A case study from
Reducing Poverty, Sustaining Growth—What Works, What Doesn’t, and Why
A Global Exchange for Scaling Up Success

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Asia-Pacific: Infrastructure, Regional Cooperation, and Poverty Reduction:
Lessons from the Region

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Executive Summary

While the contribution of infrastructure to augmenting an economy’s productive capacity is well known, its impact on poverty reduction is considered to be mainly indirect, working through the poverty reduction effects of growth. However, a realization is growing that infrastructure can also directly facilitate the access of the poor to basic services and help in increasing the income-generation capacities of the poor. Since the Asian Development Bank (ADB) adopted poverty reduction as its overarching goal in 1999, all aspects of its operations are being geared towards that objective. Infrastructure lending accounts for about a third of ADB’s total lending; hence its impact on poverty reduction is a key issue.

The paper draws upon ADB’s experience in infrastructure development in the Asia Pacific region, both in the country context as well as the regional cooperation context under which much infrastructure lending is taking place. It draws upon findings from country case studies as well as ADB’s impact evaluation studies in roads and electricity. It studies the impact of the Greater Mekong Subregion (GMS) Program as a special case, to illustrate the impact of infrastructure investments in the regional cooperation context.

An important conclusion is that under favorable circumstances, some of which can be influenced by public policy, infrastructure projects can significantly assist in poverty reduction. This conclusion is based on both the country studies on infrastructure provision in general, as well as a large body of ADB project experience in the road transport and energy sectors.

Thus it was found from both studies that road transport and electricity helped reduce income poverty, with road transport improvements having a stronger impact. Access to roads reduced prices under conditions of competitive transport services provision; increased mobility, and reduced labor market imperfections; enabled the poor to find better paying work; and allowed production of higher value cash crops and supply of cheaper agricultural inputs. Rural electrification helped stimulate the rural economy and expanded opportunities for off-farm employment for the poor. Use of television sets led to improved information on crops and contributed to improved farm productivity. Lighting allowed for longer work hours. All rural infrastructure projects also contributed directly to employment of the poor. Infrastructure provision was noted to have generally contributed to increased trade and growth in countries in the regional cooperation context. The impact on non-income poverty was also found to be significant. Roads reduced travel time and provided better access to basic education and health services. Electricity also affected non-income poverty. Better lighting increased the time for studying and years of schooling. It increased safety and security and provided better medical services in rural areas.

However, these favorable results do not have universal applicability and occur only with complementary public actions. Several considerations need to be kept in mind when up-scaling rural infrastructure provision. Strong poverty reduction outcomes from infrastructure projects can come about only if there is a strong pro-poor policy environment. Location of projects in areas of high poverty concentration, designing complementary interventions to increase the poverty reduction impact of infrastructure projects, creating market conditions for competitive reduction of transport
prices, attempting to increase the affordability of electricity prices for rural consumers are all indications of this pro-poor direction in policy. In the regional cooperation context, the role of complementary agreements to facilitate cross-border trade, for example, illustrate the importance of complementary policy action for increasing the impact of infrastructure projects.

No discussion of infrastructure can be complete without addressing issues related to the sustainability of infrastructure services. If roads deteriorate and electricity services become erratic, this affects all users, including the poor. Thus developing countries must pay much greater attention to road maintenance than they do now. The sustainability of electricity services requires that the electric companies be financially strong and that policy regarding tariffs be depoliticized. Necessary institutional changes and capacity building are also important actions to ensure sustainability.

Finally, the impact of infrastructure on growth and poverty reduction can be considerably increased in situations that call for regional cooperation by freeing the provision of infrastructure from artificial confinements within national boundaries. The GMS case provides a good illustration of this and is a worthy model for scaling up.
Introduction

This case study investigates how infrastructure investment can be upscaled to contribute to poverty reduction. While the contribution of infrastructure to augmenting an economy’s productive capacity is well known, its impact on poverty reduction, being largely indirect, is difficult to establish empirically. The literature suggests that many factors influence impact, and that there are big variations in impact within and between countries. Further, it is found that poverty impact was not determined merely by the infrastructure intervention, but also by the wider intervening socioeconomic environment.

Methodological difficulties complicate the use of much of the empirical literature. This is because of the conceptual and practical difficulties in separating out which final impacts are attributable to transport or energy investments, and which are due to other influences. Moreover, the larger the infrastructure intervention, the more difficult is this exercise. Several other problems were common to many of the existing studies. Usually the period examined was too short to identify longer term, sustainable impacts. Another problem was that few studies tried to distinguish the impacts on the poor from those on the non-poor. There was also a tendency to neglect the non-income dimensions of poverty and poverty reduction.

Notwithstanding these conceptual and analytical difficulties, there is little question that infrastructure directly facilitates the access of the poor to basic services and helps in increasing income generation capacities. Since adoption of its poverty reduction strategy (PRS) in 1999, ADB is gearing its operations towards meeting its overarching goal. As infrastructure lending accounts for more than a third of ADB’s total lending; its impact on poverty reduction is a key issue.

This paper draws upon ADB’s experience in infrastructure development in the Asia Pacific region. The paper draws upon three kinds of sources, viz., country case studies, project evaluation studies and regional cooperation review. The methodology and the database of these studies being different, one needs to be cautious while pooling findings together. In the write-up, we have maintained this separability while teasing out common lessons. The paper focuses on transport, especially road sub-sector and energy sectors as examples of infrastructure interventions. Section II starts by discussing ADB’s general experience in implementing infrastructure projects. Section III describes how transport infrastructure impacts on poverty reduction using evidence from several country studies and project evaluation studies. Likewise, energy sector related findings are discussed in Section IV. Regional cooperation related results are summarized in Section V. Factors driving the poverty reduction experience and the lessons learned are in Sections VI and VII, respectively. The last section provides some concluding observations.

Infrastructure and ADB

By first quarter of 2004, ADB had lent $44.4 billion for projects in the infrastructure sector that includes energy, roads and road transport, ports and shipping, airports and civil aviation, and railways. Of the total lending for infrastructure, lending for power and roads have been most
important and have accounted for 48.1 percent and 35.5 percent. Power projects totaled $21.4 billion, delivered through 280 projects. Roads accounted for $115.8 billion of total transport sector lending through first quarter 2004, involving 177 projects in 28 countries.

