to urban poverty and develop ways of addressing the problems that are likely to arise.

Poverty assessments in Asia and the Pacific generally find no significant difference in poverty levels between male-headed and female-headed households. This may be partly due to cultural factors, partly to the effects of migration and resource transfers, and partly to the tendency for poor households to consolidate into larger units. This apparent lack of gender bias may also reflect the fact that most poverty assessments have not looked into the intrahousehold distribution of income and social responsibilities. Children, the elderly, and disabled persons in poor households are clearly at greater risk, and strategies to reduce poverty in the future should take their special needs more explicitly into account.

Continuing progress in poverty reduction in Asia and the Pacific depends upon sustaining high levels of economic growth while controlling growth in population. The capacity of Asian countries to continue reducing poverty will depend partly on their success in maintaining a competitive advantage in the global marketplace and mobilizing

³ Pouliquen, Louis, comments offered at the World Bank’s Rural Week, 2001. For a fuller description of these concepts and their relationship to poverty, see Narayan (1998).

private investment. In addition, more equitable societies, all other things being equal, seem to be more successful in widely distributing the benefits of growth and thereby reducing poverty. Patterns of governance, and the relative importance of the public and the private sector, also appear to influence the rate of poverty reduction. Excessive public investment, indebtedness, and inflation seriously constrain the ability of governments to direct public resources toward poverty-reducing programs.

Poverty in Development Projects

Since poverty reduction was established as the overarching development goal by the international community, international finance institutions have sought ways to integrate poverty concerns more explicitly into the design of development projects and the monitoring of development outcomes. Few projects explicitly designed to address poverty reduction were approved before 1995, and most of these are being implemented. International institutions and other development partners have developed guidance for staff and clients on how to take poverty reduction into account in project and program analysis (ADB 2001, World Bank 1999). However, empirical research measuring the poverty impact of development projects is still rather limited, with relatively few research results yet available.

Early efforts to incorporate concern over the distributional effects of development projects in project appraisal (Little and Mirrlees 1974, Squire and van der Tak 1975) were generally unsuccessful (see Powers [1989] for a review of experience with this approach in the Interamerican Development Bank [IDB]).⁴ ADB’s *Guidelines for the Economic Analysis of Projects* (ADB 1997) requires that an analysis be made of the distribution of project effects (costs and benefits) among different groups, and that the proportion of the poor in each group be calculated so as to assess the proportion of net benefits going to the poor (the poverty impact ratio). Some issues with this approach have been identified: how to assess societal benefits derived from meeting the basic needs of the poor, whether to consider that different social groups may have different discount rates and different degrees of

⁴ Incidentally, Powers (1989) reports that in IDB lending, where a (differently defined) poverty impact ratio was systematically calculated for some years, transport and energy projects consistently showed the lowest values for this ratio. Fujimura and Weiss (2001) suggest that this may be due to the difficulties of tracing indirect income effects, since transport and energy are intermediate rather than final consumer goods.

risk exposure, how to specify indirect income effects, how to evaluate the share of the poor in benefits accruing to government, and how to establish the project counterfactual (Fujimura and Weiss 2001).

As part of preparing its poverty reduction strategy, ADB undertook a series of stakeholder consultations in 1998–99 in several member countries (ADB 1999a). These consultations identified the lack of basic infrastructure as one of the aspects of exclusion of the poor, but pointed out the need to balance the social gains from infrastructure investment in remote areas against diminishing economic returns. Other changes needed to overcome poverty (intensifying agricultural production, improving human capital through health care and education programs, creating nonfarm employment opportunities) were not, in these consultations, explicitly linked to infrastructure needs.

A review of 20 ADB projects approved from 1992 to 1998 in five DMCs showed that although they contained a large amount of poverty data, they usually failed to analyze the causes of poverty and often lacked a coherent strategy to overcome it (ADB 2000c). Most did not have a well-defined poverty reduction objective accompanied by baseline data, specific targets, and relevant indicators. The projects provided little information on the breakdown between poor and nonpoor beneficiaries. An ex ante review of recent (since 1995) projects in the transport sector concluded, however, that staff and clients have been moderately successful in mainstreaming poverty concerns in project formulation (Hansen 2000). This review notes the absence of agreed indicators for capturing the non-economic dimensions of poverty, and the necessity of ensuring good follow-up on project monitoring and evaluation activities to find out if their poverty reduction objectives are actually achieved.

The World Bank, too, has established poverty reduction as its overarching objective. Poverty assessments have been carried out in almost all borrowing countries, and assistance is provided to clients for the development of institutional capacity to monitor poverty as well as economic growth. The World Bank has prepared a *Poverty Reduction Strategy Paper (PRSP) Sourcebook* (World Bank n.d.), with chapters on each of the sectors. The *PRSP Sourcebook* chapters on transport and energy are reviewed in the corresponding sections of this chapter.

Infrastructure projects carry a particular risk of impoverishing, or further impoverishing, people affected by relocation associated with the construction of major facilities such as highways, bus terminals, ports, airports, railways, dams, power plants, and transmission lines. Both ADB and the World Bank, as well as other development

partners, have strong policies determining the requirements for resettling people affected by such projects and internalizing the consequent costs in project cost-benefit analysis. Current thinking in the area of resettlement policy and planning focuses on early identification of risks such as loss of land, loss of employment, loss of shelter, loss of food security and other health risks, loss of access to common property resources, and loss of social capital, including family and community ties, formal and informal social organizations, and traditional mechanisms of social control and political participation (Cernea and McDowell 2000). ADB has also prepared guidance for staff on identifying these risks and planning appropriate mitigation measures to include in projects (ADB 1998).

Poverty and the Private Sector⁵

Sustainable poverty reduction requires sustained, pro-poor growth as well as targeted transfers and safety nets for the poor. The resources needed to fuel sustained growth far exceed the resource mobilization capacity of governments and international institutions. Private capital flows are already far more significant, and the private sector is often a more efficient and effective manager of investments, particularly profit-making ventures, than government. Thus, the active involvement of the private sector is essential for successful poverty reduction. This conclusion is particularly relevant for the infrastructure sectors. (See Box A.1.)

A study of current private sector involvement in infrastructure provision for the poor shows that over 80% of low-income countries have some type of private participation in infrastructure. In the lowest-income countries, the public sector is still responsible for most infrastructure investment, although even here, private sector involvement is growing rapidly (Houskamp and Tynan 2000). About two thirds of all private sector investment in low-income countries in 1990–1999 went to two countries, India and the People's Republic of China (PRC), while significant shares were also allotted to Indonesia and Pakistan. These four countries resemble middle-income countries in the levels and types of private infrastructure, which cover all or nearly all of the sectors reviewed (energy, telecommunications, transport, and water supply). The majority of

⁵ A useful symposium on this subject is *Infrastructure for Development: Private Solutions and the Poor*, Proceedings of an international conference held in London and sponsored by the Public-Private Infrastructure Advisory Facility (PPIAF), DFID, and the World Bank, 31 May–2 June 2000. Several of the studies cited in this review are reprinted in Brook and Irwin, eds., *Infrastructure for Poor People: Public Policy for Private Provision*, World Bank and PPIAF, 2003.

Box A.1. Role of the Private Sector in Poverty Reduction

The private sector, the engine of growth, can also play a direct role in poverty reduction. It can participate in physical and social infrastructure, including provision of basic services that will benefit the poor... As the role of the private sector expands, that of the government should shift from owner and producer to facilitator and regulator... Governments must also monitor the social impacts of privatization to see that retrenchment, redeployment, or compensation programs are appropriate... For poorer areas, public investment is generally necessary (p. 9).

The contribution of the private sector to poverty reduction will be enhanced through enterprise development, expansion of infrastructure and other public services, and improvement of corporate governance and responsibility... Private operators could be enabled to increase their participation in providing infrastructure and public services and in projects targeting the poor. Regulatory reform will, however, need to precede sector-specific approaches such as privatization, contracting out, and public-private partnerships (pp. 23–24).

Source: ADB 1999.

projects in low-income countries are “green field” projects, where a private entity or a public-private joint venture builds and operates a new facility from the ground up. This category also includes build-operate-transfer (BOT) and build-operate-own (BOO) projects, as opposed to divestitures and operations and management contracts with major capital expenditure.

Komives, Whittington, and Wu (2000) made an attempt to measure the extent to which the poor benefit from infrastructure services (defined to include water, sewer, electricity, and telephones) on a global basis. Access to roads and road transport services were not included in this survey. Given the limitations of current country-wide infrastructure statistics, the paper used data from the World Bank’s Living Standards Measurement Survey to construct statistics for a pooled sample of 55,500 households from 15 countries around the world. Results suggested that the very poor rarely benefit from infrastructure services. Electricity coverage was more widespread than that of other infrastructure services at all income levels; water connections came second, then sewer connections, followed by telephones. Electricity was the only infrastructure service with significant penetration (32%) among the poorest 5% of the sample households.

A recent survey of professionals working in public utilities in developing countries (Houskamp 2000) shows strong agreement that (i) improved services are a top priority for low-income households, (ii) a majority of low-income households understand the positive health and safety consequences of improved services, and (iii) the techniques currently available for assessing the level of demand are still inadequate. Respondents agreed that the best outcome would be for everyone to receive services through formal delivery systems. Technological considerations make it advantageous to plan and build networks starting with trunk facilities and working down to distribution or feeder pipes and lines. The respondents also agreed that efficiencies from standardization and economies of scale are significant in utilities, limiting the possibilities for competition. However, they felt that if provision of services by providers other than public utilities were allowed, small entrepreneurs would offer sustainable low-cost alternatives to formal network supply. The survey reflected views that achieving some improvement in service for all low-income households is more important than meeting absolute service quality standards for a smaller number of households. Respondents also agreed that utilities in developing countries should be subsidized to ensure that the poor gain access to essential services. They felt that cross-subsidies (or social tariffs), though imperfect, are the best means of making infrastructure services accessible to low-income households.

Privatization of “natural monopolies,” such as utilities, raises some important questions about the role of public policy in protecting the interests of consumers and ensuring access of the poor to services. Ehrhardt (2000) summarizes the key structural issues that governments should consider when planning to introduce private participation in network utility industries. He recommends regulatory reform to allow entry by new providers in some market segments to compete with the incumbent or to serve previously unserved market niches. Small operators may be able to provide a “basic needs” level of service more cheaply than formal network operators. Small operators and new entrants may also offer cost-quality combinations better suited to poor people’s willingness and ability to pay; new entrants can offer innovative tariff and payment systems that make it easier for poor people to access service. To allow and support pro-poor structural changes, regulation should allow new entrants to access existing networks on fair terms, be light-handed so as not to burden small and informal providers, and be reduced as competition increases.

Smith (2000) identifies three principles for the design of pro-poor regulatory systems: (i) intervene sparingly, and with care; (ii) ensure that regulatory bodies have the right expertise, are independent of those regulated, and are placed at the appropriate level of government; and (iii) involve stakeholders in regulatory policy formulation and implementation through a transparent process. Regulatory bodies need access to reliable information in order to make sound decisions. This includes information about the needs and priorities of consumers, firms, and other stakeholders, as well as information about the performance of regulated firms. A pro-poor regulatory strategy would focus on deregulation, eliminating barriers to entry, reducing the scope and intensity of price controls, and being more pragmatic in attempts to control service quality. In addition, such a system would systematically take into account the perceptions and priorities of the poor in evaluating industry performance.

Legally established monopolies in infrastructure services such as transport and energy, with provisions for cross-subsidies between different categories of users, are often justified as a form of “protection” for the poor. However, recent research has shown that the intended benefits of such regulation rarely reach the poor. Restructuring and privatization of public enterprises to promote competition may be a more effective way to accomplish this objective. Regulators need to become effective advocates for the needs of the poor, and to help in ensuring that they are heard. This may involve building new partnerships with civil society and adopting new methods of obtaining information about the practical effects of different regulatory approaches.

Pro-Poor Growth

In recent years, considerable work has been done on the nature of “pro-poor growth” and the role that infrastructure investments may play, alone or in combination with other public expenditure priorities, in enhancing the distributive impacts of growth (Ahluwalia 2002, Ali and Pernia 2003, Jalan and Ravallion 2002, Kakwani and Pernia 2000, Kakwani 2000, Pernia 2001, 2003). These studies tend to show that the benefits of trade policy and institutional reforms are less likely to reach the poor, especially those who are geographically isolated, when public (or private) investment in infrastructure is constrained. Infrastructure has a key role to play in streamlining product and factor markets and extending opportunities to the poor, especially the rural poor (Yao 2003). Particularly in Asia, economic growth and poverty reduction

have followed expanding access to global markets, which in turn depends on expanding transport and logistic infrastructure at the national level (Carruthers and Bajpai 2002). Other types of public investments (e.g., education) are also needed so the poor can take full advantage of these opportunities.

The importance of linkages between farm and non-farm growth in the rural economy for the welfare of the poor has been known for some time (e.g., Hazell and Haggblade 1993). Recent research has underlined the increasing marginalization of agriculture in the world economy and its consequences for the rural poor (Bryceson, Kay, and Mooij 2000). This theme suggests that the positive impacts of infrastructure investments on poverty reduction, even in rural areas, may be achieved more by expanding opportunities in the nonfarm sector than by increasing agricultural output. However, a recent analysis of data for Viet Nam shows that the processes determining poverty and those inhibiting diversification of income sources are not the same (van de Walle and Cratty 2003). Thus, development of the rural nonfarm economy offers a way out of poverty for some, but not all, of the poor.

The World Bank recently completed a wide-ranging review of the literature on the impact on poverty reduction of increased access to infrastructure services in four sectors: energy, water and sanitation, transportation, and information and communication (Brenneman and Kerf 2002). This review defines “increased access” in terms of greater quantity, improved quality, or reduced costs (greater affordability). It looks at eight categories of impacts, from general growth linkages to economic impacts on the poor (through cost savings or employment opportunities); impacts on health care, education, and governance; non-economic welfare impacts; and fiscal impacts (releasing public resources for implementation of pro-poor social policies). The definition of poverty alleviation used in this review is equally broad, ranging from growth impacts in poor countries (assumed to benefit the poor) to targeted impacts on the poorest of the poor. The review found strong evidence of growth-enhancing impacts for transport and energy, as well as strong synergies with education. Some positive synergies were also found with public health. Linkages with improved governance and fiscal impacts were generally found to be weak, except for information and communications. The report concludes that infrastructure impacts on poverty are similar in all regions, but are better documented in regions where physical infrastructure is still largely lacking (e.g., Africa) than in regions where access problems are due more to affordability and quality issues (e.g., Asia).

The United Kingdom's Department for International Development (DFID) has been one of the main sponsors of research on transport and energy interventions targeted to the needs of the poor. Recently, its work has focused on directly linking infrastructure activities to the achievement of the MDGs (DFID 2002a, 2002b). A background paper prepared for this program stresses the need for efficient management and timely expansion of national networks in tandem with policies and investments designed to improve services to the poor (Willoughby 2002b). The paper argues that infrastructure should be seen as a leading sector in efforts to improve the productivity of the poor. Infrastructure contributes to pro-poor growth in four ways: by spreading the benefits of trade to low-income areas, reducing the risks associated with private investment in manufacturing and agriculture, facilitating the delivery of education and health care services, and reducing the risks associated with natural and man-made disasters. Making infrastructure more responsive to the needs of the poor requires institutional and regulatory reform to promote competition, with greater accountability to and participation by the public, including the poor, as well as the elimination of subsidies now largely captured by the nonpoor.

A recent International Labour Organization (ILO) publication provides an extensive analysis of requirements for the rapid assessment of poverty impacts, with special reference to employment-intensive infrastructure projects (Murphy 2000). The proposals reflect current thinking on the livelihoods approach to analysis of the effects on poverty of potential interventions. Basically, what makes the proposed approach "rapid" is the avoidance of direct measures of income and expenditure, relying instead on scaled (and somewhat subjective) measures of access to food, water, shelter, energy, and "nonfood essentials," as well as health status and asset ownership (household goods and tools, land and livestock). The methodology proposes categorizing respondents into four groups: the "ultra-poor" who are extremely deprived and highly vulnerable; the "poor" who are deprived and vulnerable; the "modest" who are not deprived, but still vulnerable; and the "prosperous," who are neither deprived nor vulnerable. The first three categories roughly reflect the concepts of chronic poverty, structural poverty, and transient poverty.

