Regional Cooperation and Integration (RCI) through Cross-Border Infrastructure Development in South Asia: Impact on Poverty

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Abstract

This paper examines the poverty reduction potential of regional cooperation in cross-border infrastructure in South Asia and identifies priority areas for intervention. It analyzes the direct links between cross-border infrastructure and poverty such as improved access to markets, health services, and education and the indirect links through an increase in productivity and growth. It also discusses the complementary policies and investments needed to enhance the impact of regional infrastructure on the poor. Using cross-country data, it shows that road density is a significant variable in explaining the variation across countries in life expectancy at birth. Life expectancy is more responsive to road density in landlocked countries. It also finds that road density has a significantly positive impact on access to health services using state level data for India.

REGIONAL COOPERATION AND INTEGRATION THROUGH CROSS-BORDER INFRASTRUCTURE DEVELOPMENT IN SOUTH ASIA: IMPACT ON POVERTY

I. INTRODUCTION

1. The largest concentration of the world's poor, at around 40%, lives in South Asia. Although impressive economic growth in the region in recent years has brought down poverty levels considerably, the number living in poverty remains high, and the current global financial and economic turmoil has slowed growth and threatens to reverse gains. Yet the crisis also provides an opportunity to boost intraregional trade through greater cooperation and integration to compensate for the reduced demand from developed countries. Regional integration can increase the region's capacity to link up with global production networks and participate in the global economy with greater efficiency.

2. Indeed, given very low levels of trade and investment within the region, there is significant untapped potential for cooperation. Despite initiatives for regional economic cooperation and integration under the institutional arrangement of the South Asian Association for Regional Cooperation (SAARC), South Asia's intraregional trade as a share of total trade is the lowest in the world, at less than 2% of gross domestic product (GDP), compared to 40% for East Asia. At the same time, only 7% of all international calls are regional, compared to 71% for East Asia (Ahmed and Ghani 2008). Additionally, there is very little cross-border investment within South Asia, the movement of people across-borders is low due to conflicts and concerns about security, and infrastructure bottlenecks have left the costs of cross-border trade high.

3. Apart from its impact on growth and development through greater integration, cross-border or regional infrastructure, by increasing mutual dependence, could even reduce the likelihood of conflict. Such investments involve coordination and cooperation between two or more countries either through bilateral agreements or through regional institutions such as SAARC.

4. More importantly, for the purposes of this study, the role of cross-border infrastructure investments in reducing poverty in the region has been increasingly recognized and emphasized in recent years (Kuroda 2006, World Bank 2006). The objective here, therefore, is to identify the links between cross-border infrastructural development and poverty reduction. If it is demonstrated that the potential benefits to growth and poverty reduction are large, faster progress can be expected in regional cooperation and integration (RCI), setting aside political differences. The removal of infrastructure bottlenecks reduces costs of trade and makes investment attractive, leading to an increase in productivity and economic growth. The moot question, however, is whether such an increase in growth would be inclusive: What complementary investments and/or policy changes would be required to make cross-border infrastructure investments pro-poor?

5. The rest of the paper is organized as follows. The next section provides an overview of poverty and human development and infrastructure indicators across the South Asian economies. Three infrastructure sectors are considered: transport (road/rail), telecommunications, and power. Section 3 provides a framework for analyzing the poverty impacts of cross-border infrastructure investments. Section 4 reviews the empirical evidence on the impact on poverty and growth of connectivity infrastructure in general and regional infrastructure in particular. Section 5 econometrically estimates the impact of infrastructure on

poverty and its correlates Section 6 discusses complementary policies and investments required for maximizing the impact of infrastructure on the poor. And the last section summarizes findings and presents policy conclusions.