**Figure 1. Composition of ADB’s cumulative infrastructure lending through 31 March 2004**

![Figure 1a. Sectoral Share of ADB Cumulative Lending Activities, in percent as of 31March 2004](image1a)

![Figure 1b. ADB Cumulative Lending Share to Total Infrastructure, in percent as of 31 March 2004](image1b)

In transport, roads have been most important with funds used for construction and improvements of primary, secondary, and feeder roads; bridges; restoration of damaged infrastructure; and maintenance operations. Most loans have been for inter-urban and rural roads. However, there has been a change in pattern of investments over the past three and a half decades, reflective of development trends in the region. During the 1970s, loans in the road sub-sector were mainly for the construction of new highways and rural roads. In the 1980s, the focus moved towards improving existing roads. The 1980s projects increasingly included components aimed at improving road maintenance, and also saw the introduction of the sector lending modality, which funds time slices of national road improvement and rehabilitation programs.

**Performance.** As compared to loans in other sectors, infrastructure projects in ADB have performed relatively better. Of the 19 road infrastructure projects evaluated by the end of first quarter 2004, 36.8 percent were rated highly successful, 52.6 percent successful, and a further 10.5 percent percent were rated partly successful.

Evaluation of ADB road projects shows that the majority has been successful in producing their expected outputs. The cases of underachievement of physical targets are relatively few; and the envisaged roads have been constructed and the improvements made. Construction quality has also been generally good.

ADB’s energy projects have also had a high level of success. Of the total 172 completed public sector energy projects financed by ADB, 103 or 59 percent were postevaluated by the Operations Evaluation Department (OED). Among these projects, 72 percent were rated generally
successful, 2 percent highly successful, 7 percent successful, 17 percent partly successful, and only 2 percent unsuccessful.

**Poverty Reduction Orientation.** The successful implementation of infrastructure projects of course, does not automatically translate into successful poverty reduction impact. The latter including upscaling potential of infrastructure projects depends significantly on its design, location, complementarity with other projects, supporting policy environment and the manner of its implementation.\(^1\) Infrastructure projects in the rural sector or locations with a high concentration of the poor may have greater poverty reduction impacts than otherwise. The extent to which infrastructure does contribute to poverty reduction is often a matter of project design such as the issue of location in rural versus non-rural areas, and is to considerable extent affected by policy commitment in implementing development priorities. As we shall see below, in several cases a definite prioritization has been made to impart a greater pro-poor orientation of infrastructure projects (see the Lao PDR road projects in Box 1 and the Thai Rural Electrification Project in Box 2).

**Evidence on Poverty Impact of Transport Infrastructure**

**Comparative Country Studies**

A study was launched in 2001 to assess the impact of transport and energy infrastructure on poverty reduction.\(^2\) Practitioners, in particular the governments of developing member countries (DMCs), had a strong sense that infrastructure plays a major role in poverty reduction. But there was little reliable research to support this view. Skeptics argued that ADB should not continue to invest heavily in transport and energy without evidence that these investments do reduce poverty.

The studies were conducted in Thailand, Shaanxi province of People’s Republic of China (PRC), and Gujarat state in India. The methodology followed is described in the Appendix. The studies found that infrastructure development particularly in transport and to a lesser extent in energy has had significant impacts on poverty reduction. Transport had the greatest influence. It was especially important for providing access to non-farm employment and supporting educational enrollment and quality. Energy was also important, but its effects were more long term – by enabling productivity and efficiency improvements. Some of the main findings are summarized below.\(^3\)

**Impacts—Income dimensions.** As expected, the main effects on income dimensions of poverty were through the lowering of transport and other costs; productivity gains; and from improved access to markets, technology and employment.

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\(^1\) See Prakash (2003).
\(^2\) RETA 5947: *Assessing the Impact of Transport and Energy Infrastructure on Poverty Reduction*. This was implemented by ADB in collaboration with DFID, JBIC, and World Bank.
\(^3\) Keeping in view the goal of the Conference, the findings have been presented in the paper in a broad brush manner. For a more precise and nuanced articulation of findings, please refer to the main research reports at http://adb.org/Documents/Events/2001/RETA5947/default.asp.
In the **PRC** study, econometric analysis found that having paved village roads, and the density of roads, were both highly related to poverty status. Reducing the distance from major highways helped to bring about poverty reduction. The major exception was that extreme poverty was not influenced by road status—perhaps because the extreme poor suffer from structural and demographic problems that prevent them taking up opportunities made accessible by roads. Studies of the impact of completed rural roads in Shaanxi over the period 1998-2001 found these were associated with a much higher rate of poverty reduction, and with higher growth in poor people’s per capita incomes and assets. After road improvement, both the poor and non-poor increased their production of cash crops, vegetables and livestock. To do so, improved road access played an important role in their being able to increase their use of technical training and credit. It was found that people strongly associated transport improvement with increased outside employment, employment in the village, rising living standards and income, and access to technical services.

In PRC, the impact of a newly built railway was also examined by comparing counties on and off its alignment. Per capita income growth was much higher in counties on the alignment. This was due to induced economic growth, including mining and tourism developments, along the rail corridor. Railway construction also provided a significant injection of employment and income, for poor and non-poor alike, which served as a catalyst for sustained higher growth in these counties. However, there was only limited influence on other counties. The main influence zone was found to be within 5 km of railway stations. Railways were also found to support long distance migration to employment, including among those living further from railway stations.

The **India** study found that poverty rates were lowest for households with good roads and electricity and highest for households with neither. In households with electricity there was a statistically significant relationship between transport interventions and poverty status, and with literacy, primary education, and cropping patterns. For households without electricity these relationships were much weaker. About a third of households surveyed in Gujarat reported changes in income due to transport improvement. This was generally higher for those farther from the road, and not consistently different between poor and non-poor. Factors cited were improvement of the village economy, better prices, more sales, better wages, and more wage jobs in and outside the village. The Gujarat study depended more on qualitative interpretation of survey results than the PRC and Thailand studies. Improved market access through road improvement seems to have contributed to changes in cropping patterns from food crops to cash crops, and to declines in prices of agricultural inputs. Villagers reported increases in wages, perhaps because road improvement reduced labor market imperfections. They were now able to obtain wage employment in neighboring towns; some now commuted to work; and contractors now visited villages to recruit labor. However, overall changes in occupation were quite small.