Transport

Most of the early empirical work linking transport investments with poverty reduction defined poverty in terms of a region or a rural economy, without disaggregat-

ing to the village or household level. A recent survey of the issues and evidence on the links between transportation and poverty reduction uses the "sustainable livelihood" framework developed by DFID. It is argued that a general equilibrium approach would be needed for a rigorous assessment of the complex consequences of transport interventions for the lives of poor people. Current studies are limited to the roads subsector, and suffer from many methodological problems. The report stresses the role of transport infrastructure and services in building the asset base (physical, human, and social) of the poor. However, the report also points out that the effects of transport improvements on the livelihoods of the poor depend on both the broader structural and institutional context and the other assets available to the poor. Therefore, projects should evaluate sector policies and possible needs for institutional strengthening, especially in building capacity for decision making at decentralized levels that may be more responsive to the needs of the poor.

The World Bank has developed informal staff guidance on addressing poverty issues in transport sector operations (Gannon and Liu 1999). The report suggests caution in evaluating project benefits based on measures of willingness to pay, which may place a premium on projects primarily benefiting higher-income groups. It also points out that privatization of public transit may lead to labor redundancy, increased fares, and reduced affordability, which would impact most severely on the poor. Conventional cost-benefit analysis is not suitable for evaluating improvements to very low-volume rural roads and the benefits to nonmotorized transport users (including pedestrians) of improving roads to all-weather standards. In these contexts, alternative appraisal methods such as cost-effectiveness analysis should be used to guide project selection.

Additional guidance is provided in the Transport chapter of the World Bank *PRSP Sourcebook* (Gannon, Gwilliam, Liu, and Malmberg Calvo, undated). This chapter aims to help decision makers integrate transport interventions into poverty reduction programs. It points out that transport affects poor people as consumers, producers, workers in transport operations, and groups exposed to adverse impacts. Demand for transport is largely derived from other sectors; hence, transport investments will have the greatest impact on poor people when other sector interventions (both policies and investments) are also in place. The *Sourcebook* stresses the need to address both infrastructure and services in transport policy, establish public accountability for poverty outcomes, and promote broad public participation in planning and action to meet trans-

port needs. The chapter also includes a set of diagnostic tools and key questions that can be used to assess the transport needs of poor people and the performance of the transport sector from a poverty reduction perspective. It describes key policy and strategy options in relation to rural transport, urban transport, and institutional reform. Finally, it discusses the role of monitoring and evaluation in the transport sector and includes proposed indicators.

The empirical literature on transport and poverty reduction is heavily biased toward (i) roads, (ii) rural dwellers, and (iii) Africa. Asia is very different from Africa. The difference may be most striking in terms of the role of women (see Box A.2), who provide the main mode of transport in the parts of Africa most studied in relation to poverty. In Africa, women spend much time head-loading goods on foot, in addition to undertaking other physical tasks, little shared by men. This is not typical of Asia.

Transport Needs of the Rural Poor

Staff members at Intermediate Technology Limited, in collaboration with the ILO, conducted early studies on rural transport services in Bangladesh, India, Kenya, Republic of Korea, Malaysia, Nigeria, Philippines, Tanzania, and Western Samoa (Barwell et al. 1985). These studies concluded that transport planning in developing countries did not take adequate account of the needs and requirements of the rural poor. The transport needs of the rural poor are largely for the movement of small loads over relatively short distances. Much of this is “on-farm” transport, between farmers’ homes and their fields, pas-

tures, woods, and water sources. The majority of the rural poor lacked direct access to a motorable road, and consequently they also made infrequent use of public transport services. Lack of credit facilities in rural areas was a major constraint on the ability of the poor to acquire appropriate means of transport.

Further work focused on the problems of supply and appropriateness of transport vehicles serving the poor, whether in urban or rural areas. Dawson and Barwell (1993) noted the existence in different parts of the developing world of low-cost vehicles and carrying devices appropriate to local-level transport tasks. These are collectively called intermediate means of transport (IMTs)—intermediate, that is, between walking (with loads carried on the head) and conventional, expensive, and high-capacity motor vehicles. IMTs include simple devices to facilitate the carrying of loads by people, such as the shoulder pole and the backpack frame; human-powered vehicles such as wheelbarrows, handcarts, and bicycles; animal-powered vehicles such as donkeys with panniers and animal-drawn carts and sledges; small, low-cost motor vehicles such as mopeds and motorcycles; and boats propelled by oars, sails, or small motors. (See Box A.3.)

Given that so much rural travel is on foot or by IMT remote from the road network, improving the condition of footpaths and tracks can also have a significant impact on the efficiency of rural travel and transport (Barwell 1996). Improvements can take the form of increasing the safety of footbridges or other water crossings so that people do not have to make long detours to avoid dangerous river crossings; straightening paths so that they are not unnecessarily long and indirect; reducing the length of steep or

Box A.2. Women’s Transport Needs

Women’s transport needs are different from men’s, and the transport responsibilities of women and men are quite separate. The triple burden of women—reproductive, productive, and community-managing work—determines their transport activities and needs. Women are time- and energy-impooverished from meeting transport needs and are generally less mobile than men in the same socioeconomic group. Also, women are much less likely to have access to and use transport technology than men. Existing transport infrastructure, services, and technology may be inappropriate for women (e.g., bicycle design). Women have less money and face more cultural constraints.

Women’s transport activities are much less visible in transport planning. Infrastructure and transport services oriented to the needs of women could drastically reduce women’s workload and free up time and energy for other productive and reproductive tasks. Transport planners need to consult with men and women to address the intrahousehold division of labor, multiple transport needs, and cultural attitudes and norms. Furthermore, planners need to implement targeted schemes, such as providing credit for appropriate intermediate means of transport, and to develop and enforce regulations to ensure the safety of women, especially while walking or on public transport.

Source: Hanmer, L., E. Lovell, R. Chapman, and T. Slaymaker. 2000. *Poverty and Transport: Toolkit*. London: Overseas Development Institute.

Box A.3. Introduction of Intermediate Means of Transport in Ghana

The First Transport Rehabilitation Project in Ghana included a pilot program to introduce new forms of intermediate means of transport. In Ghana, as elsewhere in Africa, few transport options were available to bridge the gap between head-loading and motorized transport. The project aimed to bring benefits to the poor by constructing or rehabilitating farm-to-market roads, using labor-intensive construction methods, and promoting the manufacture and sale of low-cost transport vehicles (bicycles with trailers). Design models supplied by international consultants were modified and manufactured by local agencies, mostly in the informal sector. Rural women were the main beneficiaries, since they do most of the head-loading. They learned to ride bicycles and also used the trailers as pushcarts. One local producer modified the trailer for use as an “ambulance” to carry sick people.

Affordability for the poor was a problem, as was the capacity of local manufacturers to produce vehicles at significant scale. The Government set up revolving funds in some communities to start hire-purchase programs. Other group purchase schemes were initiated by nongovernment organizations (NGOs). Local NGOs were also used successfully as consultants for collecting socioeconomic data, providing feedback on vehicle design, and as subcontractors in some projects.

Source: Pankaj, Thampil. 1991. *Designing Low Cost Rural Transport Improvements to Reach the Poor*. Infrastructure Notes, Transport RD-3. Washington, D.C.: World Bank.

slippery sections; and making a footpath also passable by an IMT such as a bicycle or an animal-drawn cart. A World Bank publication provides further guidance on incorporating nonmotorized transport (NMT) into project design (Guitink, Holste and Lebo 1994). This requires addressing issues ranging from economic policy (analysis of import and tariff regulations, availability of credit) to traffic engineering and management (developing design standards for infrastructure accessible to NMTs and integrating them with design standards for motorized traffic), road safety regulation, and integrated land use planning. The World Bank has recently conducted a comprehensive review of its experience with introducing NMTs (Starkey et al. 2002).

To learn more about local transport needs in rural Africa, village-level travel and transport surveys and related case studies were carried out in the early 1990s. Barwell (1996) synthesizes the key findings and recommendations from research comprising five village-level surveys of household travel and transport demands, carried out in Burkina Faso, Uganda, and Zambia. The study found that women contribute at least 65% of the household time spent on travel and transport. The study also found that rural households in Sub-Saharan Africa (SSA) make significant use of IMTs. Finally, the village-level studies showed that proximity to an active urban center and to a main road, complemented by good road access, has a positive influence on the level of household income. Since few rural households in SSA own conventional, four-wheeled motor vehicles, it is through transport services provided by commercial motor vehicles (trucks, buses, taxis) that they benefit from improvements to the rural road network.

Transport Needs of the Urban Poor

Relatively less attention has been paid to the transport needs of the urban poor, a small but growing category in Asian towns and cities. Kranton (1991) reviewed the literature to date, which was mainly based on information obtained during the late 1970s. The research was also biased toward travel by public transport and toward longer trips, neglecting the frequent, short pedestrian trips made by the poor to reach markets, schools, and social services. The vast majority of trips made by the urban poor represent travel either to work or to school. While in urban areas the journey to school is generally short, the journey to work may be quite long and time-consuming. The problem is less significant for residents of inner-city slum areas than for poor households clustered on the urban periphery, far from the central business district. Crowded, infrequent, and unreliable public transport makes commuting especially difficult for the poor, who may have to transfer several times in order to reach their job sites. Costs in many cases remain prohibitive in relation to their incomes. Kranton also notes that the need to travel long distances to work affects the household economy and the intrafamilial division of labor, limiting the employment and educational opportunities of poor women and girls in urban areas.

Men in urban areas make more and longer trips than women (Allport 2000), whose trips are mainly for marketing and accompanying children to and from school and other services. If a poor household owns a bicycle or other means of transport, the male head of household is more likely to use it for the journey to work, so that women, children, and the elderly must walk or use public transit.

Local culture is also an important determinant of modal choice, even for poor people. In some cities, for example, walking and cycling are not seen as acceptable modes of transport, especially for women. This attitude has been associated with the development in urban areas of alternatives to public transportation, through the use of paratransit (small, owner-operated motor vehicles) or NMTs (carts, rickshaws).

A recent report, prepared as part of the World Bank's efforts to develop a new urban transport sector policy, provides some additional evidence from Africa (Howe and Bryceson 2000). This study found that walking is the only mode of transport used by at least half of the urban population, and among the poor it accounts for 80% to 90% of all trips. Yet the urban infrastructure in the four cities studied makes little accommodation for pedestrian movements. While some of the poor can be found in informal settlements on the urban periphery, the poor are more widely dispersed, both in informal "in-fill" settlements and in nominally wealthy areas. This makes it difficult to meet the transport needs of the poor with geographically targeted interventions. Finally, the study found that NMTs accounted for 50–80% of the trips made but less than 10% of the total direct transport costs, while private cars accounted for about 5% of trips but 60–70% of total direct transport costs. Including indirect costs such as pollution and accidents would only increase the costs attributable to motorized transport.

Rural Transport Improvements

The focus on rural development in the late 1970s as the key to poverty reduction produced a flurry of studies of the socioeconomic impacts of rural road investments. These early studies were reviewed in a United States Agency for International Development (USAID) program discussion paper (Devres 1980). The report paid particular attention to the evidence regarding distributional effects. It found that, in general, rural roads created opportunities, and that those in the best position to take advantage of these opportunities were likely to benefit most, in the absence of complementary programs to counteract this effect. The study also points out that participation of affected communities in rural road planning could help resolve many social and economic issues and maximize the desirable impacts of projects. (See Box A.4 for a more detailed summary of findings.)

Cook (1983) reviewed the findings of World Bank-funded research on travel behavior in rural areas of devel-

Box A.4. Early Evidence on Rural Road Impacts

- Roads lead to agricultural production increases. Larger, wealthier farmers are able to benefit most.
- Subsistence farming yields to commercial farming. Production of crops that are perishable and/or are transport-intensive generally increases the most.
- Rural roads expand the use of new tools, machines, inputs, and modes of transportation. Wealthier producers benefit most.
- Rural roads encourage the establishment of government services and private cooperatives. The major beneficiaries appear to be the larger farmers.
- Agroindustrial, industrial, and commercial enterprises increase along the road corridor. Such expansion can hurt local cottage industries.
- Rural roads stimulate short-term employment, especially if they are built using labor-based technologies. They also contribute to wider employment opportunities in the medium and long term. However, workers engaged in traditional modes of transportation may be displaced.
- Road improvements lead to higher land values and more intensive land use. These benefits may be captured by wealthy outsiders and/or a local elite.
- Transport cost savings are available to all, but the new modes of transportation may be out of the economic reach of the poor.
- Marketing activities increase and new marketing patterns arise with road improvements. The largest beneficiaries are large cash crop producers and those close to markets.
- Rural roads increase the availability and use of consumer goods, social travel, and recreational activities. The consequences for the poor are mixed.
- Rural roads increase access to health and education services, but the benefit of these services to the poor is not always evident. Other barriers remain. Also, roads may serve as the vectors of new diseases and/or new cultural values disrupting the community.
- Roads have mainly negative effects on ethnic minority groups but mainly positive effects on women.
- Farm-to-market roads have relatively little impact on rural-urban migration, but rural arterial roads may accelerate migration to urban areas.
- Rural roads accelerate deforestation through the expansion of agricultural land and the increased commercial exploitation of forest resources. Intensified production may lead to soil degradation and erosion as well as pollution from fertilizers and pesticides. Poor road design may lead to flooding and other types of environmental damage.

Source: Devres, Inc. 1980.

oping countries, including studies carried out in the Benin, India, Republic of Korea, Mexico, and Upper Volta. The results showed that personal travel on rural roads is an important activity in rural areas, consuming a substantial amount of time and energy.⁶ A significant share, but probably less than half, of all such travel is work-related. Other reasons for traveling include seeking health care or education services, or participating in social, political, or religious activities. The study shows that changes in personal mobility resulting from rural road improvements may have far more profound effects on rural development than changes in commodity transport. It points out that the appropriate design of projects intended to serve mobility needs may be different from those designed to promote commodity transport.

Additional case studies were comprehensively reviewed in Howe (1984), who found little evidence for any effects of road investments on rural incomes and income distribution, although some evidence existed for effects on access to services. Howe points to some of the more negative outcomes documented by these early case studies, such as land consolidation by the wealthy and increasing landlessness among the rural poor, the decline of local industries in the face of competition, and damaging effects on natural resources. His review highlighted important policy implications: the difference between the poverty-reducing impacts of new roads and improvements in existing roads, the importance of the agriculture sector policy context in determining whether expected benefits could be realized, the failure of project evaluation methods based on agricultural value added to capture the benefits associated with improved personal mobility, the role of land tenure in determining income distribution outcomes, and the need for a coordinated set of public policies and programs to ensure the effective participation of small farmers in project benefits.

Four case studies published in Howe and Richards (1984), on Botswana, Egypt, India, and Thailand, also showed little evidence of transport planners being responsive to concerns about income distribution and poverty reduction. Labor-based methods of road construction and maintenance were not widely used, despite their well-documented benefits to the poor. In the absence of targeted interventions, the authors conclude that rural road investments are likely to reinforce existing socioeconomic

structures in rural areas and to speed up any tendency toward social and economic stratification.

From the early 1980s into the 1990s, considerable interest was shown in using low-volume rural road construction and maintenance to generate employment opportunities for the rural poor. Employment in road construction provides direct, immediate benefits to poor people and also generates additional benefits through the multiplier effect of expenditures in the rural economy. Labor-intensive methods also often make use of locally available construction materials, adding to the transfer of investment benefits to the rural economy. Where labor-intensive methods have been used, the benefits that are likely to result are clearly evident (Edmonds and Howe 1980). Programs can be wage-targeted to reach the poorest of the poor, and ways found to ensure participation by women. The multiplier effects from wages spent in the rural economy have been estimated in the range of 1.5–2.8. Furthermore, labor-intensive works can be constructed at costs 25–30% less than those of comparable capital-intensive methods (Keddeeman 1998). Labor-based techniques are most appropriate for roads in areas of relatively high population density but with low expected traffic levels, and where communities are expected to assume responsibility for future road maintenance. However, labor-based methods of road construction are only infrequently used in practice, and the immediate benefits of wage employment are not usually sustained over time.

A study of access effects in Bangladesh (Ahmed and Hossain 1990) compared outcomes in a matched sample of 16 villages having comparable soil and agronomic conditions, topography, and water regimes. The villages were ranked on an index based on village access (taking into account distance, main means of transport, and cost) to primary and secondary markets, secondary schools, banks, bus stops, and the *upazila* center. The study found somewhat higher (24%) agricultural incomes in the villages with better access, and a larger increment (78%) in incomes from livestock and fisheries. The study also found that agricultural wages rose (by 12%) and total wage income almost doubled (92%) in villages with better access. Significantly, this study concluded that landless laborers and poor farmers benefited proportionally more than the wealthy from these increases in agricultural income and wage earnings. However, the effect on business and industry was relatively small and had little poverty impact because of the ability of wealthy families to capture these gains through their better access to capital.