II. POVERTY AND INFRASTRUCTURE IN SOUTH ASIA

A. Overview of Poverty and Human Development

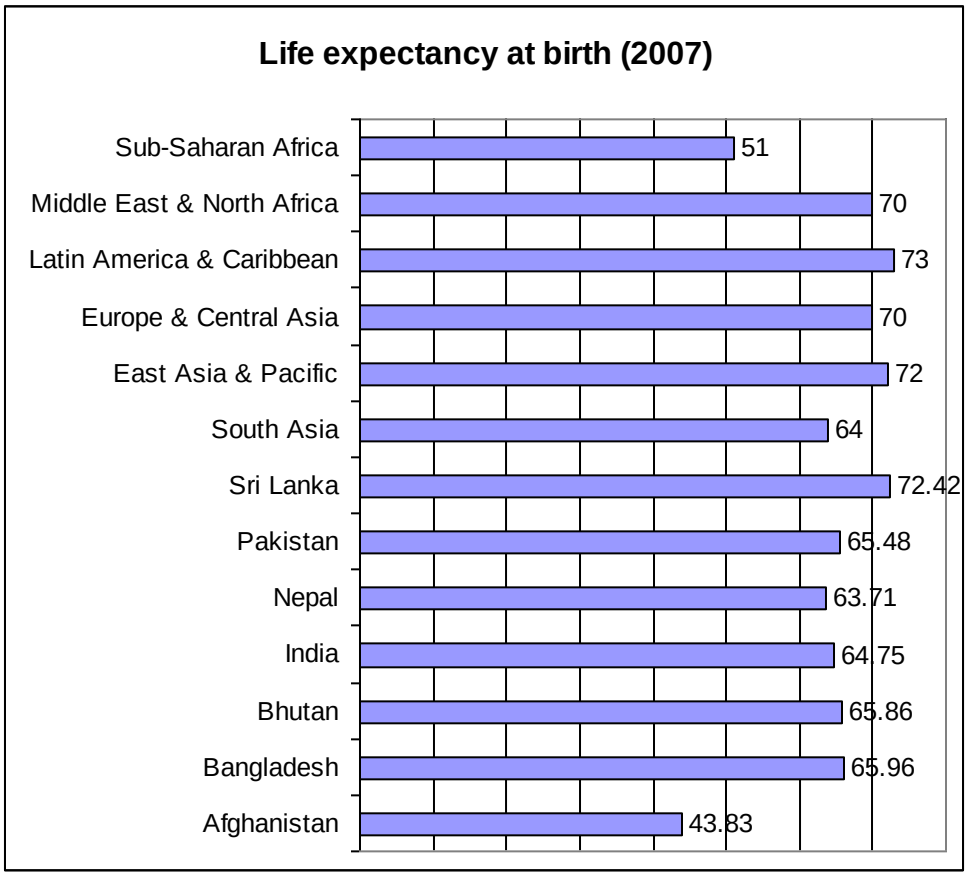
6. South Asia is densely populated, with almost a quarter of the world's population, and more than a third of that is poor. Its socioeconomic indicators are weak, meaning that the quality of life in general is low, with infant mortality and life expectancy at birth among the worst in the world (Table 1). Yet, human development among countries within the region varies significantly: life expectancy at birth is as low as 44 years in Afghanistan and 72 in Sri Lanka, as high as in East Asia and the Pacific (Figure 1). Access to health services also varies: while in Sri Lanka, 98% of births are attended by skilled staff, less than 20% are in Nepal or Bangladesh. The average for South Asia as a whole is 41%, significantly lower than that in the industrial countries (Figure 2). South Asian nations also share common features. Poverty is higher in rural areas than in urban areas and all have high regional imbalances, with varying levels of poverty across regions (states/districts/regions). The poor in rural areas are either landless laborers or small landholders depending on subsistence agriculture and are mostly illiterate and lack the skills required for non-farm employment. The urban poor also have low literacy and are generally unskilled casual workers, living in shantytowns in unhygienic living conditions.

Table 1. Recent socioeconomic indicators

	Population 2007 (millions)	GNI per capita (2007, (US$ PPP)	Life expectancy at birth (2007, (years)	Births attended by skilled staff (2007, % of total)	Primary completion rate (2007, % of relevant age)	Under-5 mortality rate (2007, per 1,000)	Poverty 2005 (% living on less than $1.25 a day)	Poverty (2005, % living on less than $2 a day)
Bangladesh	159	1,330	66	18	NA	61	26.23	49.49
India	1,125	2,740	65	46.6	86	NA	41.64	75.6
Nepal	28	1,060	64	18.7	78	55	55.12	77.55
Pakistan	162	2,540	65	38.8	62	NA	22.59	60.27
Sri Lanka	20	4,200	72	98.5	106	20	13.95	39.71
South Asia	1,522	2,532	64	41.51	80	78	40.34	73.91
East Asia and Pacific	1,912	4,969	72	88.55	98	27	16.78	38.64
Europe and Central Asia	446	11,262	70	94.8	98	23	3.8	9.2
Latin America and Caribbean	561	9,678	73	88.51	100	26	8.22	17.12
Middle East and North Africa	313	7,402	70	80.76	90	38	3.6	16.85
Sub-Saharan Africa	800	1,870	51	45.31	60	146	50.91	72.85