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4 The **India** study also examined the private port development at Mundra. This had led to significant employment creation at the port and in factories established nearby, and in provision of additional education and health facilities. However, the communities interviewed were not benefiting from this employment as they had been replaced by outside labor following a dispute over unionization. The outside labor was probably also poor, so the development has helped toward state or national level poverty reduction, even if not in the communities surveyed.
The **Thailand** study also found significant links between transport and poverty status, but these were weaker than in PRC and India. Regression analysis was used to test links between transport status and household income and household assets. For household income, only length of paved roads to the district office had statistically significant results. This applied to the poor and non-poor alike. Village dummy variables yielded significant results, suggesting that other situational factors also have an important influence. A series of indicators of transport coverage and quality, including average travel time and length of roads, were found to be predictors of household assets, but less for the poor than the nonpoor. Econometric tests of improved and unimproved roads between 1992 and 2001 found that road improvement helped to raise the income of both poor and nonpoor households. Improvement of laterite roads to paved standard had greater impact on poor people's incomes than improving to laterite standard only.

**Impacts—Non-income dimensions.** One of the most striking findings concerns the impacts on non-income dimensions of poverty. Transport, and to a lesser extent energy, led to significant improvements in poor people’s status in terms of education, health, safety, access to information, social interaction, and security.

In PRC, statistically significant links were found between road access and the proportion of trained teachers in schools and school attendance by children. The incidence of disability and chronic diseases was higher in villages without access, and may be linked to difficulties in accessing health services. The Shaanxi participatory assessment found that people strongly associated transport improvement with better medical services, schooling, and even improved marriage prospects. In India, improved transport services and all-weather access were considered important for accessing health facilities at critical times such as around childbirth. Availability of bus services also seems to have contributed to sharp increases in school enrollment, especially for girls. In Thailand, regression analysis found that lower travel time and the number of roads were found predictive of higher average years of schooling, including for the poor.

**Changes in use of Transport.** Improvements in transport infrastructure and services led to changes in usage of transport by both the poor and non-poor. In each of the countries, road improvement was followed by expansion of bus services and increased use of mechanized vehicles. As a result many of the poor changed from walking or using bicycles or draft-animals to using buses to travel to market. This was because they valued the time they would save. There was also a general increase in frequency of travel outside the village. Changes in transport use were greatest in PRC, where road coverage was poorest prior to improvement, and least in Thailand, where initial road coverage was highest. The extent to which there was change in the use of different transport modes was affected by the conditions of competition among service operators. While services in Thailand were competitive, in PRC fares were relatively high on some routes due to lack of competition among operators, and in India the services were publicly run and not very reliable.
Project Evaluation Studies

Some of these findings on impacts of transport and road projects on poverty reduction are further corroborated through ADB’s project post evaluation studies. These are briefly summarized below.

Economic Impacts: Though impact evaluation is systematically carried out, this commonly do not quantify the broader economic impacts of road projects. However, various examples of broader welfare impacts have been noted for completed road projects.\(^5\) ADB’s impact evaluation study of the road sector in Nepal, completed in 2000, was in this sense an exception. It tracked vehicular operating cost (VOC) savings from road upgrading to lower bus fares and freight rates, and subsequently to reduced prices of general consumer goods. As expected, the extent to which the benefit was passed on in the form of lower fares and freight rates was higher where transport competition was greater. Parallel development of agriculture was seen to have occurred in some areas but not everywhere, and a direct link between road improvements and dairy output was apparent in the east of the country. Other specific examples of broader economic impact are found in the Seventh Road (Sector) Project in Indonesia, where an increase in tourism occurred because road upgrading allowed tourist coaches to be used, and the Third Road improvement Project in the Lao People’s Democratic Republic, where factories arose along the road (Box 1).

Qualitative reviews of projects in the Philippines and Papua New Guinea (PNG), however, reveal that a disappointing number of road improvement projects, which aimed at stimulating agriculture failed to produce any noticeable impact on rural output. The mixed results prompt the conclusion that road improvements can stimulate broader development, but they are not always sufficient by themselves. Complementary development of a more direct nature may be needed to produce the desired poverty reduction and to enhance its up-scaling potential.

Social Development: As shown in many project evaluation studies, disadvantaged and the poor also benefit from improved access apart from the improvements on account of cheaper transport, easy availability of local goods and increased employment during the construction phase. Roads bring improved access to health, education, and public services; encourage the expansion of services like electricity, telephones, schools and clinics; and enable greater contact between people of different areas. The importance for poor groups of more reliable and faster bus services, apart from any reduction in bus fares, has been noted in many studies of road projects. While these social benefits are frequently recognized, they are often not quantified. The benefit of good public transport is even higher for women who do not often use other modes of transport such as bicycling, or riding in others’ vehicles.

Safety and Security. Improved roads as a result of ADB’s road projects have enabled faster travel and in the process have also resulted in accidents and an increase in fatalities, especially of low-income pedestrians. Starting in the 1990s, ADB’s road projects have more actively addressed safety concerns but road safety remains a major issue that has not been accorded the importance it deserves. This is an area that needs greater attention.

Box 1: Lao Road Improvement Projects

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\(^5\) ADBI Series No. 3: Paving the Way to Poverty Reduction Through Better Roads.
The Fourth and Fifth Road Improvement Projects of the Lao People’s Democratic Republic (Lao PDR) addressed the Government’s larger development strategy of poverty reduction through rural development and reducing the isolation of the northern parts of the country. The projects helped improve the northern part of national road 13 (N13), which is the backbone of the country’s road network, linking the northern and southern provinces of Lao PDR. The following are its impacts observed at post evaluation.

Impact on Costs to the Poor: The projects made the road usable in all weather conditions and ensured secure passage to road users throughout the year. The number of registered trucks more than doubled while the number of buses trebled between 1990 and 1995. Traffic counts grew by 150-230 percent for passengers and around 50 percent for goods between completion and evaluation of the projects. Travel times have been reduced considerably and travel cost has become affordable to most villagers. Villagers interviewed during the time of post evaluation confirmed that journeys of 40km which previously took a day or longer could be undertaken in less than 5-8 hours.

Impact on Basic Services for Poor: The time reduction contributed to greater access to health and educational services was within the reach of most rural communities who lived within the road influence area (RIA). The improved roads allowed access to villages that were previously excluded from Government programs on immunization, special education and training.