The study found no significant difference in educational levels between the more accessible and less acces-

⁶ The study does not include off-road travel common in rural areas such as farm-to-field travel, herding, and water and wood gathering, nor does it include home-to-school travel for most children.

sible villages in the sample. However, their levels of health differed significantly and, although it found no difference in health status between men and women in villages with better access, the study observed a significant difference in health status between men and women in villages with poor access. For a variety of reasons, however, the Bangladesh experience may be unique in this respect, and investment outcomes there are unlikely to be replicable elsewhere.

A more recent effort at empirically evaluating the impact of rural road improvements on the rural economy and the life of rural people is found in Levy (1996). This study of a rural roads (paving) project in Morocco compares before- and after-project data for a sample of four project roads and four control roads.⁷ The study did not disaggregate the beneficiary population in terms of poverty, except for stratifying the sample households by farm size. In addition to reducing vehicle operating costs, the project succeeded in eliminating frequent road closures during rainy days. Reduced vehicle operating costs were reflected in lower prices for goods and passenger transport, resulting in (considerable) induced (and deviated long distance truck) traffic growth on project roads. Ownership of motor vehicles and the supply of passenger transport services increased significantly. Access time to service centers was cut by at least 50%, due partly to better road transport and partly to the location of new facilities in the study areas. Agricultural production patterns changed dramatically as farmers shifted from low-value, less perishable foodgrains to high-value fruits and vegetables produced for export markets. Use of inputs and extension services by small farms increased more than for large farms, which had previously had sole access to such services. Off-farm employment increased dramatically in both sample and control zones, but growth was twice as great in the areas affected by project roads.

The sample zones showed much higher gains in primary school enrollment than the control zones. The quality of schools improved through better teacher recruitment and retention. Use of health care facilities also increased, as quality improved due to the ability to attract more qualified staff and to ensure a regular supply of medicines. Paved roads facilitated the implementation of immunization and other preventive health care programs. Significant impacts

for women included a major increase in female primary school enrollment and the availability of maternal and child care programs. Women's lives were also affected by the presence in the market of butane gas at affordable prices, reducing the requirements for fuelwood collection. Travel between the study areas and urban centers increased markedly.

A second impact evaluation study addressed the impacts of feeder roads constructed in the state of Bahia, Brazil, some 10–15 years after completion (World Bank, 1997). The goal of the program was to promote coffee, cocoa, and dairy development in the state; poverty reduction was not an explicit objective. Roads were selected in consultation with the major producer organizations for each commodity. Not surprisingly, the roads initially benefited primarily the large farmers already living in the project areas. However, they also stimulated in-migration and brought improved living conditions for the population as a whole, including small farmers and landless farm workers. The share of landholdings under 50 hectares (ha) (“small farmers”) increased substantially over the study period. The report is largely based on data collected under contract by a local nongovernment organization, which did not permit quantification of social impacts or analysis of the distribution of costs and benefits.

The DFID Infrastructure and Urban Development Department has sponsored much research on labor-intensive technologies for road construction; appropriate design for low-volume roads, tracks, and trails; and appropriate technologies for NMT. This research has shown that reductions in transport costs can have a significant impact in rural areas, as there is a high elasticity of demand (30% increase in demand with a 10% cost reduction).⁸ Such cost reductions can be achieved through improved asset management and a better interface with the private sector. Private investment in the provision of transport services accounts for well over half of all transport costs. DFID research on the market for transport services has shown that significant cost reductions can be achieved by providing better information to operators. DFID has also paid particular attention to road safety and the distribution of safety-related costs imposed on road users.

In parallel with the present RETA, ADB's Operations Evaluation Department carried out a study of the impact of rural roads on poverty reduction (ADB 2002d). The analysis was based on in-depth case studies of six ADB-financed rural road projects in Indonesia, Philip-

⁷ Note, however, that the preproject data was not actually collected before the project, but is based on the recollections of survey respondents. Control roads were selected after the project was completed, but no attempt was made to “match” the control villages to the sample villages.

⁸ John Howe, personal communication.

pinas, and Sri Lanka. In each country, one project was a stand-alone road project and another was part of a rural development project. The study concluded that the poor and the very poor benefited substantially from social impacts through improved access to state services. However, economic benefits were difficult to identify, especially since most projects lacked baseline data and failed to implement planned monitoring and evaluation activities. The study found that the poor were often unable to capture the benefits of transport cost savings, due to their indebtedness to traders and the lack of competition on transport routes. Lack of maintenance of improved roads was another constraint, leading to a rapid decline in the benefit stream and reduced incentives for the poor to take the risks involved in changing their livelihood strategies. Problems with access to land, poor land quality, and lack of other assets, particularly access to information, meant that the poor in the cases studied were largely unable to capitalize on rural road improvements.⁹

ADB also sponsored a study of the impact of roads on poverty reduction in Bangladesh (TA 3508-BAN). This study found that providing all-weather access for rural residents on small roads with improved earthworks, bridges and culverts, and assuring regular maintenance of such roads, has a strong impact on reducing poverty (ADB 2000e, The Louis Berger Group, Inc. 2002). In addition to improving the integration of the poor in the national economy, these interventions are important in mitigating risks to the poor during floods. Maintenance works can also provide a significant source of employment for the poor, both men and women. However, paving improved rural roads has little effect on the poor because the benefits largely accrue to larger farmers. Improving major roads promotes economic growth that can absorb low-skilled labor in nonfarm occupations, possibly helping to move some rural poor out of poverty. Regional road improvements may have similar effects if targeted to relatively poorer regions, although the majority of benefits were found to accrue to the nonpoor.

A carefully designed study of the welfare impacts of rural roads in Viet Nam is nearing completion. Preliminary conclusions from the first and second round of data collection indicate an expansion of access by the poor to freight transport services following road rehabilitation, and also a slight

increase in bus and other forms of passenger transport services (boat, rail, animal-drawn carts) (van de Walle and Cratty 2002). However, the study notes a decline in two- and three-wheel motorcycle services, suggesting that passengers are substituting cheaper alternatives (including accompanied freight transport) which were not available before road rehabilitation. Significant time savings were noted in access to health facilities. However, time needed to reach local shops has increased.¹⁰ Agricultural credit is now more widely available in the project communes. Impacts on migration to look for work were similar for the poor and nonpoor, but the poor were slightly more likely to reduce their agricultural and other unskilled labor days in favor of increased days of work in crafts or industry. Significantly, time savings were highest for the poor. This finding may reflect a poorer initial condition of roads in the poorer communes served by the project.

A cross-sectional analysis of data from the 2000 Living Standards Measurement Survey for Guatemala, which included a special module on transport, showed that poor and indigenous households had less access to motorable roads than others, both in urban and rural areas (Puri 2002). Perceptions about improvements in road quality did not differ among poor and nonpoor households, but they differed significantly by region. The frequency of road closures, taken as another indicator of road service quality, did not vary significantly across income groups or ethnic groups, or between urban and rural areas.¹¹ In rural areas, road closures (mainly due to flooding) had a greater impact on poor and indigenous households by restricting access to schools and employment and by raising the cost of consumer goods. Lack of access to public transport services was another key variable disproportionately affecting the poor and indigenous households in rural areas.

The study examined the links between the availability and quality of transport services and access to other goods and services related to poverty reduction, including water, wood, health care services, schools, and places of employment. With the exception of health services, the links were not very significant, since most of these needs are met by walking, by both poor and nonpoor households. The propensity to use motorized transport increased slightly with household income. Travel times were not significantly different between urban and rural areas, a fact accounted for by the high congestion and consequent slow traffic speeds

⁹ When the results of this study are compared with those of the present RETA, it should be noted that the countries selected for the ADB/OED study were to complement those selected for the RETA; thus, while the RETA selected sites where economic growth had been accompanied by strong performance in poverty reduction, the ADB/OED study was carried out in sites where poverty reduction had been less successful.

¹⁰ This surprising conclusion is interpreted to mean that local small businesses—food stalls and shops—may have been driven out of business by competition from newly accessible, bigger, and better stores.

¹¹ Road closures in urban areas were often due to unrelated causes such as political demonstrations and other social conflicts.

experienced in urban areas. Places served by motorable roads generally had shorter travel times than others, suggesting that service providers are more likely to deliver services in areas that can be reached by motorized means. Communities with motorable roads were also more likely to have markets, banks, post offices, police and fire stations, and telephone service. A follow-up study on the impacts of road improvements showed that road closures were reduced, public transport services increased, and the travel cost (though not the travel time) for accessing other services was reduced (Puri 2003).

An ex post study of the poverty impact of the ADB-financed Jamuna Bridge in Bangladesh showed that the bridge has substantially reduced poverty in the region that it serves (The Louis Berger Group 2003a). New economic activities developed in the vicinity of the bridge and along access roads. The growth of freight traffic was smaller than expected, but the growth rate for passenger traffic (buses and light vehicles) was significantly (four to five times) higher than expected. A computable general equilibrium (CGE) model of the national economy showed that the bridge dramatically reduced transport costs, releasing a key constraint on trade and development of the regional economy, as well as on the circulation of labor. The bridge also facilitates energy supply to the region and has improved the environment for private industrial investment. The CGE model was then combined with a social accounting matrix to estimate the impacts of these changes on different socioeconomic groups. While the results show that landowning nonpoor rural households and rich urban households captured a greater share of the benefits than the poor, the benefits to the poor were nevertheless large enough to reduce (by 20–40%) the number of rural households in poverty. An interesting sidelight of this analysis is that the abrupt decline in transport margins affected the incomes of (urban) vehicle owners and operators more strongly than the corresponding general price decrease, causing a net decline in their welfare.

The direct impacts of bridge (and ferry) user cost savings were also studied, based on small sample surveys and participatory discussions with users and other affected people. This approach found that the poor and very poor received a relatively small share of the direct benefits, as they do not own or operate the types of vehicles that are allowed to use the bridge, and they account for a relatively small share of bus passengers. Thus, the benefits to the poor are largely derived from the impetus to regional growth provided by the bridge, rather than from its direct effects on their own transport needs. In addition, bridge planners failed to consider the likely effects of the bridge on land

values and the problems that this would pose for displaced people, who are likely to have been further impoverished by the project.

Urban Transport Improvements

The heavy transport cost burdens faced by the urban poor are symptoms of poverty, not causes of poverty. The urban poor reside in less accessible locations precisely because, given their meager income, these locations serve them best. Much can be done in terms of transport to help the *rural* poor. It is less clear how to use transport as an effective policy instrument to help the *urban* poor. Direct interventions targeting the transport needs of the urban poor are more difficult to implement, and may be less effective, than interventions targeting the rural poor.

Especially in urban areas, transport subsidies are widely used with the intention of helping the poor. The effective targeting of transport subsidies is crucially dependent on market structure. The more competitive the market for transport services, the greater the retention of subsidy by users. It is difficult, however, to limit transport subsidies to the poor: subsidies are vulnerable to misuse and to capture by the wealthier residents; they also weaken transit operators' incentives for cost control, create opportunities for rent-seeking, and eventually become financially unsustainable. In rail and metro (urban rail) investments, even subsidized fares are often beyond the means of the poor; indeed, these investments work against the poor by increasing land values and forcing the poor out of rental housing, to relocate on the urban fringe.

Urban transport corridors tend to be constructed through poor areas because property acquisition costs there are low. Furthermore, poor households often rent housing units from richer owners, who may capture the benefits of transport interventions targeting poor areas. The costs of involuntary relocation and community severance, however, fall upon the poor. And those who remain are, in the case of a road project, exposed to greater air and noise pollution as well as serious safety risks.

Rickshaws and other types of human- or animal-powered transport may be banned to reduce congestion. This is to the advantage of the well-off, at the expense of the poor who provide such transport services and who may use these services, if they can afford them. In many cities, more could be done to encourage the use of bicycles as an inexpensive form of transport that makes efficient use of scarce road space and provides employment through roadside services such as pumping tires and simple

repairs. However, cities are often hostile to bicycles, which must share road space with fast-moving traffic and face limited and insecure parking.

The ways in which transport tariffs are set have important implications for public transit utilization by the poor (Allport 2000): when fares are set below market levels, poor people living in the inner city may benefit, but those in peripheral areas lose because transit operators will reduce or withdraw services. Graduated fares benefit the poor who travel on short journeys, whereas market flat fares are advantageous to commuters over longer distances. For commuters with journeys requiring interchange, the need to pay more than once leads to much higher costs than for journeys not requiring interchange.

At present, DFID is sponsoring new work on the need for transport services in poor urban areas and the ways in which these needs can best be addressed. Case studies are being conducted in Faisalabad, Pakistan; Colombo, Sri Lanka; and in Dar es Salaam, Tanzania. These studies build on the results of an earlier study of “partnerships to improve access and quality of urban public transport for the urban poor,” carried out in Karachi, Pakistan (Sohail 2000). Karachi is a port city that has developed a large industrial base. For historical reasons, low-income settlements have been forced to the outskirts of the city, so most poor workers must commute a long way to their jobs. The unpredictability of transport services and likely loss of time inhibit both work-related and social travel, significantly affecting the life chances of the urban poor. Public (bus) transit is the cheapest option, but it is highly disorganized and unreliable. Regulated fares provide low returns to private operators, who consequently neglect all maintenance and safety considerations. Graft and corruption abound, adding to the costs and delays of service. Route planning is nonexistent, route permits are not respected, and urban infrastructure takes little account of public transport needs (bus stops, parking, workshops, etc.). Vehicular pollution and high losses of life and property due to accidents add to the costs borne largely by the poor.

The situation in Colombo, Sri Lanka, is similar, though perhaps not as chaotic. Public transport services are provided by old public buses operated by eight partially privatized regional transport companies, and privately operated minibuses, motorcycles, and three-wheelers. These vehicles have low carrying capacity and contribute to congestion. Entry into the sector is virtually unregulated. Income-generating opportunities have been created for poor and unskilled operators as well as for vehicle owners, repair shops, spare parts dealers, etc. However, the poorly distributed and unreliable transport

service fails to meet the needs of many people, especially the poor, elderly, disabled, women, and children. Buses as well as roads are poorly maintained. Pedestrian walkways are subject to encroachment by hawkers and vehicle operators. Regulatory agencies exist but are ineffective, due to the political influence of private bus operators. Virtually no opportunity exists for public participation in urban transport policy decisions.

DFID also sponsored research on urban transport services in Uganda (Benmaamar 2003). While not focused explicitly on the urban poor, the study showed that, contrary to conventional wisdom, the deregulated transport services market is far from being competitive. Entry is effectively controlled by the Uganda Taxi Operators and Drivers Association, which has the responsibility of collecting revenues from drivers for the City Council. Of the substantial profits generated, little is reinvested to improve services. The policy, planning, and regulatory functions of the Government have been marginalized. An alternative to the privately operated minibus and taxi services is the *boda boda* (bicycle/motorcycle taxi) service (Howe 2002). Entry into this sector is less difficult, though vehicle ownership is still constrained by high costs, limited credit availability, and the difficulty of obtaining repairs and spare parts in many parts of the country. Research indicates that the great majority of *boda boda* operators are poor (in the case of motorcycles, most operators do not own their vehicles). However, even *boda boda* fares are too high for the poor to use them more than occasionally. In addition, they constitute a safety hazard, and the motorcycles used contribute to urban air pollution.

The *boda boda* research is a spin-off of a major study sponsored by DFID of sustainable livelihoods, mobility, and access needs in Uganda and Zimbabwe (Box A.5). The study builds on earlier work undertaken in Zambia in a rural context (Davis 2000). The purpose of the Zambia research was to identify the mobility and access needs of the poor by using the “sustainable livelihoods” approach. This approach considers five categories of assets for the poor: natural capital, physical capital (including infrastructure), human capital, financial capital, and social capital. Davis’s research showed that inadequate access to markets was the main livelihood constraint in Zambia, closely linked to food insecurity through the difficulty of obtaining agricultural advice, fertilizers and credit, as well as high transport costs resulting in high input prices and low profit margins. Access to health care and education services was also highly constrained.