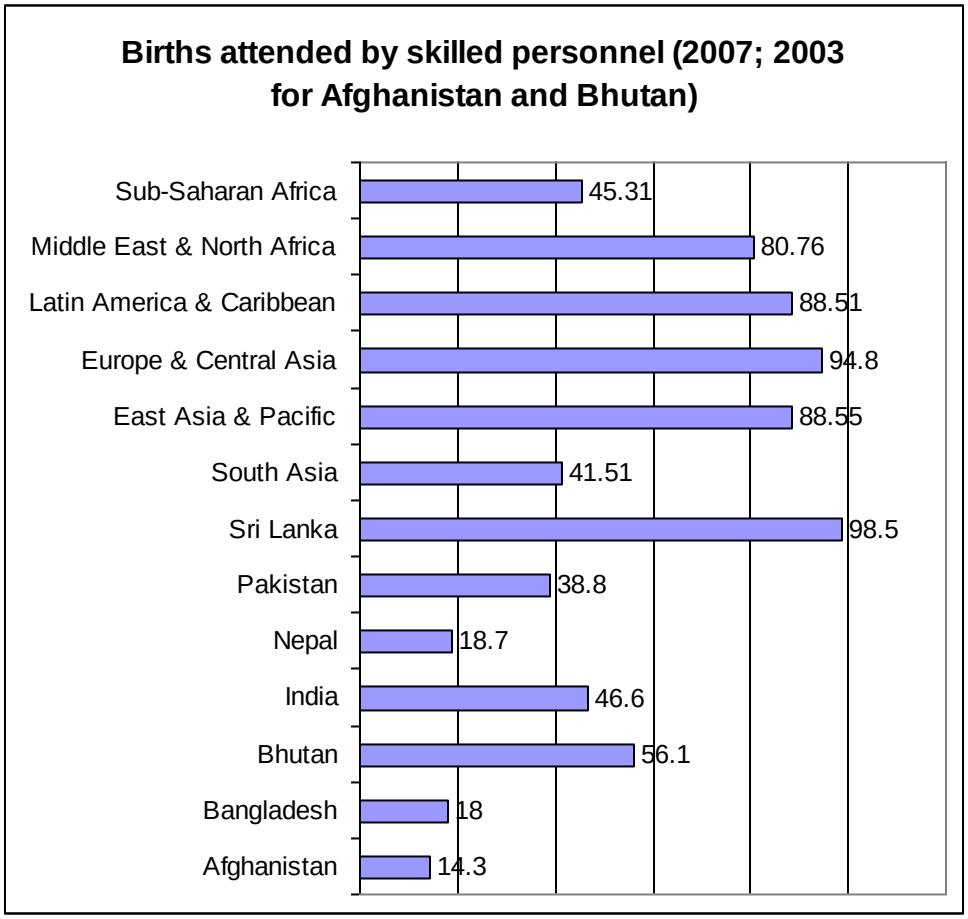
Note: Sri Lanka poverty data are 2002 and Nepal 2004
GNI = gross national income; NA = not available ; PPP = purchasing power parity
Source: World Development Indicators

Figure 1. Life expectancy at birth—2007



Source: World Bank, World Development Indicators.

Figure 2. Births attended by skilled staff (2007, 2003 for Afghanistan and Bhutan)



Source: World Bank, World Development Indicators.

B. Cross-Border Infrastructure as Part of Poverty Reduction Strategy

7. Infrastructure development is a key element of poverty reduction strategies in most South Asian economies.

8. Bangladesh's poverty reduction strategy paper PRSP, for example, emphasizes the importance of infrastructure development in all three areas mentioned above—transport, information and communication technology (ICT) and electricity—for faster poverty reduction. In particular, it mentions the "development of strategic national and regional road transport corridors, including the Dhaka-Chittagong corridor, construction of the Padma Bridge to link eastern and south-western parts of Bangladesh, an effective and sustainable strategy of road maintenance, development of the full potentials of the Chittagong Port as a national and regional gateway, and, formulation of a long-term strategy to develop inland water transportation."

9. Bhutan's Ninth Plan emphasizes the expansion of the road network (particularly feeder roads to improve rural access), provision of electricity and telecommunications to rural households, and urban infrastructure. Bhutan became a signatory to the BIMST-EC

(Bangladesh, India, Myanmar, Sri Lanka, Thailand-Economic Cooperation) Free Trade Area which would enable it to diversify its export markets and link transport infrastructure. It also signed the Framework Agreement on South Asia Free Trade Area (SAFTA), which is expected to open up new markets for its products.

10. In Maldives, one of the twelve goals set up in its seventh national development plan emphasizes the development of infrastructure to ease the movement to all its inhabited islands and reduce travel time to the airport, and provide access to electricity and high speed internet to all its households.

11. The Nepal PRSP emphasizes rural roads to link potential agricultural production pockets with markets and rural electrification for harnessing groundwater for irrigation. An agreement was signed with the People's Republic of China (PRC) for customs free export of Nepalese goods to the PRC in 2006. Moreover, preliminary work is underway to make Nepal a transit point between India and the PRC.