Impact on Incomes of the Poor: Some of the northern provinces are among the poorest in the country. The projects contributed to expanding economic activities to the poor who had little or no access to improved economic activities prior to the projects and in increased opportunities for wage employment. Economic activities experienced an upsurge. In 1987 only a few cash crops were grown while in 2001 all villages reported a variety of income sources, including vegetables, chilli, cotton, jute, papyrus-type grass that local enterprises used for paper making and export to Thailand, fishponds, and handicrafts. Many former slash and burn farmers grew teak. Women produced traditional embroideries of export quality, transported them to Louang Phrabang and earned enhanced incomes through export to the United States which would not have been possible earlier. Villagers also benefited from employment in road maintenance activities. Roadside stalls to sell produce were also reported in many places. Tourism has increased along the route, with centers developing around Vang Vieng and Louang Phrabang contributing to earnings. Post evaluation findings confirm substantial improvement in the standard of living of the beneficiaries. The increase in the level of prosperity of villagers was manifest in improved standard of housing and existence of television sets and satellite dishes.

Impact on Security: Security, which was a major issue prior to the projects, has now been resolved as more villages were built along the route and travel speed increased. Studies undertaken during post-evaluation confirmed that villagers acknowledged the security and empowerment conferred on them by the road development process.

Institutional Development. Infrastructure that decays before its economic life has expired does little good to the poor and the non-poor alike. Institutional development and capacity building of infrastructure agencies are key to the sustainability of infrastructure interventions for poverty reduction. ADBs road projects have contributed to the establishment of road sector policies and regulations and to the strengthening of both public sector road agencies and private sector contractors and consultants. The main sector policies of concern are those related to maintenance, such as vehicle overloading, and appropriate laws have been introduced in a number of countries. The contribution of most projects, to institutional development, however, has been limited to technical and administrative aspects. An important lesson in this context is that success in upgrading the technical and
administrative capabilities of road agencies depends upon governments maintaining an appropriate policy environment, allocating appropriate staff for training or participation in technology transfer arrangements, and allowing trained staff to remain in positions where their new skills can be used. ADB’s projects have also contributed to the strengthening of local private contractors and consultants, and have encouraged a shift towards their greater use in infrastructure development.

**Evidence on Poverty Impact of Energy Infrastructure**

Since 1966, ADB has made 284 public sector loans in the energy sector, totaling $19.1 billions. Fifty-four of these loans were approved between 1995 and 2001. Their total value was $6.4 billion, or more than $0.9 billion per year. This accounted for about 15 percent of total ADB lending in terms of value. The loans were mainly for electricity (mostly power transmission, followed by power sector restructuring), with gas in second place.

**Evidence from Country Studies**

**Income Impact.** The PRC study found that electrical connection had a lesser impact on the incomes of the poor and non-poor than transport. Households with electricity were found to have higher incomes, but the link between electricity connection and poverty reduction was not clear. This may have been because households without electricity tended to be in more remote locations, and were more willing to seek non-farm employment outside their villages, than households with electricity. It may also reflect the problem of the poor quality of the rural electrical system, which meant that much of the potential for using electricity to enhance income-earning activities (other than lighting) could not be exploited.

The analysis of the Thailand experience also did not identify as clear link between electricity connection and income as it had between transport and income. Electricity connection was linked with higher consumption expenditure – as a result of electricity bills and the steady accumulation of electrical appliances. In the household survey, about 40 percent of respondents associated electricity with increases in income. The main mechanism identified was through increases in non-farm employment, both within and outside of the village. The non-poor was considered more likely to exploit the economic opportunities created by electrification as they had more resources to invest. Few respondents associated electricity with occupational change among the poor.

**Impacts on Non-income dimensions.** Non-income impacts of electricity were mainly those associated with lighting and power for electrical appliances. Electric lighting allowed children to study longer each evening. In Thailand, regression analysis found that electrical connection was predictive of higher average years of schooling, including for the poor. Electricity coverage, years electrified, and the value of electricity bills were found to be predictors of educational attainment, although only electricity bills were statistically significant for the poor. Similar to PRC, the participatory assessment found strong perceived links between transport and electricity improvements.
and education and health status, particularly as a result of electric lighting, and the effect of refrigeration on food hygiene and medical services.

**Other Impacts—Time savings.** Energy interventions enable use of labor saving electrical appliances and lighting to extend the time available for production and education. In the past there was a tendency to assume that the value of poor people’s time must be low. However, it was found that time savings can be central to poverty reduction. Lack of time often hampers participation in income earning activities and undermines household support systems. Time savings, thanks to electrification, help the poor to overcome these problems.

**Changes in Use of Energy:** When electricity became available it was used mainly for consumption purposes, such as lighting, television, and other appliances. To a much lesser extent it also supported income-earning activities, such as food processing and irrigation, but this required investment in appliances, and was more common among the nonpoor than the poor. In each country, electric lighting extended the day for productive activities, homework by children, and social activities. Television was one of the most common appliances owned by the poor and nonpoor, and was an important source of information. In PRC, after electrification two thirds of poor households changed to use of electrical pumps for irrigation purposes. Half of the poor households surveyed in PRC used information on farming technology obtained from public television programs to raise their farm incomes. In PRC, Thailand and India, energy spending was correlated with income. In India and Thailand, this was also so for electricity. In PRC, electricity spending was not significantly different between the poor and the nonpoor, but the nonpoor spent more on other energy types such as kerosene. This was linked to the problems of low voltage and poor reliability of the rural electricity supply in PRC that made it unsuitable for many productive uses.