The work undertaken in Uganda and Zimbabwe extended this analysis to urban and periurban areas, with a

Box A.5. Sustainable Livelihoods, Mobility and Access Needs

United Kingdom's Department for International Development has been sponsoring research on sustainable livelihoods, mobility, and access needs in Zimbabwe and Uganda to validate the usefulness of the sustainable livelihoods approach in assessing poverty reduction through interventions in the transport sector. The research was carried out in two transport corridors, one in each country, including the capital city, a secondary town, rural and periurban settlements. The research is unique for its focus on rural-urban linkages and on the role of personal mobility in the survival strategies of the poor. This approach led to a focus on transport services and the modes and means of transport rather than on transport "infrastructure."

Through a study of household activity and travel patterns, the study explored the access of the poor to formal and informal employment opportunities, natural resources, services, and markets. Starting with secondary data collection, key informant and focus group interviews, the research included a large household survey complemented by more in-depth studies of travel and transport behavior in a subset of sample households.

Source: Maunder et al. 2001.

particular focus on rural-urban linkages (Bryceson *et al.* 2003). In each country, a corridor was chosen linking a primary city to a secondary city. Research was conducted in both cities, in a periurban neighborhood and in a rural village in the corridor. The research methods included focus group discussions, household surveys, transport surveys, and travel diaries. The study found that agricultural activities were important even for urban households. It also showed a high degree of residential mobility between urban and rural areas. Not surprisingly, journeys to work and school were the main travel purposes, followed by social visits. Walking was the main modal choice for short journeys, although Uganda showed a higher rate of bicycle usage, partly due to the availability of boda boda transport. Long-distance travel in both countries was predominantly social in nature, including travel for funerals, weddings, and rituals. This type of travel can be considered an investment in building social capital.

Rail Transport

The role of railways has declined as investment has poured into roads. Rail passenger transport is rarely affordable by the poor. Where rail is used extensively by the poor, fares are heavily subsidized, either by public revenues or by other railway users. In these circumstances, the railway is often

expected to make up a shortfall in passenger revenues by cross-subsidizing from freight traffic. Given that rail is already at a disadvantage in relation to road transport operators, this is a recipe for the demise of rail services. Even by direct employment of labor, the railways offer little potential for sustained poverty reduction. If the railways are obliged to employ more labor than needed, this cost burden will hasten the demise of rail services.

In urban areas, rail rights of way must be carefully monitored to avoid encroachment by poor residents and consequent safety hazards. New rail corridors are likely to be located in low-value areas occupied by the urban poor. (The same applies to intermodal transfer facilities such as ports, bus terminals, etc.) In such cases, special care must be taken to ensure that the resulting disruption, including displacement and resettlement, does not impose costs on the poor without adequate and appropriate compensation.

Ports and Waterways

In the past, ports have been an important source of employment for unskilled labor. With advances in transport technology and more effective port management, these opportunities are likely to diminish. However, water transport, including river transport and coastal shipping, remains important for poor people to meet travel and transport needs, as well as to earn income. Some places in the developing world, such as parts of Indonesia and the Pacific Islands, are still so remote that water transportation remains the major means of access. In other cases, such as Bangladesh, a dense waterway network complements the road system to ensure all-weather access for rural communities.

Bangladesh has provided an important contribution to the literature on water transport serving the poor, with studies on its extensive fleet of "country boats." However, the focus has been on policy and technology rather than on poverty impacts. The International Forum for Rural Transport and Development (IFRTD) has produced a useful guide to recent literature on water transport, including several Asian cases (Palmer 1998). It is currently planning further case studies with a stronger poverty focus, funded by DFID. ILO has also initiated studies on river transportation in Cambodia where asset distribution is a component of the analysis.

Aviation

Aviation is a high-technology mode and thus offers few employment opportunities for the poor, other than manual labor on civil works during airport construction. Nevertheless, the poor may share in the benefits that spring from airports and air services. Air access to remote areas, such as scattered island archipelagos, facilitates provision of services and can be a lifeline in emergencies. Access by air can also be a prerequisite for tourism, which may employ unskilled poor people and give them a chance to develop skills and improve their livelihoods.

Gender Impacts

As of 2001, little research focusing on the gender distribution of impacts of transportation and energy investments had been published, but considerable work on this topic has since been completed. The general theme of this research, in both transport and energy, has been the need to move away from a gender perspective that focuses on enhancing women's capacity for productive work to one that addresses the equity dimensions of gender relations, and pursues the economic, social, and political empowerment of women. These gender-based studies have typically not distinguished poor from nonpoor women. Rather, they are based on the assumption that women are by definition disadvantaged and vulnerable in their social contexts. Projects have often succeeded in empowering women and possibly helped some to move out of poverty. They have also helped to identify political, institutional, social, and cultural barriers preventing women from capturing the benefits of infrastructure interventions. Poorer women may benefit from this experience, as well as from the solidarity and social capital achieved through strengthening women's organizations.

With regard to transportation, early reviews based on African experience showed that typical rural road improvement programs had little impact on women, whose transport needs were largely limited to the off-road network (Bryceson and Howe 1993). A study carried out in Uganda examined access to bicycles in relation to rural women's transport needs (Malmberg Calvo 1994). This study found that women were denied access to bicycles for both economic and social reasons. High prices and lack of access to credit were major constraints for both men and women. Even when a household could obtain a bicycle, women were generally not permitted to use it, either to meet household transport needs or to generate additional income.

With the MDGs came an increasing interest in gender issues and the relationship of gender to poverty. Responding to this concern, the IFRTD undertook an extensive research program on gender and transport, with support from DFID. In the late 1990s, IFRTD sponsored a series of coordinated case studies carried out by local partners in both Africa and Asia. Nineteen reports were included in a book published with support from DFID and the World Bank (Fernando and Porter 2002). Ten of the case studies are from Africa and nine from Asia. One of the main findings was that there are important differences between Africa and Asia, making it difficult to generalize across the two regions. In particular, the public sector is much more active in providing transport services in Asia, and the use of intermediate modes of transport is much more widespread there.

The IFRTD research did find, in both Africa and Asia, a consistent pattern of cultural constraints on women's transport activities, reinforcing unequal relationships between men and women. These constraints tend to exclude women from the benefits of transport investments, either by limiting their participation or by limiting their ability to retain any benefits they may receive. However, the study also finds evidence of cultural change in the face of changing economic realities. In fact, poorer women may be more readily "liberated" from these constraints than more well-to-do women. The effects tend generally to increase rather than reduce women's workloads. Walking, both on and off roads, is still the main means of transport for poor women and their children, and they are particularly vulnerable to issues of safety as well as, in the case of women and girls, sexual harassment while traveling.

Changing expectations regarding transport options can be an important part of a program of female empowerment, as illustrated by the National Literacy Programme in Tamil Nadu, India (Rao 2002a). The program actively promoted cycling for women, as a way of increasing their productivity as well as their self-confidence and their exposure to a wider world of knowledge. Many women learned to ride, although few were able to purchase their own bicycles, even though credit programs were offered. Some bicycles were purchased by women's groups, and others could be obtained through rental when needed. The value of this skill in medical emergencies was particularly instrumental in raising women's self-esteem and promoting community acceptance. One lesson learned from this program is that while women may gain access to bicycles, they rarely control the use of this resource. When a household owns a bicycle, the needs of men (or boys, for transport to school) take precedence over the needs of women or girls. Women's workloads have

increased in many cases, as they have been expected to take over transport tasks formerly performed by men. However, women also recognize an increase in their productivity, as they can complete household tasks more quickly and are no longer dependent on unreliable and unfriendly bus transport to reach markets.

The same author studied transportation needs among women of the Santhal scheduled tribe who live in the hilly southeastern part of the state of Bihar, India (Rao 2002b). Such hill tribes are generally poor, lacking in social services, and limited to unskilled occupations. Women in Santhal culture are particularly disadvantaged, being considered the property of men and having no independent access to assets of any kind. On the other hand, Santhal women experience few cultural restrictions on their mobility. Their livelihood strategies depend on diminishing and ever more distant forest resources in remote hilly areas, where even intermediate transport modes cannot penetrate. Roads in the area link villages to markets and are poorly maintained. Women must walk, and climb, both to obtain household fuel and water and to collect firewood and other forest products for sale. Access to bicycles (by men) has partially shifted the burden of transporting forest products to market, but has also shifted control of the income from marketing to men. Women's domestic transport needs are likely to be met more cost-effectively by interventions in other sectors (water supply, fuelwood plantations). Improving footpaths would also help in meeting the transport needs of both men and women in this vulnerable group, as well as reducing the risks to which they are exposed.

Two of the case studies were conducted in the state of Gujarat, one in a rural setting and one in an urban setting. Both were based on material provided by the Self-Employed Women's Association (SEWA), a leading women's NGO in India. The rural case study was built around SEWA's Water Campaign in North Gujarat, a region where access to water is a major constraint (Bid, Nanavaty and Patel 2002). This means that agriculture alone is not a viable livelihood strategy. Both men and women must rely on wage labor, gum collecting, and salt farming, all occupations which require travel to the place of work. Formal, but infrequent and irregular, transport services are provided by the State Road Transport Corporation. Otherwise, villagers must rely on informal transport, including walking. Water supplies must be head-loaded over long distances, with detrimental effects on the health of women and girls, as well as on the access of girls to schooling. Women must also purchase household necessities at the nearest market. To do this, they must make tradeoffs between the low

financial cost but higher time cost of bus transport, and the higher cost but greater speed and reliability of informal transport. Lack of access to transport services is also a significant constraint on women's participation in social and economic development activities and in events related to the creation and maintenance of social capital in rural areas.

The urban case study looked at the role of transport in the lives and livelihoods of six women employed in the informal sector in Ahmedabad, representing six categories identified through a survey of 76 self-employed women (Shresthova, Barve and Chokshi 2002). These categories include porters (head-loaders), hawkers and vendors, "recycling wallahs," farmers, home-based workers, and laborers (commuters). The role of transport in these different occupations is clear. Even the home-based workers have to obtain their materials from and deliver their products to contractors. More than half of the respondents estimated that they had to spend between 2 and 8 hours traveling every day in order to meet their work-related travel needs. Women walked whenever possible; when distances were too great, they depended on public transport services. On average, women spent nearly 30% of their cash income on travel and transport, including 13% on work-related travel expenses. Many were interested in the possibility of obtaining a vehicle (a rickshaw, bicycle or push-cart, a tractor or bullock cart in rural areas), but some felt socially and culturally constrained from operating such a vehicle. Urban women were more likely than rural women to envision operating the vehicle themselves. The last case study from India also addresses urban transport, this time in the city of Calcutta, with a focus on the problems of women commuting to the city (Mukherjee 2002). Women from periurban areas commute to jobs as maids, vendors, industrial workers, and office workers. They also travel to the city to visit a hospital or relatives; older girls commute to the city for continuing education. The survey showed that women commuters are usually extremely poor. They are away from home an average of 12 hours a day and 5–6 of those hours are spent traveling and waiting for transport. They must walk to and from bus stops or rail stations in the dark, and they are vulnerable to pickpockets and police harassment. However, they spend very little money on travel. (Most do not pay for train fares.) Often the fact that they are gone so long leads to problems at home. The study suggests that the best way to address these women's issues would be to provide income-generating opportunities located closer to their homes.

Two studies of gender, poverty, and transport in Nepal focused on the responsibilities of women in both the hill areas and the plains for transporting heavy goods, including fuel, fodder, and water, as well as providing portage for farmers and construction crews. One study reports on the experience of constructing a “green road” in the hill region (Seddon and Shrestha 2002). Women participated in the construction of this road, but had no role in decision making. Because wages were related to tasks, and men and women were assigned to different tasks, women workers generally received lower wages than men. However, little gender-based discrimination seems to occur in access to transport services and related facilities. This study traces the distribution of benefits to landowners, traders, and vehicle owners. Women operators of shops providing roadside services were included in this group. Small farmers and service providers with no land were the last to benefit. The study points out that vehicle transport has now almost completely displaced porters, especially women, who find it difficult to obtain alternative employment as wage laborers in agriculture.

The road has changed agricultural patterns in the region it serves. Now, growing vegetables and fruits, livestock and dairy production are emphasized. However, the gender division of labor remains unchanged. Consequently, the workloads of women and children (as well as men) have increased. Positive changes in education and health care have occurred, but the share of women in access to these services has not changed markedly. The big change has been the increase in women’s personal mobility and consequent exposure to the outside world.

The other case study in Nepal (Ghimire 2002) considers the gender division of transport tasks in areas that are still served by traditional trail systems, and how these have been affected by the construction of rural roads. In the mountain zone, increased access has generated an increased demand for dairy products, which has increased women’s work in collecting fodder and mulch. In the plains, improved access has encouraged the spread of bicycles, motorcycles, and rickshaws. Women can use bicycles, but they are mostly owned and controlled by men. Women’s access to bicycles has increased their mobility, and the availability of bicycles in a household has also encouraged men to participate in what were formerly women’s tasks, such as firewood collection. This study illustrates the ways in which increased communication with a wider world can help to break down social and cultural constraints on women’s participation in the benefits of transport investments.

The picture in Bangladesh (Matin et al. 2002) is somewhat more depressing. Traditional values emphasize the

subordination and seclusion of women. Thus, women’s mobility is negatively related to social status and family honor. Women from poor households, however, may travel to fields, to markets, or to road construction sites for work. Women are treated discourteously on buses, so they prefer to use the less “public,” but more expensive, rickshaws or rickshaw vans. Road improvements do provide poor women with more income-generating opportunities, both in road construction and maintenance and in gaining access to other forms of employment. Women’s travel, however, is limited by the need to get home several times during the day. Transport improvements indirectly benefit women by making it possible for services to be delivered in rural communities, where women can access them more easily. Bangladesh has opened a political space for the participation of women in local government. However, effective participation depends on women’s increased physical mobility, exposure to new knowledge and ideas, and ability to form networks and political alliances.

In Sri Lanka, a case study assessed the impact of the introduction of a new cashew-processing technology on gender roles and transport requirements. Traditionally, men handled cashew marketing. Around 1989, women also began to become involved in the marketing of decorticated cashews. They walked, carrying small quantities, while men used bicycles and motorcycles and were able to handle larger quantities of nuts. In 1994, Intermediate Technology Sri Lanka introduced a tray drier that increased the quality of the processed nuts and set up a new cashew processing center in a nearby town. Both men and women are involved in the management of the center, which requires travel and participation in decision making. Women are moving from home-based work to part-time employment as laborers at the center, while continuing to work at home in their spare time. Women’s workloads have therefore increased, as they now spend more than half an hour each day on travel. Some women have gained status and self-confidence through their participation in activities to extend the benefits of this technology to more communities. However, these new responsibilities have not reduced women’s traditional workload or changed the gender distribution of labor in activities other than cashew processing and marketing.

Policy Change and Sector Reform

In a world collectively dedicated to the fight against poverty, it will be necessary to revisit transport sector policies and to build the capacity of transport sector institu-

tions in order to meet poverty reduction objectives. Care must be taken to ensure that transport investments and recurrent expenditures do not “crowd out” investments in other areas that are equally relevant for poverty reduction. At the same time, increasing the efficiency of the transport sector can release resources for other, more targeted poverty reduction programs.

Ensuring adequate funds for the maintenance of existing capital stock is of overriding importance. While investments in pro-poor growth must still meet economic efficiency criteria, targeted investments aimed directly at poverty reduction can be evaluated using cost-effectiveness criteria. Attention must be paid to the transport needs of women and other vulnerable groups. Ensuring that transport policies and institutions are responsive to the needs of the poor will be best accomplished by providing for participation by the poor (or their representatives) at all stages of transport planning, decision making, and implementation (World Bank n.d.). In many instances the obstacle to mobility is not lack of infrastructure, but rather the lack of affordable and appropriate vehicles. In some countries, bicycles are subject to very high tariffs or taxes, making this low-cost transport mode unaffordable for the poor. Lack of access to credit is another factor preventing the poor from taking advantage of opportunities to benefit from transport improvements.

Regulations and design standards may also inhibit the development of public transport services appropriate for the poor, by creating barriers to the supply of informal transport services, restricting market entry, and imposing service standards. Commercialization and privatization of state-owned transport enterprises may result in higher prices for services that previously were affordable to the poor, and may bring about labor redundancy. Public policy will need to anticipate these possible adverse consequences and provide “safety nets” in the form of explicit, targeted subsidies and relocation assistance for the poor.

With the exception of resettlement studies, little research has been done to date on the impacts of urban transport infrastructure, rail transport, ports and shipping, and aviation on the poor. In urban areas, transport subsidies are widely used with the intention of helping the poor, but such subsidies are vulnerable to misuse and to capture by the wealthier parts of the population. For rail and metro investments, even subsidized fares are often beyond the means of the poor. In fact, these investments may work against the poor by increasing land values in transport corridors and forcing the poor out of rental or squatter housing, to relocate on the urban fringe. When fares are set below market levels, poor people living in the inner city may benefit, but

those in peripheral areas lose because transit operators will reduce or withdraw services.