12. In India, the incidence of poverty across its states is closely linked to levels of economic and social infrastructure. On the Eleventh Finance Commission's index of infrastructure, which includes economic, social, and administrative infrastructure,[1] Indian states with a high value have low incidence of poverty. The Government of India, in recognition of infrastructure's role in poverty reduction took up a massive program for the construction of rural infrastructure under Bharat Nirman, an ambitious program to provide basic infrastructure to every rural habitation in the country.

13. The Pakistan PRSP recognizes the supportive role of infrastructure in accelerating growth, employment generation, and poverty reduction and considers infrastructure development critical to better integration of its provinces and regions. It also notes the importance of the maintenance of roads and railways and a greater role for the private sector in developing power and ICT infrastructure.

14. There is, however, except in landlocked Nepal and Bhutan, no explicit reference to regional cooperation initiatives or cross-border infrastructure in the PRSPs.

C. Infrastructure Deficits in South Asia

15. Investment in infrastructure is low in South Asia, 3.5%–4% of GDP per year in comparison to Viet Nam and the PRC's 8%–10%, based on data from 2000 to 2005 (Ahmed and Ghani 2008). The quantity of infrastructure facilities in South Asia is too low in comparison to every region except Sub-Saharan Africa (Table 2).

[1] Eight major sectors: (i) agriculture, (ii) banking, (iii) electricity, (iv) transport, (v) communication, (vi) education, (vii) health, and (viii) civil administration were considered in constructing the infrastructure index.

Table 2. Infrastructure facilities in South Asia

	Electric power consumption (per capita kWh, 2006)	Landline and mobile phone subscribers (per 100 people, 2008)	Internet users (per 100 people, 2007)	Paved roads (%, 2000–06)
Bangladesh	146.43	28.74	0.32	9.5
Bhutan	665	40.55	5.92	62
India	502.76	33.75	7.2	47.4
Nepal	79.74	14.12	1.41	56.8
Pakistan	480.09	55.67	10.77	65
Sri Lanka	400.08	72.08	3.86	81
South Asia	453.34	26.07	6.63	56.9
East Asia and Pacific	1,665.46	65.89	15.13	
Europe and Central Asia	3,845.32	120	23.44	
Latin America and Caribbean	1,812.28	85.48	26.57	
Middle East and North Africa	1,394.47	66.45	13.44	
Sub-Saharan Africa	534	24.62	3.85	

Source: World Bank, World Development Indicators

i. Transport infrastructure

16. Road density (road length per unit land area) also varies considerably in South Asia. It is highest in Bangladesh—although only 30% of its roads are paved and more than 60% of its rural population lacks access to all-season roads—and lowest in Bhutan and Nepal (Table 3).

Table 3. Transport infrastructure in South Asia

	Road density: km/1000 sq km	Rail track density	National highway density	Paved roads (%)	Access to all-season roads (% of rural population)
Bangladesh (2007)	2,079	21.78	159.33	30.0	39
Bhutan	93	0.00	43.14	56.0	47
India	1,115	20.08	211.32	47.3	61
Nepal	121	0.41	71.01	31.0	43
Pakistan (2007)	335	10.05	13.57	63.0	85
Sri Lanka	1,422	25.37	421.59	81.0	65

Source: World Bank

17. India has the world's second longest road network, at over 3.5 million kilometers (km), while its national highway network is around 70,000 km long. But road quality leaves much to be desired. More than half of its roads are not paved and most highways have just two lanes, while only 60% of the rural population has access to all weather roads. Poor road quality increases transport costs—through delay and wear-and-tear on vehicles—with adverse implications for domestic and international trade. High transport costs act as a non-tariff barrier on trade and in many cases transport costs as a percentage of import value are much higher than applied tariff

rates (Table 4). Trade transportation costs as a percentage of import value are highest for landlocked Nepal.