**Use of electricity by the poor was influenced by the regulatory framework and tariff policy.** In Thailand and PRC, electrical connection by the rural poor was encouraged by public investment programs to achieve universal household coverage. Between 1990 and 2000, in the areas studied, the proportion of households with electricity rose from 70 percent to 100 percent in Thailand and from 42 percent to 100 percent in PRC. In Thailand, this was complemented by a policy of keeping rural tariffs similar to urban levels by using a share of the profits of the electricity generating authority to cross-subsidize rural consumers. In PRC, the strategy for extending rural coverage involved initially investing in a lower cost, lower quality system, and charging tariffs aimed at cost recovery. The quality limitations meant the system was mainly limited to consumption uses rather than production, while the tariff policy caused rural tariffs to be three times those in urban areas. The Government has now changed its policy in favor of providing a higher capacity rural system and equalizing rural and urban tariffs through cross-subsidy. In India, although most villages were electrified, only about half of households were connected in the areas studied, and many poor households remained unconnected. The poor had difficulties affording the initial connection fees, and a regressive tariff structure kept charges high for rural households while cross-subsidizing the agricultural sector, particularly irrigation use by large farmers. Another problem limiting use by the poor was that frequent outages make it necessary to invest in backup generators.
Evidence from Project Evaluation Studies

Rural electrification projects evaluated have noted the increase in economic activities that have resulted from these projects. The Thailand Rural Electrification Project (Box 2) found that a considerable number of new social, business and commercial/retail shops, and rice mills were established consequent to electrification. In a number of villages, electrification projects opened up opportunities for new kinds of non-farm activities and for wage employment. Electrification contributed to the establishment of new occupations such as welding, food processing and battery charging. Small-scale farmers were able to access irrigation through the use of electrical water pumps thereby increasing productivity in vegetable gardens and rice fields.

In general the projects reviewed indicate the following types of benefits—many of which are related to meeting basic human needs and enhancing the quality of domestic life:

- Lengthened working days through better lighting.
- Expanded learning opportunities via radio and television;
- Improved medical services and education;
- Increased opportunities for economic activity—for example, by raising agricultural productivity via more electrically pumped irrigation and powered milling; and widened employment opportunities, particularly in cottage industries;
- Improved food storage and supply via refrigeration;
- Reduced workload via the use of household appliances;
- Reduced indoor pollution and a cleaner environment with the replacement of coal/and or coal briquettes, firewood and biomass; this in turn has benefits on health, especially for women;
- Saved time from gathering firewood and fetching water; and
- Provided many other benefits such as avoidance of the need to keep kerosene supplies and standby diesel, improved security as a result of street lighting, and the added convenience provided by electricity.

Although energy projects are generally regarded as gender neutral, project evaluations have revealed that energy projects have had major benefits for poor women. For example, supplying electricity to dwellings reduced workload, increased cleanliness, and improved health through better indoor air quality. It was also observed that electricity supply reduced the burden of physical labor in activities such as milling; water and, to a lesser degree, firewood gathering; and other types of housework—tasks typically performed by women in many DMCs.

In the energy sector, institutional changes through projects have had wider implications for long-term poverty reduction. These have been supported mainly through advisory technical assistance and policy-based lending. These have helped improve the financial and operational capacities of electricity companies and government institutions. Policy loans have helped institutional development through restructuring the sector, improving its regulatory framework, and strengthening the capacities of the sector’s regulatory bodies.
Box 2: Thailand – Rural Electrification Project

Thailand’s development over the past decades had concentrated growth in the Bangkok Metropolitan Region (BMR). Although poverty incidence had declined substantially between 1960–1990, about 90 percent of the poor lived in rural areas. The Government was aware of this imbalance and took initiatives to promote economic growth in the rest of the country, including the development of adequate basic economic and social services in the rural areas. In view of its socioeconomic impacts, the Government gave high priority to rural electrification aiming to cover every household, thereby generating employment, establishing small-scale industries and contributing to rural poverty reduction. The Rural Electrification Project directly supported this Government strategy.

As part of the Government’s Seventh National Economic and Social Development Plan, the project was launched to reinforce and expand distribution systems in rural areas, by upgrading and enhancing distribution facilities within partially electrified villages in 73 provinces throughout Thailand. It was also to provide electrical connections to around 400,000 rural consumers such as households, commercial establishments, rice mills, public institutions, and agricultural pump houses, thereby benefiting about 2.5 million people. As such the primary objective of the project was economic growth, with the secondary objective of poverty reduction, as a significant portion of the 400,000 rural households lived below the then prevailing official poverty line of $224 per person per year.

Impact Analysis: The project enabled PEA to react quickly to help mitigate the impact of the Asian financial crisis. The project served 477,379 new customers in rural areas, a 20 percent increase over original expectations. These customers, with access to the national grid, represented about 2.7 million people. It was estimated that country-wide, the project improved household electrification ratio by about 4 percent to reach the current level of 90 percent. About 88 percent of the new customers connected under the project were located in the south, north, and northeast areas of the country, which higher levels of poverty. The Project Completion Mission estimated that 20 percent of the beneficiaries were poor.

Beneficiaries under the project had acknowledged that improvement in the quality of life and convenience were major benefits of electrification. This was particularly true of household customers who worked at home, with major activities cited being reading in good light, rice cooking and use of television sets. A considerable number of new social, business and commercial/retail shops, and rice mills were also established consequent to electrification. In a number of villages, the project opened up opportunities for new kinds of non-farm activities and for wage employment- electrification contributed to the establishment of new occupations such as welding, food processing and battery charging. Small-scale farmers were able to access irrigation through the use of electrical water pumps thereby increasing productivity in vegetable gardens and rice fields.

Lighting benefited education by better access to knowledge through radio and TV and availability of lighting for increased night studies and this applied to both poor and non-poor households. Improved safety, consequent to household lighting and street lighting, and relatively less use of firewood, were other benefits that accrued to project beneficiaries. Some negative features were the increased costs due to electricity use which some of the poorer beneficiaries could not afford. Consequently, firewood, charcoal and agricultural residues continued to be used as fuel, although on a reduced scale. Overall, as envisaged at appraisal, the project contributed to the sustenance of economic development, distribution of income and reduction of poverty, enhancement of the quality of life and conservation of natural resources and protection of the environment.
In some cases, negative impacts have been observed. For example, difficulties in relocating families displaced by hydroelectric projects; lower incomes in some of the new settlements; and some friction between the hosts and the re-settlers. However, it was generally found that there were greater employment opportunities after the resettlement thanks to improved infrastructure.

**Networking Infrastructure Beyond Borders**

It is well-known that the development impact of infrastructure projects such as roads is expected to increase manifold when these are linked with each other. Networking of transport channels, in this sense, has a significant upscaling potential for poverty reduction subject to other preconditions for poverty reduction being followed scrupulously. In Asia and the Pacific, regional economic cooperation has facilitated such networking across selected countries and has thus facilitated sharing of gains more widely. In this section, this networking aspect of infrastructure projects beyond national boundaries is highlighted.