Impact Assessment Methods

A summary of the methods used prior to 1990 to evaluate rural transportation impacts argues that conventional models, focused almost exclusively on agricultural production, fail to grasp the full workings of the rural economy. In particular, they fail to account for the values placed by rural people on such intangibles as time, energy, health care, security, social interaction, and spiritual intercession (Cook and Cook 1990). Such an incomplete specification of the impact model accounts for its relatively low explanatory power. In particular, it is strongly evident that failure to account for the value of time (on the assumption that the value [“shadow price”] of poor people’s time is negligible) and for the intrinsic, as well as instrumental, values of personal mobility leads to an underestimation of the benefits of passenger travel (including pedestrians) and nonagricultural commodity traffic. A more complex model of rural transportation improvement impacts is proposed, including the measurement of multiplier effects.

Dissatisfaction with conventional cost-benefit analysis as a way of evaluating ex ante poverty impacts has led some to experiment with alternative methods of assessing the incidence of rural road project benefits. Jacoby (1998) uses data from the Nepal Living Standards Measurement Survey to estimate a nonparametric model that assumes the benefits of road improvements to be fully captured in land value changes. His analysis shows that as a hypothetical road extends farther from the existing network (up to 8 hours walking distance), benefits become progressively more targeted to the poor. However, he also shows that the magnitude of these benefits would not be large enough to significantly affect the relative distribution of income in the project area.

Another approach, known as Integrated Rural Accessibility Planning (IRAP), was developed by ILO in the Philippines in 1990 and has since been used in Cambodia, Indonesia, and the Lao People’s Democratic Republic. The approach is based on quantifying village access to activities and services. The aim is to develop a planning tool based on rural transport needs rather than on effective demand for transport services. Using the elements of the “transport task” identified by Barwell (1996), it derives an access indicator, the value of which for a given village is calculated in relation to population served and the time and effort required to access a variety of goods

and services. Weights attached to the different aspects of the transport task are determined through consultation with local people. Such an indicator can only be used to allocate resources efficiently within a given envelope to meet an identified need; it is not the same as providing an economic justification for an investment. It is a bottom-up and participatory approach that implicitly targets the poorest communities. Proposals to initiate or further strengthen IRAP in Bangladesh, India, Indonesia, Nepal, and Viet Nam are currently being considered (ILO 2000). This approach has also been applied in South Africa (Sarkar and Ghosh 2000).

One result of the recent preoccupation with poverty reduction as the focus of development investments has been a proliferation of proposed methods to take poverty into account in ex-ante project evaluation. ADB conducted a review of transport sector projects approved since 1995 to assess current practices and determine how they could be improved (Hansen 2000). Building on this work, ADB has prepared technical guidance for its staff on the analytic and operational issues that need to be addressed in project preparation (ADB 2003a) and best practices for improving the poverty orientation of transport projects (ADB 2003b). It begins by insisting on the need for close consultation with the poor themselves in order to identify their needs and perceptions of poverty as the basis for future impact monitoring, as well as to promote project sustainability. Stakeholders should be disaggregated into poor and nonpoor groups, with attention also paid to gender distinctions and the allocation of government benefits between poor and nonpoor groups. Where equity and efficiency considerations are in conflict, ADB policy allows for cross-subsidy between different components of a project that, overall, would have an acceptable rate of return. The subsidized “social” components should then be justified on cost-effectiveness grounds. From a design standpoint, projects should include measures designed to meet the needs of the poor, and should take advantage of opportunities to employ the poor in labor-based construction and maintenance. On the policy front, attention should be paid to pricing public transport services and reducing regulatory barriers to informal private transport services. Finally, a rigorous system of poverty impact monitoring, including baseline data collection and periodic follow-up studies, is recommended.

A suggested method to estimate the poverty reduction impact of rehabilitating major roads combines the results of classical road feasibility studies with data obtained from small sample surveys of road users, potentially complemented by participatory rural appraisals or focus group dis-

cussions with users and beneficiary communities (Gajewski, Luppino, and Fujimura 2002). This approach is based on ADB’s *Guidelines for the Economic Analysis of Projects*, which call for estimating the proportion of the net benefits to each beneficiary group that accrue to the nonpoor, the poor, and the very poor, in order to calculate a poverty impact ratio. The method basically estimates the share of road user cost savings that will be passed through to the poor. The participatory approach also helps to identify nonmonetary benefits and costs perceived by the poor, and the policy and institutional changes, as well as complementary investments, which could enhance poverty reduction impacts. ADB tested the approach in Tajikistan with technical assistance (ADB 1999c) for poverty analysis of a road rehabilitation project (ADB 1999c).

The World Bank has developed detailed guidance for staff on the socioeconomic impact assessment of rural roads projects (Grootaert 2002). This guidance is intended to support the design of evaluation studies to be carried out in connection with future rural road projects. The tools provided are to be applied on low-volume roads and in projects to improve paths, tracks, and trails, and to provide NMT. They include two modules, one to capture the direct effects of these investments on transport cost, time, and accessibility of services, and one to capture the indirect effects reflected in changes in household income and other household characteristics (education and health status, social interaction, political participation). Both modules also measure the distribution of these effects upon different socioeconomic groups in the project’s influence area, enabling an assessment of project impacts on poverty reduction. A set of indicators is proposed to measure rural transport project outputs, project outcomes (direct effects), and welfare outcomes (indirect effects). Use of a quasi-experimental (double difference) design is recommended, with problems of endogeneity addressed through propensity score matching. Where baseline data are missing or comparable control groups cannot be found, instrumental variables may be used to introduce an observable source of exogenous variation.

Van de Walle (2000a) assesses current methods of evaluating rural road investments, including recent proposals to incorporate poverty reduction and equity concerns. She points out that rural road programs often operate under a fixed budget constraint and in an environment where economic efficiency is not the sole policy goal. Under these circumstances, a cost-effectiveness approach to project selection is appropriate. Based on data from Viet Nam, her study uses indices to capture the different aspects of poverty, accessibility, and economic potential in

small areas (communes). It shows that these three measures are not interrelated and therefore all three must be considered in project selection. A method for evaluating the social welfare benefits of individual road links is proposed, including a social equity measure based on income levels in the project area, and an efficiency measure based on expected economic benefits. The goal is to maximize social welfare in relation to project costs, under an overall program cost constraint. If no minimum rate of return is required, this can be accomplished by simply calculating the cost-benefit ratio for each project and ranking the results. If a minimum rate of return is required, this should be established, taking into account the expected proportion of nonmonetary and monetary benefits. This can be done simply by “discounting” appropriately the minimum rate of return.

A recent DFID-sponsored study on the valuation of transport-related time savings by the poor in Bangladesh produced very interesting results (I. T. Transport Ltd. 2002). Typically, the value of time saved by the poor is estimated at or close to zero, on the theory that their opportunity cost is low. Recent research, however, shows that the poor, especially poor women, are more time-constrained than the nonpoor. Under conditions of time poverty, travel time represents a real opportunity cost to the poor. Consequently, the value of travel time savings to them is high. This study, using stated preference methods, was able to show that poor people in Bangladesh attach a high value to travel time savings. The study points out the need to redefine the meaning of a “work-related trip” in a developing country rural context, since most poor people are self-employed. The research shows that the poor are willing to pay in excess of what conventional economics would suggest is their opportunity cost, in order to achieve travel time savings, even for predominantly “social” trips. Thus, including higher values for travel time savings to the poor in the economic evaluation of rural road projects can be justified. This argument is equally applicable to the time savings generated by energy projects.

Summary

This review of the literature on transport and poverty reduction has shown that most of the existing work has been done on roads, particularly rural roads, serving poor areas and presumably poor people. This bias is logical, since roads represent the transport mode most often used by the poor. Nevertheless, other transport modes can bring services to the poor (as an alternative to bringing the poor to the services). The bias toward rural areas is also logical, since rural areas are where the bulk of the poor population

resides. Still, large numbers of urban dwellers are also poor, and their transport needs must also be considered.

Much of the past work has focused on impacts on agricultural production. However, more recent work has also taken account of the increasing importance of nonfarm activities in the rural economy. Studies have generally treated increased access to social and economic services as a benefit, without examining whether such increased access actually enhances the welfare of the rural poor. Recent themes have included the differentiation of gender roles in transport and the impacts of transport infrastructure development on the physical and social environment. Interesting speculations have been offered about the impact of transport improvements on security, social capital, and community values. Relatively little work has looked at rural-urban linkages and at the roles of migration and remittances in the livelihood strategies of the urban and rural poor.

The literature on urban transport and poverty reduction is limited. With the exception of resettlement studies, almost no empirical analyses of the impacts of rail, port, or aviation improvements on urban or rural poverty have been undertaken. Most existing studies are of uncertain value because they do not present systematic “before and after” data on poverty, and they do not evaluate the complementary actions that could have assisted a transport project to reduce poverty. However, many people in developing countries, and not just transport planners, believe firmly that transport improvements do alleviate poverty. The need is for properly designed case studies, with baseline data collected before the project, and continuing for as many years after the project as is needed, to track the effects on poverty and to distinguish project effects from underlying change.

Energy

As with transport, a considerable literature asserts that energy projects are good for the poor, but relatively few empirical studies measure these effects. Early studies of electrification schemes suggested that electrification would encourage new businesses and other economic activity. It is now widely recognized that it is unrealistic to expect that the provision of energy infrastructure alone will precipitate growth in economic activity and related poverty alleviation (ESMAP 2000). However, the availability of modern energy, together with other enabling factors, can accelerate changes in economic welfare.

ADB's energy sector strategy recognizes that poor people in its DMCs need energy at an affordable cost (ADB 2000b). Its goal is to increase the availability of energy in a least-cost and environmentally friendly manner, and to improve access to energy, particularly for the poor. It notes broad agreement on the links between energy and poverty reduction, but little hard data on the magnitude of the welfare impacts of different kinds of energy interventions. It is expected that greater use of energy services by the poor will result in better health care and education, higher labor productivity, and easier entry by the poor into labor markets. Other benefits may come from efficiency improvements resulting in lower costs, and from the elimination of poorly targeted and nontransparent subsidies. ADB will promote these outcomes by supporting sector restructuring, greater involvement by the private sector, improved environmental performance, and regional systems integration.

The World Bank *PRSP Sourcebook* (n.d) identifies five goals for energy development that could have positive effects on poverty: (i) expanding access to modern energy, (ii) improving the reliability of energy supply, (iii) ensuring fiscal sustainability, (iv) improving sector governance and regulation, and (v) reducing health and environmental costs. Access is a function of both availability and affordability. The poor place a high value on modern energy services, and to the extent that they are available and affordable, are willing to pay the full cost. Reliable energy supply is essential for making sustained improvements in household welfare and for efficient operation of businesses generating economic growth. Lack of a reliable energy supply tends to discourage households from making the necessary investments for an energy transition, and requires businesses to invest in costly back-up facilities or to obtain alternative supplies at higher prices. Fiscal instability and growing deficits contribute to higher inflation, reducing the purchasing power of the poor and increasing their vulnerability. Good governance and effective regulation are key determinants of whether the poor receive adequate service at an acceptable price.

Brook (2000) identifies ways in which improving access to better, cheaper energy services contributes directly to the welfare of the poor: freeing cash and human resources for more productive uses, improving access to health care and communications, broadening opportunities for the development of household businesses, and improving community and household environmental quality. The ways energy policies are set and energy services are delivered also provide indirect benefits to the poor: a more efficient, sustainable energy sector contributes to national produc-

tivity, employment, and earnings; a more competitive and transparent energy sector provides fewer opportunities and incentives for corruption; decreased reliance on government subsidies frees fiscal resources; and a sector that is net contributor to the tax base can boost fiscal resources.

DFID has also sponsored a substantial program of research on energy for the poor. This program has tended to focus on ways of improving the efficiency of traditional fuels and the development of small-scale, renewable technologies to meet local needs, rather than on the issues of large-scale energy provision through public utilities. However, DFID's position paper *Energy for the Poor* (DFID 2002b) argues for greater effectiveness in energy sector management, improved performance through privatization and regulatory reform, and expanding access, especially for the poor, through creating conditions attractive to private capital and appropriately targeting subsidies for the poor. The paper promotes a people-centered approach to energy planning that gives adequate weight to different technology options in relation to different development needs.

In preparing this paper, DFID undertook a series of literature reviews on the linkages between energy and poverty in relation to the MDGs on health care, environment, gender, and education. In health care, the main impact of reliance by the poor on traditional fuels appears to come through indoor air pollution, a major contributor to respiratory diseases, which in turn are a major cause of ill health among the poor (Bruce 2002). Risk of burns and other injuries, as well as fatigue from increasingly lengthy fuel-collecting activities, are other negative consequences. Women and children are particularly exposed to these risks. A reliable energy source is also important to the effective delivery of health care services, notably in storing vaccines and sterilizing equipment. Further research is needed to link health outcomes for the poor more explicitly to energy interventions.

The review of energy-poverty linkages with respect to the environment showed that while some empirical work has been done to assess the poverty and environmental impacts of energy interventions, studies have more often focused on the ways in which poverty determines energy use and corresponding impacts on the environment (Riley 2002). It is argued that the poor are more dependent on natural resources and are therefore at greater risk from environmental degradation, notably from the overuse of biomass resources as fuel. While this relationship is particularly evident in rural areas, the urban poor are also more vulnerable than the nonpoor to the risks created by urban environmental degradation and pollution. To the extent that energy development contributes to economic

growth and rising incomes, it appears also to contribute to increasing levels of deforestation and pollution. However, recent research suggests that this relationship may follow a “Kuznets curve” that inverts once a certain threshold of per capita income is reached. Hydropower development through large dams has received particular attention with respect to its impacts on the physical environment, as well as direct social impacts on displaced people.

Energy Needs of the Poor

The studies reviewed (Barnes and Floor 1996; Foster and Tré 2000) suggest that poor people, like others, are rational consumers who will naturally seek to maximize their economic welfare by using a mix of available traditional and modern, or commercial, energy resources. People rarely use one energy resource exclusively (Table A.1). Factors affecting their choice include availability, affordability, efficiency, and reliability. For example, rural electrification is unlikely to change the use of biomass by poorer people for cooking. Providing access to modern energy, as an activity aimed at poverty reduction, should recognize the full energy needs of poor communities. Intervention to improve access to more than one modern energy resource will have a greater impact on energy use, with attendant positive impacts on the well-being of the poor.

The minimum energy requirement for sustaining life is for cooking (Alam, Sathgaye, and Barnes 1998). The poorest generally satisfy this energy requirement by using one or more biomass alternatives such as wood, dung, or agricultural waste (straw, bagasse [sugar cane waste], etc.). As people’s incomes increase, the energy resource used in cooking may change to charcoal, liquid (kerosene) or gas (liquefied petroleum gas [LPG], natural gas), depending on their availability and cost. Easy road access will be a key factor in the affordability of some of these alternatives. Electricity would normally be unlikely to be adopted for cooking until users’ incomes have reached a relatively high level. An important factor, in addition to income level, is reliability of supply (Foster and Tré 2000).

The next priority is fuel for space heating. This priority represents a significant basic need for poor people in cold countries, such as the Central Asian republics. However, the majority of people in ADB member countries need little energy for space heating. Generally, the same fuel choices as for cooking will apply to space heating. In contrast, electricity is by far the best energy source to provide lighting. Battery-driven lights are very expensive. Oil- and gas-fired lighting is relatively much less efficient than electric lighting. Other uses of electricity include entertainment (radios, tape players, televisions, etc.), lighting and fans. Electricity is the primary energy used for these activities, whether there is a grid supply or not. Batteries

Table A.1. The Energy Ladder

Use	Lowest Incomes	Rural Poor	Rural Medium Income	Rural High Income	Developed Country
Cooking	Traditional	Traditional, Kerosene	Traditional, Kerosene, Biogas, LPG	Charcoal, Kerosene, Biogas, LPG Coal	Gas or Electricity
Space Heating	None or Traditional	Traditional	Traditional	Traditional, Coal	Oil, Gas, or Electricity
Lighting	None or Candles	Candles, Kerosene	Candles, Kerosene, Electricity	Electricity, Kerosene	Electricity
Other Appliances	None	Dry-cell Batteries	Dry-cell, Storage Cell Batteries Electricity	Electricity, Dry-cell, Storage Cell Batteries	Electricity

LPG = liquefied petroleum gas.