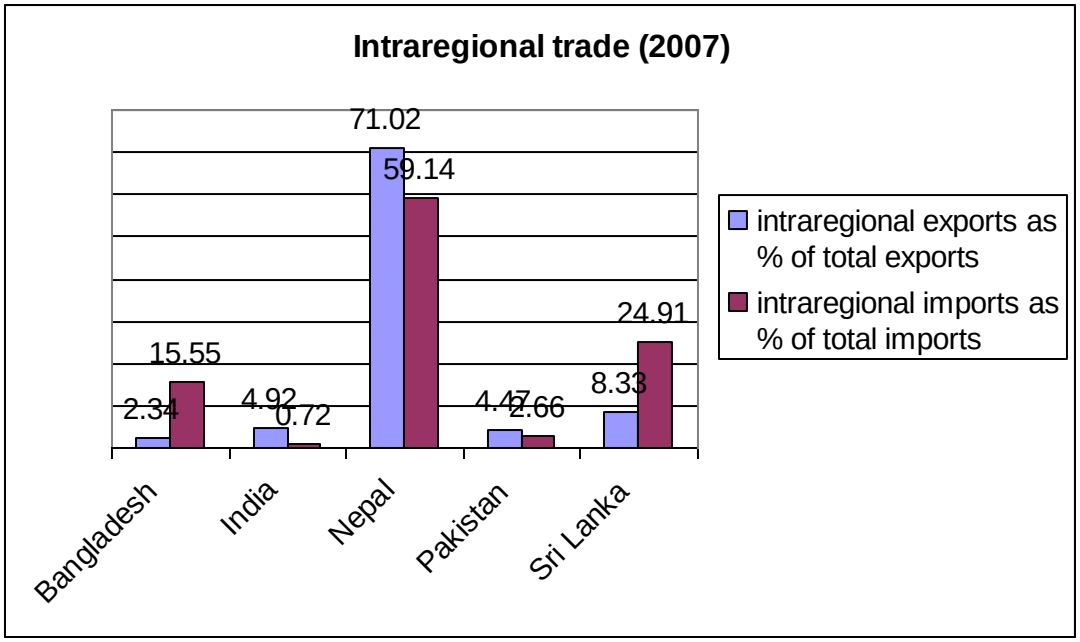
Table 4. Transport costs in comparison to applied tariff rates (2005)

Importer	Exporter	Total transport costs (% of import value)	Applied tariff-weighted average (%)
Bangladesh	India	30.5	39.54
	Nepal	6.2	4.46
	Pakistan	17.4	15.64
	Sri Lanka	20.7	18.56
	Average	14.3	
India	Bangladesh	29.4	15.87
	Nepal	48.2	22.66
	Pakistan	45	24.35
	Sri Lanka	11.9	23.29
	Average	15.79	
Nepal	Bangladesh	81.9	9.05
	India	63.1	14.7
	Pakistan	24.1	10.4
	Sri Lanka	18.8	15.43
	Average	41.53	
Pakistan	Bangladesh	21.1	6.58
	India	53.6	7.91
	Nepal	16.6	6.83
	Sri Lanka	15.6	6.58
	Average	13.29	
Sri Lanka	Bangladesh	13.2	6.81
	India	5	9.2
	Nepal	12	11.72
	Pakistan	5.9	3.76
	Average	3	

Source: De (2009)

18. High transport costs are part of the reason for low intraregional trade in South Asian countries (Figure 3), with the exception of Nepal, which as a landlocked country has a high percentage of intraregional trade.

Figure 3. Intraregional trade as percent of total



Data Source: De (2009)

19. The importance of roads/rail can be seen from the large fraction of merchandise trade within South Asia that is carried over land. India is the largest exporter, contributing to more than 70% of intraregional exports, with more than 60% of its exports to South Asia carried by road and 13% by rail, not surprisingly given that it shares common boundaries with most nations in the region (De 2009). Yet, the World Bank Doing Business database shows that the cost of trade in South Asia is only a little better than Sub-Saharan Africa and much worse than the high-income countries (Table 5). Time taken for exports and imports is particularly high, almost as long as in the Sub-Saharan African countries, in large part due to delays at land-border crossings. A significant portion of trade between some South Asian nations, as a result, has been taken over by informal channels to avoid the complexities and increased scope for corruption of official cross-border trading procedures.

Table 5. Costs of trading across borders

Region or economy	Documents to export (number)	Time to export (days)	Cost to export (US$ per container	Documents to import (number)	Time to import (days)	Cost to import ($ per container)
East Asia and Pacific	6.7	23.1	909.3	7.1	24.3	952.8
Eastern Europe and Central Asia	6.5	26.8	1,581.80	7.8	28.4	1,773.50
Latin America and Caribbean	6.8	18.6	1,243.60	7.3	20.9	1,481.00
Middle East and North Africa	6.4	22.5	1,034.80	7.4	25.9	1,221.70
OECD	4.3	10.5	1,089.70	4.9	11	1,145.90
South Asia	8.5	32.4	1,364.10	9	32.2	1,509.10
Sub-Saharan Africa	7.8	33.6	1,941.80	8.8	39.4	2,365.40
Afghanistan	12	74	3,350	11	77	3,000
Bangladesh	6	25	970	8	29	1,375
Bhutan	8	38	1,210	11	38	2,140
India	8	17	945	9	20	960
Maldives	8	21	1,348	9	20	1,348
Nepal	9	41	1,764	10	35	1,825
Pakistan	9	22	611	8	18	680
Sri Lanka	8	21	715	6	20	745

Note: The time and cost for ocean transport are not included. Cost measures the fees levied on a 20-foot container in US dollars. All fees associated with completing the procedures to export or import the goods are included. These include costs for documents, administrative fees for customs clearance and technical control, customs broker fees, terminal handling charges, and inland transport. The cost measure does not include tariffs or trade taxes. Only official costs are recorded.
Source: World Bank, *Doing Business Report 2010*.