**The Case of Greater Mekong Subregion.** While infrastructure support has mainly been provided in the national context, and its benefits and impacts studied mainly at the project or country level, increasingly in the Asia-Pacific region infrastructure creation has been initiated by ADB through subregional economic cooperation initiatives. These subregional cooperation initiatives have enabled many countries to upscale poverty reduction by exploiting cross-border economies of scale, scope and networks.

ADB’s regional cooperation initiatives began with the Greater Mekong Subregion (GMS) Program in 1992 but now such initiatives span the entire Asia-Pacific region. The GMS Program and the other regional cooperation programs that followed have *inter alia* emphasized on infrastructure provision, particularly those that promoted physical connectivity between the countries and facilitated expansion of trade and other economic relationships. Thus, of the total GMS loan program till March 2004 all 17 projects that have been approved (both national projects with sub-regional dimensions as well as purely sub-regional projects) amounting to $1.9 billion, were largely infrastructure projects (although in later initiatives the “economic corridor” design was introduced) in transport and energy and tourism sectors. The case is similar to the other regional cooperation initiatives.

Since 1992, when the six member countries of the GMS program first embarked on the program, there have been many accomplishments. Economic linkages among the six countries have been strengthened through a series of infrastructure and other associated projects. In turn, the

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6 Other sub-regional cooperation initiatives include Central Asian Regional Economic Cooperation (CAREC); South Asia Subregional Economic Cooperation (SASEC); the Central and South Asia Transport and Trade Forum (CSATTF); Brunei, Indonesia, Malaysia, Philippines East ASEAN Growth Area (BIMP-EAGA); and the Pacific Islands Subregional Cooperation activities. See Iwasaki and Prakash (2002) for a review of ADB’s regional cooperation efforts.

7 In case of CAREC, of the total regional cooperation program of $187 million approved so far, 86.6 percent is for infrastructure.

8 The countries are Thailand, Cambodia, Lao PDR, Viet Nam, PRC and Myanmar
emergence of a new trade area attracted investor interest, promoting economic growth and social development in the subregion. The GMS Program has also had a peace dividend – it contributed to trust and better relations among the member countries. Indeed, this contribution may be its most significant accomplishment: nothing could be more welfare promoting for the people in the subregion than peace and security.

Investment in transport infrastructure was complemented by attention to the regulatory framework. A framework agreement has been signed by the governments of Cambodia, Lao PDR, Thailand, and Viet Nam to facilitate the cross-border movement of goods and people. The agreement covers such issues as customs procedures, rights of cross-border passage for vehicles and drivers, vehicle and load specifications, insurance provisions, and transmit or user fees. In addition, significant progress has been made concerning trade in energy and in establishing a telecommunications network for the subregion. The two hydropower projects amounting to $380 million were breakthroughs, both in terms of bilateral partnership (between Lao PDR and Thailand) and private sector participation. They have also promoted power-sharing arrangements on a multilateral basis, along with technical assistance.

The impact of these interventions is already being reflected in higher trade and investment flows for the subregion, with early signs of an emerging virtuous trade-investment nexus (see Appendix II for intra-regional trade, growth and poverty data of GMS countries). The trend is similar for intra-GMS net FDI flows.

### Driving Factors for Improved Poverty Impact from Infrastructure Projects

Evidence from the country studies and ADB’s project evaluation experience suggests many factors that influence the extent of poverty reduction impacts from infrastructure projects. Of these, the main factors that have been identified are listed below.

**Commitment to Pro-poor Development:** In DMCs with pro-poor policies and programs, better infrastructure led to expansion of economic and social development opportunities and the poor were often able to take advantage of these opportunities both directly and indirectly. Without such a pro-poor policy commitment, the infrastructure created may not have had as much of an impact on the poor.

**Complementary Infrastructure Pricing and Services Policies.** The approach to infrastructure pricing and service quality critically affects the impact on the poor. Use of cross-subsidies from non-poor to poor, support for initial connection fees for the poor ensuring access, and varying tariff bands are example of pricing policies that can help upscale the poverty reduction impact

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9 This progression from simple construction of roads, to transport corridors and finally to economic corridors across nations, is itself a good example of upscaling.

10 Notwithstanding the different methodology of the country studies and the evaluation studies, results and findings are broadly consistent, and thus lend greater credibility to findings of both.
of infrastructure investments. In the absence of appropriate policies, there is a risk of resources being hijacked by non-poor and vested interests.

Similarly, affordable transport tariffs can make improved road infrastructure accessible to the poor if a competitive environment is fostered for transport services. Each of the three countries studied has relatively open markets for transport services. This has helped to ensure that the private sector offers a wide variety of service options to meet different needs of the poor, and to keep prices competitive. Conversely, weaknesses in the broader policy framework for economic growth and poverty reduction, as well as governance, geographical, and other limitations, can imply that improved infrastructure impact much less on expansion of economic opportunities for the poor.

**Institutional Setting.** Infrastructure services thrive better in the context of openness and competition that foster a good market environment leading to increased production, trade and growth. The country studies, project evaluation findings and regional cooperation experience emphasize this. Thus, existence of competitive transport environment enabled lower transport prices in the country studies. One of the important driving factors in infrastructure provision in the subregional context as evidenced by the GMS program has been the strong commitment to improved functioning of markets and increased trade and investments for fostering growth.

## Major Lessons for Upscaling Poverty Reduction Through Infrastructure Investment

**Infrastructure for Rapid Development.** If the evidence presented above, is indeed correct then it follows that that millions of rural poor in Asia and the Pacific are being disadvantaged in the absence of even minimum infrastructure in the form of roads and access to electricity. Provision of these basic facilities has to be part of the poverty reduction programs. Without them the progress in achieving MDGs is going to be slow and difficult. More investment in transport and energy is needed. The focus should initially be on achieving universal access. It should then move on to improving service quality for all. It is worth repeating, however, that utmost care is required to ensure that the infrastructure development is properly designed and the supporting policy Service Provision Targeted to Users. Infrastructure can be effective for upscaling poverty reduction if it is supported within a favorable policy and regulatory setting. The cases reviewed above confirm the advantages of encouraging private investment, market competition and market based pricing for services that use public infrastructure. The issue of providing affordable electricity to the poor without overburdening Government budgets with subsidies, however, remains a challenge. Programs to supply the poor with more energy efficient appliances should be considered.