Note: Traditional energy includes wood, agricultural residues, and dung.

Source: Barnes and Floor 1996.

are used to the extent the people can afford them. However, studies have confirmed that batteries are an expensive way to meet these demands (Fitzgerald, Barnes, and McGranahan 1990).

In the absence of access to modern fuels, poor people in developing countries depend on biomass for their energy needs. Burning biomass such as wood, charcoal, dung, and straw exposes them to high levels of dust and soot, directly affecting their health, life expectancy, and quality of life. Breathing air containing suspended fine particles is a major cause of chronic and acute respiratory infections, which are among the greatest causes of death and ill health for the poor (Lamech and O'Sullivan n.d.).

Energy in the Rural Community

Although poor people living in rural areas may be unlikely to use electricity to meet many of their household energy needs, electricity can help meet other needs of the poor through community services. Services to the community, such as potable water pumping, education, medical services, and security are easier to provide once electricity is available. Quantifying the value of these services, however, is difficult (ESMAP 2002c). The economic impacts of other modern energy services, such as refrigeration to improve and extend food storage, water pumping for irrigation, agricultural processing, and small scale industries, are more readily measured.

Improved agricultural productivity is often the result of using modern energy in agriculture. However, much of the energy needed is petroleum-based, as the equipment needs to be moved around the farm. The availability of electricity for processing agricultural products generally increases the opportunities for such processing to occur in the farm community. This will increase employment opportunities that may provide income to poor members of the community, especially women. Pumped water supply can also release women and children (especially girls) from domestic drudgery, giving them more time for education and/or employment. The availability of electricity in rural areas also provides an incentive for industry to locate there, generating additional employment.

A review of rural electrification programs in Africa (Webb and Derbyshire 2000) highlights the need to consider rural electrification as part of a broad power sector reform program. The main difficulty in providing electricity services to rural areas is the high cost per consumer of extending existing electricity grids. Thus, an alternative approach is needed. Such approaches may be characterized by alternative market structures and institutional

arrangements, including alternative forms of ownership, and/or the use of alternative technologies for energy production. Alternative forms of ownership could include private companies, cooperatives, local consumer associations, public-private joint ventures, or local government initiatives. Alternative technologies have focused on the use of nontraditional energy sources such as solar, micro/mini hydro, geothermal, wind, and hybrid types of projects (Box A.6).

Recent technological changes offer new possibilities for rural electrification. Advances in photovoltaics in the last decade are making it financially practical to provide some electric energy to regions outside the economic limits of traditional grid service. The impact of this option on poor consumers, however, is limited because the capital cost of the equipment remains high. In Kenya, more than 120,000 small solar photovoltaic systems have been sold to rural consumers by private companies, but most of the buyers have been among the top 25% of rural income earners. However, hire-purchase and finance agencies have entered the market, enabling lower-income (though not poor) families to buy systems on credit (Hankins 2000). Thus, strategies remain to be developed to make these technological alternatives affordable to the poor.

Some of the benefits of modern energy may be achieved through the application of alternative technologies in the use of traditional biomass (see World Energy Conference and FAO 1999). Where fuelwood is still used for cooking and heating, the atmosphere inside houses could be improved, with attendant health benefits, by using more efficient stoves and better smoke management (chimneys).

A World Bank review of rural electrification projects (Sanghvi and Barnes 2001) suggests that while such projects rarely support themselves financially, they can be justified in terms of the external benefits derived by rural populations through improved access to information and communication, education, economic opportunities, extended and more reliable health care services, and improved security. It also shows that grid extension is not always the most cost-effective solution, and that decentralized delivery options and alternative energy sources should be included in plans to meet the energy needs of the rural poor. Costs can be controlled through community contributions and local involvement in labor-intensive aspects of construction and operations. Complementary technical assistance and credit could be provided to increase the poverty-reducing impact of rural electricity by promoting its use in productive enterprises. With regard to policies favoring the poor, the review recommends financing initial connection charges rather than subsidizing operating costs.

Box A.6. Women and Wind Power in the People's Republic of China

An Asian Development Bank project is providing funds for a series of utility-scale, grid-connected wind power projects, as well as off-grid solar and diesel community projects, in three provinces of the People's Republic of China: Xinjiang, Heilongjiang, and Liaoning. Most villages in these provinces are already electrified, but some poor communities in remote areas remain unconnected to the grid. Though substantial success has been achieved in poverty reduction in these provinces over the last decade, recent natural disasters and low prices for agricultural products have caused many families to fall back into poverty.

Poverty in these areas is blamed on the lack of irrigation needed to increase yields on small farm plots. The small farms in these remote communities do not generate enough agricultural wastes to supply fuel for cooking and heating; thus, villagers must travel long distances to collect fuelwood. Although coal is available, poor households cannot afford to buy it.

A consultation with poor women who would benefit from the project showed that they expect electricity to reduce their workload significantly, enable them to participate in educational programs, and improve family health through "cleaner living." They plan to use electricity for lighting, pump irrigation, power for small businesses, and entertainment (radio and television). However, they are aware of potential affordability constraints; thus, grid-based options are preferred because of lower costs. The consultants also noted that the access to knowledge offered by radio and television programs will make a significant difference in the perception of realities and opportunities by poor women.

Source: Ma Zhong and Shen Mingming. 2000.

A recently completed study in the Philippines aims at developing methods to capture and quantify the benefits of rural electrification that escape classical cost-benefit analysis (ESMAP 2002c). The study found that willingness to pay for energy services is as high as the cost of providing grid electricity in rural areas. Indeed, many households without electricity are using more expensive and risky alternatives such as kerosene lamps and auto batteries. When providing grid electricity lowers costs, energy consumption increases dramatically. The study examined the contributions of improved lighting and television access to education, health care, security, and entertainment values, as well as the use of appliances to generate time savings and to enhance productivity of home-based businesses. Due possibly to drought and the lack of irrigation infrastructure, access to electricity had little effect on agricultural output or income. However, it proved significant in extending the time available for small businesses (mostly *sari-sari* stores), studying, and performance of household tasks. Appliances such as refrigerators, stoves, and power tools also contributed to income generation. The average incomes of households with electricity were twice those of households without electricity.

Respondents' views were mixed on the benefits of access to television, recognizing the importance of news and entertainment, but fearing that it could distract children from studying.¹² The study found little impact on

health, but this was attributed to a poor choice of indicator (days lost from work). Impacts on safety and security were perceived to be important, but could not be quantified and valued. The study suggests that future research should explore the use of other methods taken from resource and environmental economics, including contingent valuation and land value increases.

A joint World Bank-Global Environment Facility (GEF) project in Bangladesh is promoting extension of electricity services to remote households and small businesses by expanding a successful partnership between the Bangladesh Rural Electrification Board and village electricity cooperatives (VECs) (DevNews Media Center 2002). The VECs are governed by councils, including elected consumer representatives. They establish tariff rates and oversee collections, providing cost-effective and client-responsive services to rural communities. The project supports the development of stand-alone generation and distribution systems, based on renewable energy, for communities too remote to be connected to the national grid. Because nonpolluting renewable energy sources will replace the current use of kerosene, the project is eligible for a grant from GEF to recognize its contribution to the reduction of greenhouse gases.

A study in Tajikistan financed by ADB aimed inter alia to identify policies that would alleviate the effects of higher electricity tariffs on the poor (The Louis Berger Group, Inc. 2003). Currently, poor households are paying about as much as the nonpoor for access to electricity, while the supply they receive, especially in rural areas, is much less reliable. Poor households rely heavily on wood, and to a lesser extent on diesel fuel and candles, to meet

¹² After electric lights, televisions are typically the first appliance purchased by households benefiting from grid electricity. Some nonelectrified households also run televisions on auto batteries.

their energy needs. The study showed that electricity services would have to be greatly improved before people could be expected to pay higher tariffs or comply with stronger collection efforts. Introduction of a complete and fully transparent metering system would be needed to accomplish this goal. Furthermore, surveys of customer willingness and ability to pay would be needed to determine the true levels of effective and potential demand. The study recommends maintaining the current lifeline tariff until a transparent system for metering and billing in accordance with actual consumption is in place. After such a system is established, significant subsidies for the poorest households will still be needed.

An ongoing DFID study (DFIC 2004a) is looking at the role of renewable energy in alleviating rural poverty and promoting sustainable livelihoods in rural communities. Through a partnership with local universities, it will conduct case studies in Cuba, Nicaragua, and Peru on the introduction of renewable energy schemes in remote areas, aiming to identify factors associated with their success or failure. On this basis, it aims to develop a multicriteria model for decision making on energy policy and technology options. In the Philippines and Viet Nam, another ongoing study (DFID 2004b) will explore the possibility of reducing the cost, improving the quality, and expanding the use of family-hydro systems to generate small amounts of electricity, by securing financing from the Prototype Carbon Fund. Such systems are currently being used by low-income households in the PRC and Viet Nam. The research will focus on quantifying the carbon emission reductions associated with the use of such systems, as well as on the potential demand for such systems in other countries, such as the Philippines.

Energy in Urban Areas

Most Asian cities are already served by grid electricity. The challenge is to help the urban poor gain access to these services at affordable rates (ESMAP 2001). The cost of extending electric service to the urban and periurban poor should be low because they live near where an electric distribution system has already been built and, as their demands are small, only small additions to the infrastructure should be needed to supply them. Further, small loads should allow these connections to be made using lower-cost technical specifications. The problems are low use rates, a high proportion of illegal connections, and poor payment performance, resulting in high overhead costs to manage these potential consumers. The poor payment performance recorded in many urban centers is less likely to

be due to an inability to pay than to a number of other factors, including poor service and high tariffs caused by the utilities' efforts to compensate for low collection rates.

This report concludes that the low cost of extending urban electrification to the poor should make such programs economically justifiable. However, the authors do not address the issue of property ownership and the fact that many of the urban and periurban poor are squatters. In some countries, this represents a barrier that makes obtaining a legal connection very difficult or impossible. Where the utility does not seek proof of ownership, other institutions might. For example, in Sri Lanka, the utility does not demand proof of ownership of the property as a condition of service, but when poor consumers seek the financial support available to help pay for the connection charges, the banks demand such documentation.¹³

The study by Powell and Starke (2000) points out that unless electrical energy can be produced and delivered more cheaply, it will remain beyond the reach of many of the poor. New technologies *are* drastically reducing the costs of electricity generation, but transmission and distribution costs are still a barrier to expanding grid-based services in isolated or sparsely populated areas. This study concludes that the urban poor stand to benefit from efficiency improvements resulting from sector reforms, but that alternative solutions will be required in rural areas.

The DFID energy research program includes a number of completed and ongoing projects aimed at addressing poverty-energy linkages in urban areas.¹⁴ One project (DFID 2000c) addresses the role of energy in relation to the sustainable livelihoods approach adopted by DFID. It explores the energy/poverty linkages in poor urban households in the PRC, Ghana, and Indonesia, focusing on the strategies they have adopted to cope with rising energy costs. The results show that the poor cope by shifting down the energy ladder (e.g., from kerosene to fuelwood), by reducing their energy consumption, and by reducing other expenditures. These strategies have a strong negative effect on the assets of the poor. Natural assets are affected by increasing pressure on fuelwood supplies. Physical assets, especially housing, deteriorate due to lack of maintenance. Health declines because of poor nutrition (often directly related to a reduction in the number of cooked meals) and because of more limited ability to pay for health services. Education also suffers because of poor

¹³ Carol Litwin, personal communication.

¹⁴ The following project descriptions are taken from materials available on the DFID Knowledge and Research Energy Website. Available: <http://www.DFID-kar-energy.org.uk>.

lighting and lack of access to television and radio, as well as reduced ability to pay for schooling. Finally, social capital is affected by constraints on participation in social events and recreational activities. All of these effects make the urban poor more vulnerable and demonstrate their need for more affordable and cleaner forms of energy.

Another study (DFID 2002d), carried out in East Africa, assesses the impacts on the urban suppliers of traditional fuels (wood and charcoal) of shifts from traditional to modern fuels. The study distinguishes between large-scale transporters and wholesalers, who tend to be male and nonpoor, and small-scale transporters and vendors, who tend to be female and poor. The shift from traditional to modern fuels also entails a shift from traditional (manual) transport to modern (mechanized) transport. Fuel substitution has positive effects on lower-income households in terms of conditions for cooking, although it increases their vulnerability to price increases and periodic shortages. The study recommends legitimizing the charcoal industry in order to protect the livelihoods of poor fuel suppliers and to promote efficient and sustainable production.

An ongoing study (DFID 2004c) attempts to identify barriers to access to modern energy by the urban poor. This study focuses on the demand characteristics of urban poor households and on the supply constraints faced by local utility companies, aiming to identify workable solutions through a participatory approach. Research is being carried out in India, the Philippines, and South Africa. Yet another study (DFID 2004d) is looking at the impact of the withdrawal of modern energy on the livelihoods of the urban poor in Albania, Kyrgyzstan Republic, and Moldova. Based on community focus groups, it will identify ways in which the urban poor have been made more vulnerable by the deterioration in energy services following the collapse of centrally managed economic systems, as well as the ways in which they are coping with these changes.

Energy for Commercial and Industrial Development

The availability of reliable modern energy is an important factor in the selection of a location for a new

enterprise. Where access to modern energy is not available, the probability of new enterprises locating there is very low.¹⁵ The only exception to this rule is the existence of a large, natural resource such as an exploitable deposit of some commercially valuable mineral. In this instance, if the value of the resource is great enough, the mining enterprise will develop its own energy for the mine. Because such enterprises are generally private, their investment in energy is not likely to benefit poor people in the surrounding community.

Lamech and O'Sullivan (n.d.) enumerate the social benefits of expanding commercial energy provision. They include economic benefits (growth in incomes resulting from increased employment opportunities, and increased time for employment), social welfare benefits (increase in quality of life resulting from better lighting, access to information, and health gains), and environmental benefits (reduction in deforestation and diversification of crops resulting from a switch to greater use of commercial energy). However, little evidence is available on the degree to which claimed benefits, from rural electrification in particular, are realized. World Bank studies in Asia suggest that investments in rural electrification are only economically justified where a dynamic agricultural or rural industrial sector already exists (World Bank 1994). Exceptions are found in parts of the PRC and India, where massive rural electrification programs led to a significant shift in agricultural production, although similar effects could have been achieved with alternatives such as increased use of diesel pumps. The conclusion is that rural electrification can support rural economic growth but not initiate it. The driving force behind expanding commercial energy services is, however, largely political, and therefore the pressure for expansion is unlikely to diminish.

Gender Impacts

A DFID-sponsored review showed that gender bias is evident in energy poverty, although little quantitative data is available (Annecke 2002). This bias derives from role expectations requiring women to provide and manage household energy, while also contributing their own energy to the accomplishment of household and agricultural tasks. Programs to promote energy development for economic growth have not addressed these needs of poor women. Alternative energy sources are particularly important in freeing up the time of girl children to attend school, as well as providing lighting that can facilitate schoolwork and safety at night. While small-scale energy

¹⁵ As noted previously, the opposite relationship generally is not true, i.e., that making modern energy available will precipitate new industrial investment. The availability of modern energy in a region is only one factor in the decision to locate a new enterprise. Other factors, including availability of appropriately qualified workers, easy access to markets, and business-friendly regulations may be more important.

projects have often been gender sensitive, gender specialists have paid little explicit attention to the role of energy in the poverty cycle. A gendered approach to energy and poverty would not simply seek to make the execution of women's tasks more efficient, but would seek to alter the distribution of household responsibilities between men and women and achieve greater gender equity in the distribution of benefits from energy interventions.

In the context of the World Energy Assessment, UNDP, with support from the Swedish International Development Agency, carried out a set of case studies on energy and gender issues (Karlsson and Misana 2001). The eight case studies focus largely on Africa, and mostly concern alternatives to grid-based electricity for meeting the energy needs of rural women. Based on lessons learned from earlier projects, these case studies show a strong emphasis on linking energy services to the creation of income-generating opportunities for women and facilitating their participation in community decision-making. They also tend to show, however, that where grid-based electricity cannot be economically supplied to rural communities, alternative technologies also require some sort of financial subsidy to be affordable to poor people. The case studies show that gender-sensitive energy policies should include (i) making electricity for lighting widely available in homes and communities (to extend women's working day, support female literacy and educational attainment, and increase women's safety); (ii) providing electricity to run productive equipment; (iii) promoting cleaner fuels, improved fuel distribution systems, and improved stoves; (iv) involving women in technology development and dissemination; (v) developing energy credit programs accessible to women; (vi) improving market information to assist women in becoming energy entrepreneurs; (vii) supporting gender equity in sector policies more generally; and (viii) removing barriers to women's full participation in economic, social, and political life (Karlsson and McDade 2001).