20. SRMTS (2006) identifies several barriers to free trade, including a lack of bilateral or multilateral agreements to facilitate uninterrupted movement of goods and vehicles across the borders; lack of coordination for gauge conversion programs on different railway systems; lack of warehousing and customs clearance facilities at several border posts, in addition to a lack of transparent customs procedures. Tapping intraregional trade potential therefore requires dealing with these issues on a priority basis, apart from providing reasonable cross-border transport connections that integrate the transport networks of different countries.

21. The effectiveness of border logistics can be seen from the Logistics Performance Index (LPI) launched by the World Bank International Trade and Transport Department. The LPI takes into account various aspects of trade facilitation, giving scores ranging from 1 to 5. South Asian countries score poorly compared to other regions, with the exception of India with a LPI score of 3.07, which is close to the PRC but significantly below Japan or Singapore (Table 6).

Table 6. Trade infrastructure in South Asia

Country	LPI	Customs	Infrastructure	International shipments	Logistics competence	Tracking and tracing	Domestic logistics	Timeliness
Afghanistan	1.21	1.3	1.1	1.22	1.25	1.0	3.13	1.38
Bangladesh	2.47	2.0	2.29	2.46	2.33	2.46	3.08	3.33
Bhutan	2.16	1.95	1.95	2.06	2.18	2.27	3.36	2.57
India	3.07	2.69	2.9	3.08	3.27	3.03	3.08	3.47
Nepal	2.14	1.83	1.77	2.09	2.08	2.33	3.25	2.75
Pakistan	2.62	2.41	2.37	2.72	2.71	2.57	2.86	2.93
Sri Lanka	2.4	2.25	2.13	2.31	2.45	2.58	3.08	2.69
PRC	3.32	2.99	3.2	3.31	3.4	3.37	2.97	3.68
Singapore	4.19	3.9	4.27	4.04	4.21	4.25	2.7	4.53
Japan	4.02	3.79	4.11	3.77	4.12	4.08	2.02	4.34
United States	3.84	3.52	4.07	3.58	3.85	4.01	2.2	4.11

PRC = People's Republic of China
Source: LPI Report, World Bank (2009)

22. Countries in the region are interdependent and require connectivity infrastructure to obtain market access and exploit natural resource endowments. Table 5 shows that the cost of imports for landlocked Bhutan and Nepal is much higher than for others in the region, almost 3 times and 2.5 times respectively compared to that of Pakistan. Improving cooperation with neighboring coastal countries is the only way to decrease transport costs. There can be mutual gain if transit facilities are provided by charging a reasonable price not just for trade in goods by roads or rail, but also for oil and gas pipelines. As the realization grows that the potential gains for trade and investment can be high, there will be greater willingness among countries to cooperate and coordinate in building cross-border infrastructure.

23. The potential benefits from regional cooperation are big. The importance of cross-border road/rail links cannot be over emphasized considering that the alternative modes of trade could be both time consuming and expensive. Large cost savings are possible, for example, in transporting goods to and from India's northeastern states to the rest of India by transiting through Bangladesh instead of going around the northern end of Bangladesh through a narrow congested corridor referred to as the "Chicken's Neck".[2] India's foreign trade with Nepal and Bhutan also goes through this corridor, increasing the costs of transport and causing delays. Similarly, there are cost disadvantages due to a restriction on the movement of Nepalese trucks on dedicated routes within India (see Box 1 for more examples). Such lack of cooperation among countries not only increases costs but also gives rise to an unofficial flow of goods (informal trade) as the borders between the countries are often porous. The potential for trade can be gauged by the fact that despite hostile relationships between Pakistan and India there is significant informal trade between the two countries through circuitous routes via Dubai, Iran, and Afghanistan (SATIN 2008).