**Policy Framework for Ensuring Benefits to Poor:** Establishing appropriate policies is a key for ensuring benefits for the poor. This includes not only the regulatory arrangements in the transport and energy sectors, but also the various polices and programs that govern other sectors in

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11 While the evidence presented is from mainly rural area where most of Asia’s poor reside, similar studies from urban areas, given urbanization and growing urban poverty may also be revealing.
Design of Appropriate Investment Package. Including complementary activities in the total infrastructure investment package can enhance the scale of the poverty reduction impact. This can be accomplished in many ways. One option is to provide complementary facilities to connect the poor in the same infrastructure project. For example in PRC feeder roads improvements are often included as part of expressway projects. There is also scope for increasing the area of influence of railway projects by improving transport connectivity in the hinterland around railway stations – even by including a feeder road in a railway project. An important lesson is that the overall economic impact of a project and its impact on the poor can be increased by providing interventions that complement each other and increase synergies rather than taking up projects in isolation. It would also be desirable to coordinate transport and energy projects with other poverty reduction programs, such as microcredit and training, which can provide the poor with the missing ingredients they need to take up opportunities created. Effective coordination mechanisms during project implementation would, however, be necessary to prevent problems (similar to the IADP projects of the past) from emerging.

Maintaining Technical Quality and Standards. Lower technical standards in investment projects should be avoided, even if it might be tempting to spread investment budgets more widely. These hurt the sustainability of investments, and result in costly repairs and reconstruction efforts. Unless infrastructure projects are maintained well, they would cease to yield benefits. A key factor in the maintenance is the availability of funds for O&M. Currently in many DMCs, road funds are being created for maintaining the road networks. Similarly, lack of appropriate technology or requisite skills could be a constraint on proper maintenance. Timely and appropriate adjustment of tariffs is also necessary for sustaining infrastructure projects. These measures will increase the operational efficiency of executing agencies and the sustainability of poverty reduction upscaling.

Institutional Changes and Capacity of Infrastructure Agencies. Both in roads and electricity, project evaluation studies have repeatedly stressed the need for further capacity building and institutional strengthening. Despite the implementation of many projects and much training, DMC infrastructure agencies still suffer from weaknesses in planning and implementing projects. Hence this remains an area where much support is required.

Institutional changes appear a special priority in electricity. ADB’s earlier advisory work had limited impact as it mostly tried to improve management and efficiency within state-owned enterprises or agencies through training, improving accounting systems and financial discipline, and getting tariffs right, but not addressing the key need to encourage reforms to bring in competition to provide built-in incentives to prove efficiency and reduce costs. A major sector lesson is that more attention should be given to these broader issues of restructuring utilities that can produce more sustainable results.

Private Sector Involvement. Development agencies are looking more and more to the private sector to finance and develop large infrastructure projects jointly with the public sector. Road development, however, entails substantial construction and traffic risks, which can inhibit private
sector financing. One lesson from ADB projects is to involve the private sector after construction, when the construction risks have passed and the traffic load risks are more or less known. An important aspect is the ability to impose a toll on the use of the road to cover operations, and which can be securitized, if needed, to form part of a debt financing package or to finance further road investments.

**Summary and Conclusions**

Under favorable circumstances, infrastructure projects can significantly assist in upscaling poverty reduction. This conclusion is based on both country studies on infrastructure provision in general, as well as a large body of ADB project evaluation work in the road transport and energy sectors.

Evidence presented above based on the country case studies and the project evaluation studies suggests that road transport and electricity both helped reduce income poverty, with road transport improvements having a stronger impact. Access to roads reduced prices under conditions of competitive transport services provision, increased mobility and reduced labor market imperfections, enabled the poor to find better paying work, allowed production of higher value cash crops and supply of cheaper agricultural inputs. Rural electrification helped stimulate the rural economy and enlarged opportunities of off-farm employment for the poor. Use of TVs led to improved information on crops and contributed to improved farm productivity. Lighting allowed longer work hours. All rural infrastructure projects also contributed directly to employment of the poor. Infrastructure provision was also noted to have generally contributed to increased trade and growth in countries in the regional cooperation context.

The impact on non-income poverty was also found to be significant. Roads reduced travel time and provided better access to basic education and health services. However, they also caused an increase in accidents, requiring better capacity to address road safety matters. Electricity also impacted on non-income poverty. Better lighting increased the time for studies and years of schooling. It increased safety and security and provided better medical services in rural areas.

However, these favorable results do not have universal applicability and occur only with complementary public actions. When up-scaling rural infrastructure provision several considerations have therefore to be kept in mind. Strong poverty reduction outcomes from infrastructure projects can come about only if there is a strong pro-poor policy environment. Location of projects in areas of high poverty concentration, designing complementary interventions to increase the poverty reduction impact of infrastructure projects, creating market conditions for competitive reduction of transport prices, attempting to increase the affordability of electricity prices for rural consumers are all indications of this pro-poor inclination in policy. In the regional cooperation context, the role of complementary agreements to facilitate cross-border trade, for example, illustrate the importance of complementary policy action to increase the impact of infrastructure projects.

No discussion on infrastructure can be complete without addressing issues relating to the sustainability of infrastructure services. If roads deteriorate and electricity services become erratic it affects all users including the poor. Thus much greater attention has to be paid by developing
countries to road maintenance than is being provided now. The sustainability of electricity services requires that the electric companies are financially strong and that tariff policy be depoliticized. Necessary institutional changes and capacity building are also important actions to ensure sustainability.

Finally, the impact of infrastructure on growth and poverty reduction can be considerably increased in situations that call for regional cooperation by freeing the provision of infrastructure from artificial confinements within national boundaries. The GMS case provides good illustration of this and is a worthy model for scaling up.