Two of the eight case studies were carried out in Asian countries. In Bangladesh, the case study concerns a micro-enterprise project involving women in improving lighting in rural households by producing and marketing battery-operated lamps to replace traditional kerosene lamps (Khan 2001). The lamps are used in homes, shops, religious and social centers, and on fishing boats in an area not likely to be reached by grid electricity. Traditionally, women and girls are barred from the marketplaces where evening lighting is provided by privately operated diesel generators. The battery-operated lamps are markedly safer and better for health than traditional alternatives. Their batteries can be

recharged using diesel generators or solar panels. The high cost of batteries and long distances to battery-charging stations initially proved to be barriers for poorer women. However, the project has designed a credit program (including a subsidy) that will enable poorer women to participate in the future. The study showed that increased income generation was a main motivation for women to buy the lamps, along with providing children with light for studying at night. The project has also been beneficial to the women who received training, learned to assemble the lamps, and have taken over marketing and sales activities. Their increased income has gained them status and voice in their homes and in the community.

The Nepal case study concerns a community development program that offers remote communities the option (among others) of developing microhydropower systems to provide electricity. The program aims to ensure gender equality by forming separate community groups for men and women to discuss development priorities, and then forming functional groups to implement projects on which men and women are equally represented. All projects must be agreed upon at the village, district, and national level, and each level of government participates in the investment. Microhydro projects are accompanied by skills training for every participating household to ensure that additional income is generated to cover the operating costs of the system. The program also supports solar photovoltaic systems, biogas systems, and improved stoves, as well as a range of nonenergy interventions. Energy improvements reduce the time taken for women's traditional tasks and enable them to participate in other activities, both for income generation and for building social capital through community participation. The study concludes that energy projects should not be promoted in isolation, but should be introduced as a component of integrated development planning.

Policy Change and Sector Reform

It is very difficult to devise a program of subsidies that will achieve the three desirable results of helping poor people, being affordable to implement, and not distorting the market system. It is well accepted that economically efficient use of a commodity will be achieved if that commodity is priced at its cost of supply. Subsidizing, or overtaxing, a commodity will tend to increase, or decrease, the amount used and thereby reduce the overall economic welfare of the community. For example, in many countries some forms of energy, typically imported petroleum fuels, are taxed more heavily than other fuels. The result is both to reduce the use of the taxed fuel and to raise the price of the alternative indigenous fuel to levels

that keep it just competitive. The effect is particularly harsh on the poor (Barnes 1995).

Electricity is often subsidized to agricultural and domestic consumers. This type of subsidy benefits the better-off consumers more than the poor because the better-off consume more energy. A better approach, one that is used in many countries, is to provide a subsidized lifeline rate for a limited amount of electricity to domestic customers each month. Although all consumers will benefit, the amount of the benefit is limited and can be recouped by setting the rates for higher levels of consumption at levels that are just high enough to recover the subsidy in the initial consumption.

Barnes and Halpern (2000) note that subsidies are likely to remain a key part of pro-poor energy policies in developing countries for some time. Traditional ways of delivering subsidies, particularly cross-subsidization of consumption, often fail to help the poor. Thus, energy subsidies should be directed at encouraging access to service, rather than covering the operating costs of providing services. Subsidies should (i) reach the poor; (ii) be structured in such a way that they encourage provision of services at least cost; and (iii) achieve social goals at the lowest program cost while providing incentives to business to serve the poor and rural population.

Electricity is known to have the highest connection costs of all forms of modern energy, and these costs can be an insurmountable obstacle to the poor. To a lesser extent, the initial cost of using kerosene and LPG may also be high, as new stoves and storage containers are needed. One approach to the issue has been to provide new customers with the option of paying for the connection and other equipment costs over time as an additional charge on their electricity or liquid fuel bill. Such an approach may still not be sufficient for the poorest consumers. In the past, ADB has generally followed the principle that subsidies should be eliminated. However, the most recent Energy Policy (ADB 2000c) recognizes that subsidies that are well focused on poverty reduction may be acceptable and necessary for a period of time.

Recent studies have indicated that most poor consumers can afford the recurrent monthly costs of electricity, but not the capital costs of the initial connection, wiring in their homes, and electric appliances. Where this can be shown to be the case, a well-focused subsidy of these costs may be more effective than the more widely used lifeline tariff on energy. As noted above, other forms of modern energy also require new appliances, so it will be important to establish a consistent policy for all forms of modern energy (Barnes and Halpern 2000). Efforts should also

be made to ensure that all alternatives are priced consistently, so that economically rational use and consumption rates may be expected (Barnes and Floor 1996).

Villagran (2000) states that power sector reform programs should aim at improving access to electricity for potential consumers regardless of their location with respect to the grid. Recognizing that in the long run, grid electricity is the least-cost, highest-quality solution, he points out that the government should allow customers and service companies to make the technology decisions. Governments should also avoid blocking the development of markets for alternative fuels through price subsidies and quantity controls. Off-grid systems can be successfully managed by village committees, local vendor representatives, rural electric cooperatives, or rural energy corporations. Mechanisms for bidding on the right to serve a rural market can be used to minimize the subsidy required. Finance for the high initial costs of off-grid systems is often a problem, and innovative financing methods may be required.

Private Sector Involvement

Various models have been examined as ways to involve the private sector in the supply and maintenance of equipment, and different financing mechanisms, involving either utilities or the private banking system, have been tried. The same institutional arrangements have been examined as vehicles for well-targeted subsidy of the systems. The studies have also considered the various ways the private sector can become involved in providing and maintaining these systems (Jechoutek 2000; Ehrhardt 2000).

As most countries seek to restructure their energy supply systems, in particular their electric supply systems, debate has been renewed over whether the involvement of the private sector in the provision of services is likely to improve access by the poor (see Albouy and Nadifi [1999] for a review of the evidence on this issue). The immediate reaction is to suggest that, as the private sector must focus on the profitability of the enterprise, poor consumers who use little energy and are expensive to interconnect will receive far less service from a restructured energy supply system (Houskamp 2000). However, it can be argued that the long-run effects will be positive, on the basis that efficiency improvements will stimulate general economic growth and that this will have a positive impact on poverty alleviation. In addition, the removal of a major cost to the national budget may bring direct benefits to the poor, as

the funds released (assuming that they represent real revenues) can be directed to well-focused social programs.

A preliminary assessment of the impacts of the utility privatization and sector regulation in Argentina (Chisari, Estache, and Romero 1999) shows that economic gains are significant and that all income groups will benefit. However, it predicts that higher income groups will benefit more, in relation to their pre-restructuring utility expenditure, than the lowest income groups. At the same time, the analysis shows that effective sector regulation would produce significantly greater benefits for lower-income groups, reaffirming the belief that the poor consumer suffers the most from poor governance (See Box A.7 for a more detailed description of this study.).

Covarrubias and Reiche (2000) describe the approach being taken in Argentina to reform and privatize the production and delivery of energy services, while also actively promoting the expansion of rural electrification. The government awards concessions to private companies to provide electricity to small rural markets (between 3,000 and 25,000 potential customers). Companies are invited to bid on the basis of the subsidy they would require to provide minimum levels of service, encouraging them to identify cost-effective technologies and marketing methods to supply low-income consumers. Current spending on kerosene, candles, bottled gas, and dry batteries is used to determine what consumers should be able to pay, with the subsidy making up the difference between these payments and the cost of providing service. The benefits of rural electrification are seen as (i) dramatic improvement in the quality of lighting, allowing children to study and adults to extend income-generating activities into the evening; (ii) elimination of the health

and safety hazards of using kerosene or candles for illumination; (iii) improved access to national and worldwide information through the use of radio and television; and (iv) better learning conditions in schools through the use of computers, the Internet, and satellite television.

Several more examples of methods being used to involve the private sector in the provision of modern energy to rural areas have been described, particularly in Latin America (Jadresic 2000; Estache, Gomez-Lobo, and Leipziger [2000] for a review of this experience). The examples describe several alternative models that are being tested. Estache, Gomez-Lobo, and Leipziger conclude that the relation between “privatization” and the poor is complex and in general ambiguous, and that more research on this matter is badly needed. However, greater involvement of the private sector is expected to lead to innovation in the provision of energy services and, with appropriate government regulation, seems likely to increase the access of the poor to modern energy.

Community Participation

It has been widely suggested that, if alternatives are adequately explained to the community, and the community is given the right to make the ultimate decision, an infrastructure intervention is more likely to be successful (ESMAP 2002b). Energy infrastructure must be paid for, and different energy options will have different costs and benefits, so the community must fully understand the implications of each option. The community may determine that a better source of energy for cooking would have a greater impact on community welfare than a rural electrification scheme. This might be provided through

Box A.7. Impacts of Power Sector Reform and Privatization in Argentina

Using a computer generalized equilibrium model built around a social accounting matrix constructed for Argentina, a World Bank research study explored the effects of changes in utility performance on revenue and expenditure for 21 productive sectors, external trade, government, and domestic consumers in five income classes. The pluses of privatization included efficiency and productivity gains, quality improvements, and cost savings.

The study showed that privatization generated significant benefits to the economy. The impact of these benefits on the poor, however, depended upon the effectiveness of sector regulation. Direct gains were significantly higher for the higher-income classes, because when regulation was not effective, the gains from privatization were turned into a quasi-rent captured by the richest, who were the largest domestic owners of capital in infrastructure services. Part of these gains was also captured by foreign consumers and the government, because they owned part of the “privatized” areas.

The study found that through its indirect effects on the economy, privatization improved the overall distribution of income, as measured by the Gini index (a measure of inequality). When sector regulation is effective, however, the income distribution effect was six times as great, because under effective regulation, more of the gains translated into labor income, the principal source of income for the poor. When sector regulation was ineffective, a larger share of the indirect benefits went to the owners of capital.

Source: Chisari, Omar, Antonio Estache, and Carlos Romero. 1999.

locally generated biogas, better supplies of kerosene, or LPG. A fuel service station for users of a new or upgraded road could also be the base for providing alternative modern fuels for domestic and small commercial use.

If a rural electrification scheme is selected, the community may need to become involved in its management. As a minimum, such management will be responsible for collecting charges for electricity consumed and making payments for communal energy uses. For local management to be successful, training will be needed in bookkeeping and general management. In addition, training can provide local people with the ability to safely install and maintain basic house connections. Nevertheless, the community will need access to qualified maintenance services to do necessary work on the high-voltage systems and to perform checks on work done in households, in order to reduce the risk of injury and property damage caused by improper installations.

Impact Assessment Methods

In a recent paper, Foster and Tré (2000) discuss the feasibility of measuring the impact of energy sector interventions on the poor. Indicators measuring the impact of energy sector projects on the poor should consider a household's full portfolio of energy sources. The approach would require the specification of quantitative welfare indicators, including basic needs, economic benefits, and social benefits. Values would then be determined for each indicator for both poor and nonpoor groups. Data would be collected for the same households before and some time after the intervention, as well as for a control group (the "double difference" design). The authors show that much of the information needed can be obtained from living standards measurement surveys or other income and expenditure surveys commonly carried out in developing countries. Based on the results of the 1998–99 National Survey of Household Income and Expenditure in Guatemala, they calculate the values of the proposed indicators for 1 year, suggesting that these could be used as a baseline for a potential future assessment of the impact of electricity reform on poverty in Guatemala.

Another study proposes the use of shadow prices, based on semi-input-output analysis, to estimate indirect income effects on the basis of directly measured income effects (Potts 1999). The approach is illustrated with the example of a district heating rehabilitation project in the Republic of Latvia. The benefits of electrification projects are valued based on a combination of consumer willingness to pay, the benefits generated from additional income-earning activity, and savings compared to the use of alternative

energy sources. The cost-benefit analysis for this project identified savings in energy costs due to increased efficiency as the main benefit, with additional savings in maintenance and labor costs. It was assumed that the efficiency savings would be passed on to consumers, while the maintenance and labor cost savings would accrue to the utility. Labor cost savings would be achieved at the expense of semi-skilled and unskilled workers, who would be the main losers from the project. Consumers could be disaggregated into residents, public institutions, and public and private industry. To evaluate the incidence of poverty resulting from consumer benefits, it is necessary to carry out a survey of consumers and their energy consumption, stratified by poor and nonpoor groups.

Additional research sponsored by DFID has developed a toolkit for the selection of appropriate combinations of energy services to meet the needs of poor communities on a sustainable basis.¹⁶ Use of this toolkit (called "Empower") begins with a participatory analysis of the energy needs of the community. The kit provides information on the financial and nonfinancial benefits associated with different energy options to meet identified needs. (Financial benefits are cost savings; nonfinancial benefits have to do with the quality of service provided.) Combined with information on current energy expenditures and aspirations for the future, the toolkit helps assess the affordability of different options for different members of the community. Alternative scenarios are then used to support community-based decision making. The goal is to encourage the development of more inclusive approaches to energy supply, by enabling the community to balance the needs of all stakeholder groups. The toolkit has been piloted in Namibia, South Africa, and Tamil Nadu, India; a final version is in preparation.

Summary

It seems likely that biomass will continue for many years as poor people's main source of energy for cooking and space heating, notwithstanding the developed world's best efforts. However, it is important to recognize that biomass supply is limited and may not always be sufficient. The arguments in favor of making modern energy, electricity in particular, available to all are many, but the expense is currently prohibitive. The poorest people will not be able to use electricity in their homes until they have

¹⁶ An electronic version of this toolkit can be downloaded from: http://www.etsu.com/energy_voices.

improved their income levels to a point where they can afford the energy, although even then they are not likely to be able to afford the full installation and connection cost. Hence, when a rural electrification scheme is being planned, the broader energy needs of the community should be considered. The program might include improving the source and cost for kerosene and LPG and the introduction of more efficient stoves for those who must continue to use biomass.

Various models have been examined as ways to involve the private sector in the supply and maintenance of equipment, and different financing mechanisms, involving either utilities or the private banking system, have been tried. The same institutional arrangements have been examined as vehicles for well-targeted subsidy of the systems. As most countries seek to restructure their energy supply systems, in particular their electricity supply systems, debate has been renewed over whether the involvement of the private sector in the provision of services is likely to improve access by the poor. However, it can be argued that the long-run effects will be positive, on the basis that efficiency improvements will stimulate general economic growth and that this will have a positive impact on poverty reduction. In addition, the removal of a major cost to the national budget may bring direct benefits to the poor, as the funds released can be directed to well-targeted social programs.

Transport and Energy

Most of the literature concerning infrastructure impacts on poverty reduction is focused on one sector: transport, water, energy, irrigation, telecommunications, etc. However, some studies have looked at the composite effects of infrastructure investments (together, in many cases, with investments in the social sectors) on economic growth, particularly in rural areas, and on poverty reduction. These studies are particularly valuable in assessing the relative importance of different types of investments and their appropriate sequencing and timing for optimal impact.

Some difficulties arise in comparing the results of these studies because of their differing definitions of “infrastructure.” Most studies have included both transport and energy investments in this definition, although some have looked only at utilities (e.g., Houskamp [2000], and Komives, Whittington, and Wu [2000]). Most studies also distinguish “physical infrastructure,” which includes

transport and energy, from “social infrastructure,” including schools, clinics, and other public buildings. In addition to transport and energy, the physical infrastructure “bundle” usually includes water, sewer, and telecommunications systems, and sometimes irrigation as well.

Sawada (2000) took a dynamic approach to poverty in a study evaluating the role of infrastructure in reducing both transient and chronic (“structural,” as defined above) poverty. The study concludes that infrastructure, including both roads and irrigation, has a role to play in relation to both types of poverty. In addition to increasing economic opportunities to alleviate structural poverty, infrastructure helps to minimize the risks of agricultural production, which are the main cause of transient poverty in Asia. Infrastructure increases information flow, lowers transaction costs, and increases personal mobility, providing access to a wider labor market. The study also cites the role of infrastructure in generating employment; reducing the risks of natural disasters; and stabilizing production, prices, and wages across the national economy.

Pouliquen (1999) stresses the role of rural infrastructure projects in building social capital at the community level, but points out that this does not necessarily result in poverty reduction. Projects may target poverty areas or aim to generate employment for the poor through the use of labor-based methods. However, these are blunt instruments, and the benefits are subject to capture by local elites. Greater community participation, together with more decentralized administration, may help to empower the poor, but only to the extent that the poor participate effectively in decision making at the local level.