24. Currently, while India permits Bangladesh to use land routes to Nepal, the latter is not allowed to trade with a third country via Bangladesh. After the introduction of SAFTA, it is expected that India may consider granting transit routes to Bangladesh via West Bengal to markets in Nepal and Bhutan, in return for a transit route that facilitates movement of goods

[2] See Subramanian and Arnold (2001).

from West Bengal to India's northeastern states, and even Myanmar, passing through Bangladesh. South Asia could follow the successful example of the Greater Mekong Subregion (GMS) Cross-Border Transport Agreement and have a regional transport and transit agreement facilitating uninterrupted movement of goods, vehicles, and passengers.

Box 1. Examples of Inefficiencies Due to Inadequate Regional Agreements

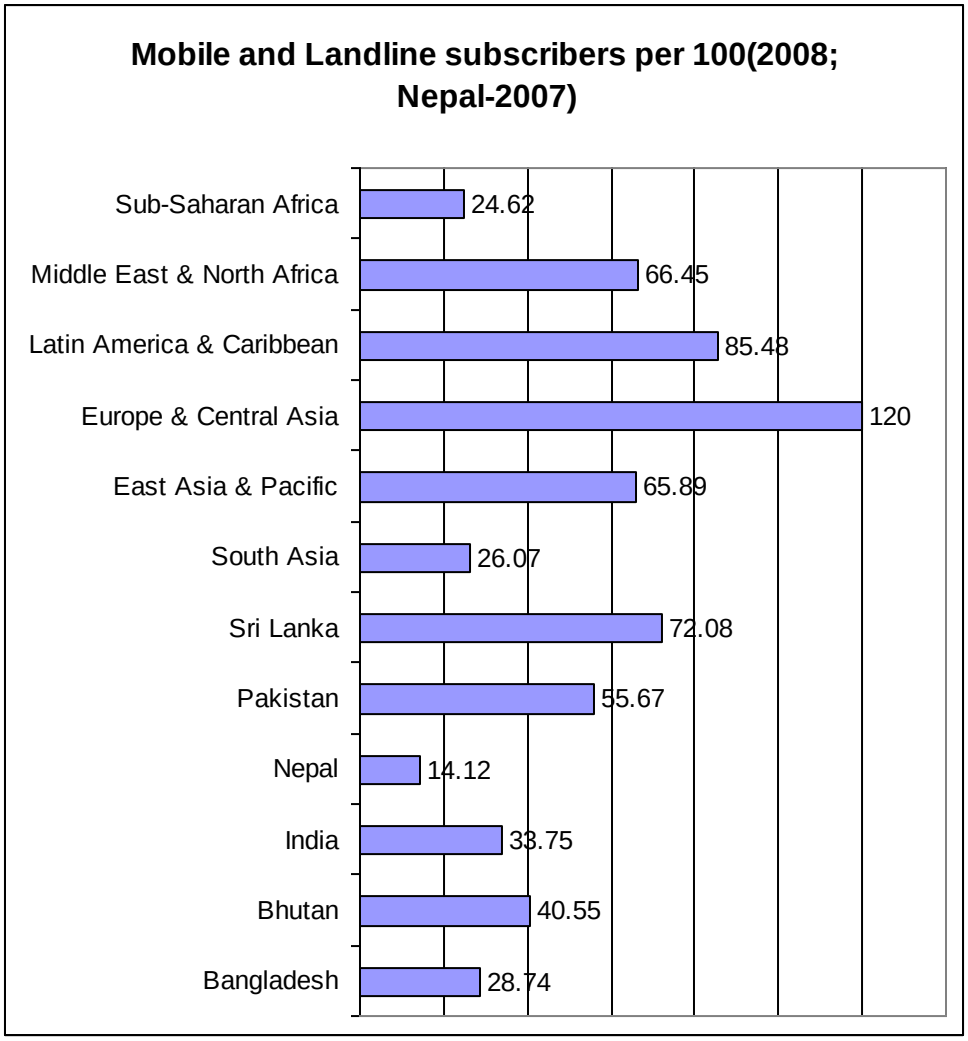
- A container shipped from Delhi to Dhaka moves from Delhi to Tuglakabad, then to Mumbai port and then via Singapore to Chittagong port, from where it is moved to Dhaka, taking 45 days. It is estimated that the distance of 2,000 kilometers between Delhi and Dhaka could be covered by rail in 2–3 days.
- A truck taking tea from Assam (in northeastern India) to Europe (Liverpool, United Kingdom) goes from Assam to the Port of Kolkata over a distance of 1,400 km by going around Bangladesh, from where it is shipped via Singapore to the European port. Going from Assam to Chittagong port in Bangladesh would cut the distance by almost 60%, though shipping to Europe would still be via Singapore.
- Woolen carpets from Kathmandu to Europe are shipped from Kathmandu to Kolkata port from where they are shipped via Singapore to a European port. Alternatively, if transit is allowed via Mumbai port they can be shipped directly to the European port, resulting in savings in logistics costs and time.
- The export of perishables (fruit and fruit-based products) from Nepal and Bhutan to Dhaka involves clearing four customs points at two border crossings and transferring the cargo between trucks because foreign trucks are not allowed into Bangladesh. Although the time and cost of transfer is a small part of the total transport and logistics costs, the damage to cargo can be significant. Allowing trucks to carry cargo the whole way to Dhaka would reduce these inefficiencies.
- Movement of goods by rail and road between Pakistan and India is restricted to the Wagah border, with only a limited number of items allowed to be traded (e.g. cement to India from Pakistan and vegetables and livestock from India). As per quarantine rules, Pakistan does not allow the import of cotton by rail and the textile mills located around Lahore import cotton from Mumbai via Karachi. Exporters from Kolkata are forced to ship to Karachi via Singapore as they are unable to book rail wagons due to inadequate capacity.