The poverty reduction impact of infrastructure investments hinges on the way in which they connect to the poor, and if investments are designed to address both the immediate infrastructure requirement, and the imperative of having a infrastructure provision context that ensures that investments pay-off, are sustainable, and are complemented by supportive policies in the sectors for which infrastructure is an input. Learning from past experience, understanding the needs of the poor, understanding the context in which it is to be provided, and designing interventions that tackle both the provision of infrastructure and its enabling context, are central to the role that infrastructure plays in poverty reduction. Operating in a catalytic manner has the potential to facilitate more rapid and broad-based scaling-up since constraints are eased that impede all stakeholders from making progress. It is also a role whose effectiveness hinges very much on the quality of the knowledge-base used to identify those factors that are binding constraints to scaling-up poverty reduction initiatives and to identifying why poverty is or isn’t responding to particular interventions. This requires a deeper knowledge and understanding of poverty conditions and the context for poverty reduction, and explains why enhancing country focus, on the one hand, and knowledge management, capacity, on the other, underpins the search for effective interventions to enhance upscaling potential of poverty reduction.
References


__________. *Paving the Way to Poverty Reduction through Better Roads*: OED’s Assessing Development Impact Study Series No. 3.

__________. *Powering Economic Development and Reducing Poverty with Energy*: OED’s Assessing Development Impact Study Series No. 5.


Appendix I

A Background Note on the Approach and Methodology of the Country Studies under RETA 5947

Approach to Country Studies: Retrospective studies of past transport and energy interventions were conducted in three countries in developing Asia. Choice depended on whether there was a likelihood that transport and energy had contributed to poverty reduction; availability of poverty data; the capacity of domestic research institutes to carry out the research; and having a broad mix of countries. The three countries selected were the People’s Republic of China (PRC), India, and Thailand. In the two larger countries, it was decided to concentrate on a region rather than the whole country: in PRC Shaanxi Province, and in India the state of Gujarat.

Shaanxi Province in PRC has a population of 36 million. Most people are self-employed farmers, although off-farm employment is growing quickly. Like much of PRC, Shaanxi has experienced rapid economic growth and poverty reduction. Using the local poverty line, the rural poverty rate was 17 percent in 2000. In the 1990s its road length increased from 38,000–44,000 km, with the paved proportion rising from 70–80 percent. The length of railway also increased 30 percent. The state of Gujarat in India has a population of 50 million. The economy is diversified with only 17 percent of state domestic product due to the primary sector; and chemicals and industry having a leading role. Gujarat has invested relatively heavily in roads, and since 1995 encouraged the development of private ports. In the last three decades poverty declined from about 50 percent to about 15 percent; although substantial pockets remain with much higher poverty rates. The Thailand study examined selected rural communities in the Northeast and Southern regions, and urban slums in the Northeast and Bangkok. Poverty has already been greatly reduced in Thailand, with rural poverty standing at 20 percent in 2000 and urban poverty at 6 percent. Poverty is concentrated mainly in the rural North and Northeast. Compared with PRC, the road network and electricity coverage is already well developed in many of the areas studied, with only pockets of lower coverage.

Approach and Methodology. The case studies examined poverty reduction impacts at community and household level. Such micro level studies cannot identify the aggregate impacts of the intervention but can provide a detailed picture of what happens to selected communities and households falling within the lens of the study. Where possible the case studies used the double-difference method to try to separate the impacts of the intervention from other influences (with, without, before, and after).

The Shaanxi case studies focused on the impacts of interventions in rural villages in two mountainous prefectures, where there were major highways and railway investments in the past ten years. The villages were in quite isolated areas that still have significant poverty, but they have been experiencing poverty reduction through growth of both farm and off-farm incomes, and have received strong support from state poverty reduction programs. The study premise was that effective use of transport and energy services by the poor is necessary for transport to contribute to poverty reduction. It therefore examined the use of transport services by the poor and non-poor, under different
conditions of transport infrastructure and service availability, and examining the impact on various indicators of their well-being. Household survey data for 1998 and 2001 was used to examine how village transport status affects the poor and non-poor, and then to compare the impacts of selected road and rail investments on the poor and non-poor. Focus groups and participatory assessments were used to clarify the findings.

In Gujarat a household questionnaire and focus groups were conducted in four districts—one that achieved high poverty reduction over the last 15 years (Jamnagar); one where poverty was low throughout the period (Bharuch); one with persistently high poverty (Panchmahal); and one where private ports were developed (and there was also significant poverty reduction) (Kuchchh). Communities were selected where road improvements were completed in 1997/98, distinguishing between those living near the road and those living farther away.

In Thailand, a double-difference approach was used to examine both objective indicators of poverty status and subjective indicators. The survey questionnaire covered socioeconomic information, information on transport, and perceived impacts of transport improvements. Focus groups were used to validate the survey findings.

Each country study began with sector studies, an assessment of contextual factors, and proposals for case study methodology. In each country up to five interventions were selected for preparation of case studies, each one having been completed for about 5-10 years.

*Case Studies:* The transport interventions covered roads, railways, and ports. The energy interventions covered rural and urban electrification. A separate study was also conducted of the impact of complementary investments alongside transport and energy. The case studies in each country are shown in Table 1.

**Table 1. Case Studies by Country**

<table>
<thead>
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<th>Case</th>
<th>People's Republic of China</th>
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<th>Thailand</th>
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</thead>
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<td>X</td>
</tr>
<tr>
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</tr>
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<td>Long distance travel</td>
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<td>X</td>
</tr>
<tr>
<td>Bus/rail stations</td>
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Appendix II

Selected Data From Greater Mekong Sub-region

Table 1. Share of Intraregional Trade to Total Trade (percent)a

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GMS = Greater Mekong Subregion, Lao PDR = Lao People’s Democratic Republic. PPP = purchasing power parity, PRC = People’s Republic of China.

a Ratio of total trade with GMS countries (total trade with entire PRC was used) to total trade with the world.

b Ratio of total trade of the entire PRC with the other GMS countries to total trade of the entire PRC with the world.

c Weighted average based on PPP Gross National Income shares.

Source: International Monetary Fund. Direction of Trade Statistics. Washington DC.
<table>
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<tr>
<th>Country</th>
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<td>4.8</td>
<td>6.2</td>
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--- = not available.


- Weighted average based on PPP gross national income shares.
- Weighted average does not include Yunnan Province, PRC, in 2002 because data are not yet available.

### Table 3. Population Below the National Poverty Line in Urban and Rural Areas (percent)

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<sup>a</sup> 1994 figure.
<sup>b</sup> 1999 figure.
<sup>c</sup> 2000 figure.
<sup>d</sup> 2002 figure.

— = not available.

Lao PDR = Lao People’s Democratic Republic.

Source: Country yearbook and websites; and ASEAN in Figures 2003.