A comprehensive review of the literature on rural electrification, with an emphasis on the evidence concerning poverty reduction, showed that poor beneficiaries perceived important noneconomic benefits, even when the investment had little impact on their agricultural productivity (Songco 2002). This review, which also covered irrigation, rural roads, rural water supply, and sanitation, emphasizes the importance of complementary investments in equipment, services, and credit to enable the poor to access the benefits that improved infrastructure provides. Complementary inputs would also include education or technical training, as well as provisions for participation by the poor in project planning and management. The study specifically confirms the conclusion that multiple sector investments benefiting the same target group have synergistic effects, especially when infrastructure investments are combined with education initiatives.

Case Studies

A study carried out in India by the International Food Policy Research Institute (IFPRI) (Fan, Hazell, and Thorat 1999) looked at the allocation of public funds in relation to growth and poverty reduction goals in rural areas. The study used an econometric model to evaluate the effects of government expenditure in a number of sectors plausibly related to rural poverty: agricultural research and development (R&D), irrigation, roads, education, rural and community development, power, health care, and soil and water conservation. This study found that investment in rural roads, followed by agricultural R&D, had the greatest effect in reducing poverty. Furthermore, rural roads were second only to agricultural R&D in explaining increases in agricultural productivity. Investments in education followed in third place for poverty reduction. In contrast, expenditures on electricity had little impact on either farm productivity growth or poverty, while expenditures on irrigation were related to productivity growth but only marginally to poverty reduction (Box A.8).

The lack of energy impacts was attributed to the fact that the government had already invested heavily in rural electrification, so that the marginal returns from additional investments were low. About 90% of India's rural villages were already electrified by the time of the study. Most of the measured effects of energy expenditures derive from nonfarm employment rather than from farm productivity increases. The study also found that public investment in health services had a statistically insignificant impact on (income-based) poverty and on agricultural productivity, at least over the time frame of the study (20 years).

The formulation of the IFPRI model illustrates the multiple linkages between road expenditures and poverty reduction. Investment in roads acts on three major variables: total factor productivity in agriculture (because of cost savings in transport of inputs and outputs); agricultural wages (because of structural transformations in agriculture placing a greater premium on wage labor); and nonagricultural employment (due to the employment-generating impact of road works, the stimulus to nonfarm commercial and industrial activities, and greater efficiencies in the rural labor market). In India, the growth in total factor productivity helped to keep prices of foodgrains low, benefiting the poor. It was also hypothesized that growth in total factor productivity would increase the value of land, leading to increasing landlessness among the poor; this hypothesis was not confirmed by the data, however.

An interesting byproduct of this research was the ability to estimate the time lag for investments to have their maximum impact on poverty. The lag times determined by the model are 7 years for roads and power, 8 years for irrigation, 10 years for health, 11 years for education, and 13 years for agricultural R&D. The study notes that these lag times are actually short compared to similar lag times calculated for the United States.

A similar study (Fan, Zhang, and Zhang 1999) was carried out for the PRC, although the specification of the model was slightly different. In the PRC, community development, health care, and soil conservation expenditures were not included in the model, but telecommunications expenditures were included. In this case, education expenditures had the greatest impact on poverty reduction, followed by rural telephones, agricultural R&D, and then roads and power, having approximately equal effects. For agricultural productivity, R&D was most important, followed by education and rural telephones, with roads and electricity again in fourth and fifth place. As in India, irrigation investments had a small positive impact on agricultural growth, but little effect on poverty. The poverty reduction effects of infrastructure investments (telecommunications, roads, and power) came about mainly through increased nonfarm employment and improved wages in the agriculture sector, due to a more competitive labor market.¹⁷

Recent research on poverty reduction in the Philippines (Balisacan 2001) examined why agricultural growth failed to stimulate the growth of the rural nonfarm economy, and thereby achieve the positive effects on poverty experienced in many other Asian countries. Rural infrastructure was postulated as one of several factors affecting the response of the rural nonfarm sector to agricultural growth. Other factors cited include the distribution of assets and incomes, the quality of human capital, and the macroeconomic and political environment. Based on data from 73 rural provinces in the Philippines, road infrastructure endowments proved to be by far the strongest predictor of successful poverty reduction. The model also included changes in access to electricity, but this did not prove to be a significant determinant of poverty reduction.

This work was expanded to disaggregate the effects on poverty of different sector endowments (Balisacan and Pernia 2002). The second study finds that while education endow-

¹⁷ An earlier study carried out in Mexico (Cook et al. 1983) confirmed the synergistic effects of transport and telecommunications investments in rural areas, especially with regard to nonfarm employment.

Box A.8. The IFPRI Model

The “International Food Production Research Institute (IFPRI) Model” uses a set of simultaneous equations to estimate the effects of different types of government expenditures (including both investment and recurrent expenditures) on rural production and rural poverty. Poverty is defined as the percentage of the rural population falling below the poverty line. In these equations,

- Rural poverty reduction (DP) is estimated as a function of changes in agricultural production, rural wages, nonagricultural employment, rural/urban terms of trade, and population growth (lagged by 1 year).
- Agricultural production is estimated as a function of agricultural land, agricultural labor, use of fertilizer, agricultural machinery and animal traction, percentage of irrigated agricultural land, current and lagged expenditures on agricultural research and development (R&D), road density, electricity supply, average years of schooling in the community, and annual rainfall.
- Rural wages are estimated as a function of road density, electricity supply, average years of schooling, agricultural production (lagged by 1 year), and growth in nonagricultural gross domestic product (GDP) (lagged by 1 year).
- Nonagricultural employment is estimated as a function of road density, electricity supply, years of schooling, agricultural production (lagged by 1 year), and growth in nonagricultural GDP (lagged by 1 year).
- Rural-urban terms of trade are estimated as a function of local and national agricultural growth, as reflected in food prices, divided by a relevant nonagricultural GDP deflator.

In turn, road density is related to current and lagged public expenditures on roads, electricity supply to current and lagged public expenditures on electricity, average years of schooling in the community to current and lagged expenditures on education, and percentage of irrigated land to current and lagged expenditures on irrigation.

The independent variables are government expenditures in different sectors. Growth in nonagricultural GDP, population, and rainfall are exogenous (contextual) factors affecting outcomes. Availability of agricultural land, labor, and technical inputs (fertilizer, machinery, and animal traction) is a situational factor that is endogenous to the model, affecting outcomes in terms of agricultural productivity. Expenditures on agricultural R&D and on irrigation are also related to agricultural growth but not to growth in nonfarm employment. Other types of public expenditure affect both the farm and nonfarm sectors of the rural economy.

The model has been applied in different countries with some variations. In India, health expenditures were included; in the People’s Republic of China, expenditures on rural telephones were included; in Thailand, rural-urban migration was included. However, the results are fairly consistent across countries. They suggest that public expenditures on infrastructure are significant determinants of rural poverty reduction, partly through their positive effects on agricultural productivity, but much more importantly, through their effects on nonagricultural employment, wages, and rural/urban terms of trade.

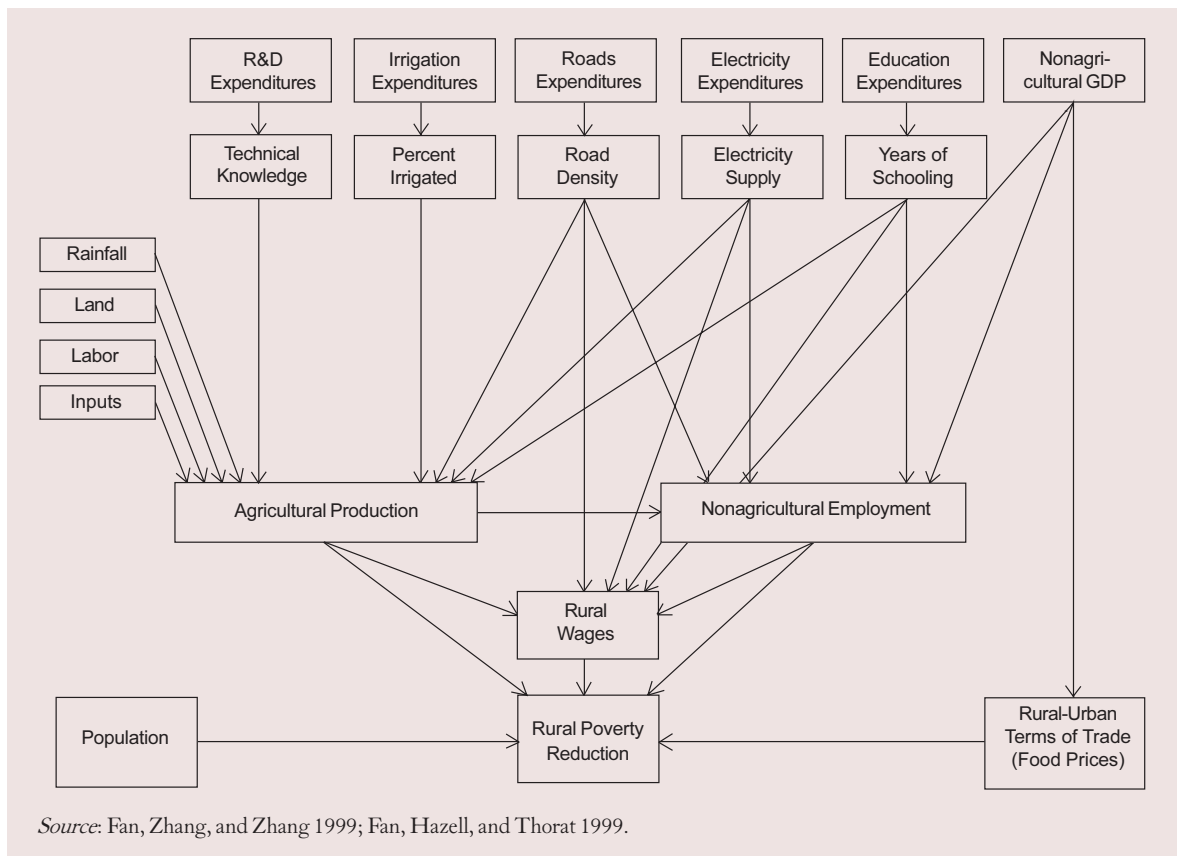
ments alone are unrelated to poverty, and roads alone may even be negatively related, the combination of roads and education has a positive effect on poverty reduction.¹⁸ Electricity does not have a significant effect, either alone or in combination with education. However, irrigation infrastructure had a significant positive effect, although farm size did not, indicating that land quality matters more than quantity for poverty reduction. High transport costs in landlocked provinces and the frequency of typhoons were also significant, indicating the vulnerability of the poor to conditions that can be partially addressed through infrastructure investments. Governance factors, captured by variables on the presence of local political dynasties and party affiliation of local authorities, also had significant effects on poverty reduction performance.

The evidence regarding rural transport, energy, and irrigation investments is summarized in Ali and Pernia (2003). This review concludes that rural infrastructure investments offer the potential for a major impact on pov-

erty reduction through promoting economic growth. However, it stops short of suggesting ways in which the policy environment could be altered to improve the distribution of the benefits of growth. It also highlights the importance of considering country specificities in establishing sector priorities for rural infrastructure investments.

ADB’s Economics and Development Resource Center led another study carried out in Indonesia. Stage 1 of this study looked at public expenditures in the 25 provinces of Indonesia from 1976 to 1996 (Kwon 2000). The study considered government investments in irrigation, roads, health care, science and technology, agriculture and forestry, and education. The rate of decline in poverty was found to be most sensitive to road investments, followed by education, agriculture, and irrigation. In addition to the indirect effects of roads on poverty through intervening variables, the study was able to isolate a significant direct effect of road density in reducing poverty in Indonesia. Thus, road capital may be considered one of the assets of the poor, improving the functioning of labor and product markets. The study also highlights the direct impact of road construction on poverty by providing employment opportu-

¹⁸ The authors point out that the results might have been different if the independent variables had been public expenditures on education and roads, rather than current endowments.



nities for large numbers of the rural poor. The findings of this study have been strengthened by the Stage 2 research using more disaggregated data (Balisacan, Pernia, and Asra 2002).

A major study on ways to support rural poverty reduction through projects has recently been completed in the PRC (ADB 2004c). The study looks at policy, rural industry, microfinance, rural infrastructure, and rural mobility. Its main report (Biotech Consultants Ltd. and Harvard Institute for International Development 2000) focuses on policy recommendations. The study notes that past rural infrastructure investments in the PRC have been undertaken more as a way of generating income for poor people (through Food for Work programs), than as part of a broader strategy to stimulate economic growth and reduce poverty in rural areas. Consequently, little work has been done to evaluate the broader impacts of such investments. Given the need to learn more about the link between infrastructure and poverty reduction in the PRC as a guide for more coordinated planning, the study proposes a pilot project to test the impacts of small-scale

infrastructure at the village level. This pilot project is currently being carried out.

A study of water and electricity service provision in Peru looked explicitly at the question of whether synergies can be obtained by “bundling” infrastructure services (Grootaert and Oh 2001). Based on data from the Living Standards Measurement Surveys (LSMS) of 1994 and 1997, the study constructed a panel of rural households. Previous analysis of the larger data set (urban and rural) showed not only that access to basic services was a key determinant of growth in per capita consumption, but also that the impact of each service increased as new services were added. However, when the data were disaggregated into urban and rural groups, this effect did not hold for urban households, and was much weaker for rural households as well. The research reported here considered four services: water, sanitation, electricity, and telephone. Water and electricity were the most widely available and most likely to occur in combination. This study showed that the combination of water and electricity increased

incomes by much more than either service alone or the simple addition of the two separate effects.¹⁹ This synergistic effect occurred for both poor and nonpoor households. While the data in the LSMS on quality of services is scant, it was possible to test the impact of water availability for at least 12 hours a day, which had an even stronger synergistic effect.

It is often argued that the introduction of market-oriented reforms will make the growth process more inequitable, because the benefits of infrastructure investments are more likely to be captured by higher-income households. The investment opportunities for poor households are constrained by land, labor, and credit market imperfections, as well as by disparities in educational attainments. A recent study uses data from Viet Nam to test the hypothesis that educational differences and labor market failures interact to create inequalities in the returns to investment in physical capital (irrigation), with poorer and less educated families receiving lower returns (van de Walle 2000b). The results support this conclusion. They suggest that increasing investment in education for the poor, as well as targeting public investments to areas of lower returns, would enable the poor to capture a greater share of the returns to irrigation. The paper also notes that infrastructure deficiencies—in roads, electricity, and communications—reduce the impacts of irrigation investments, and make the case for a multisector approach to development planning.

Additional research on irrigation and poverty was carried out by the International Water Management Institute in India, Philippines, Thailand, and Viet Nam (Bhattarai, Sakthivadivel, and Hussain 2002). This work shows that poverty levels are generally lower in irrigated areas than in unirrigated areas, even though the bulk of the irrigation benefits may be captured in the first instance by the nonpoor. It emphasizes the importance of multiplier effects in spreading the benefits to the poor through increased farm and nonfarm employment. Additional work undertaken by Japan Bank for International Cooperation Institute in collaboration with the International Water Management Institute and Sawada in Sri Lanka focuses on the role of irrigation in ensuring sustainable poverty reduction, by permitting dry-season cropping and thereby mitigating seasonal fluctuations in income that otherwise

could create at least transient poverty for many farm households (Sawada and Shinkai 2002). The study also found that access to credit was a key determinant of the ability to hedge against seasonal risks, and that access to credit was more constrained for female-headed households, households with a high proportion of female members, and households in nonirrigated areas.

Summary

Strong evidence is now available that (i) investments in infrastructure (including transport and energy), education, and agriculture work together to improve rural productivity and reduce rural poverty; (ii) roads may be the single most important sector investment in pursuing a program of rural poverty reduction; and (iii) investments in irrigation and power may also influence agricultural productivity, but are likely to have only marginal effects on rural (income) poverty. These findings in no way invalidate the benefits to the poor of earlier large-scale investments in irrigation and agricultural inputs that underpinned much of the green revolution in Asia. However, as modern agriculture expands into less suitable (and therefore poorer) areas, returns to such investments are likely to diminish, and this may also impose long-term environmental costs. Initial findings from the latest studies suggest, however, that rural roads and electrification also have significant, unmeasured effects on the quality of life of the rural poor.

¹⁹ Water service increased incomes (measured by consumption) by 3 percentage points, and electricity by 19 percentage points, but the combination increased incomes by 28 percentage points.