Sources: Subramanian and Arnold (2001) and Taneja (2007).

ii. Communication infrastructure

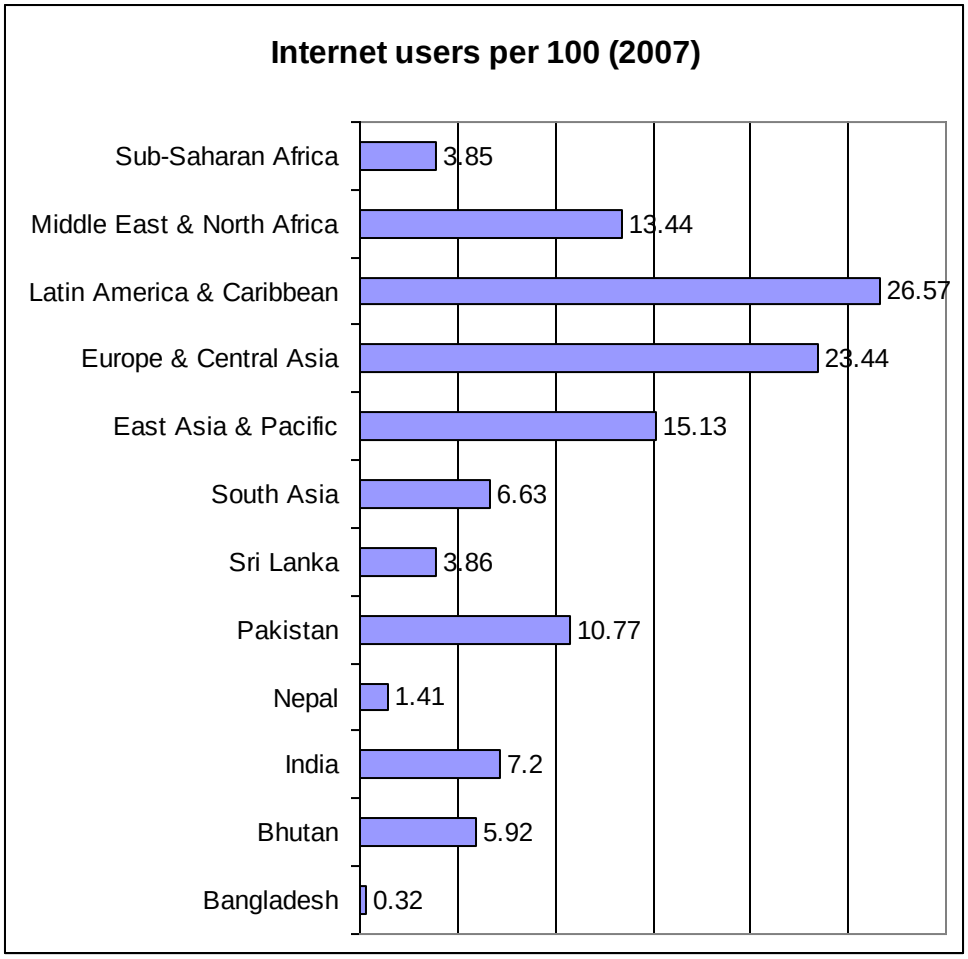
25. Telephone density in South Asia is quite low, 26% compared to 66% in East Asia and the Pacific and 85% in Latin America and the Caribbean (Figure 4). Internet usage has increased dramatically all over the world in recent years and the trend is likely to continue. Yet access to the internet varies a great deal across South Asia, and the percentage without internet access is still quite high (Figure 5).

Figure 4. Communications infrastructure in South Asia



Source: World Bank, World Development Indicators.

Figure 5. Internet access in South Asia



Source: World Bank, World Development Indicators.

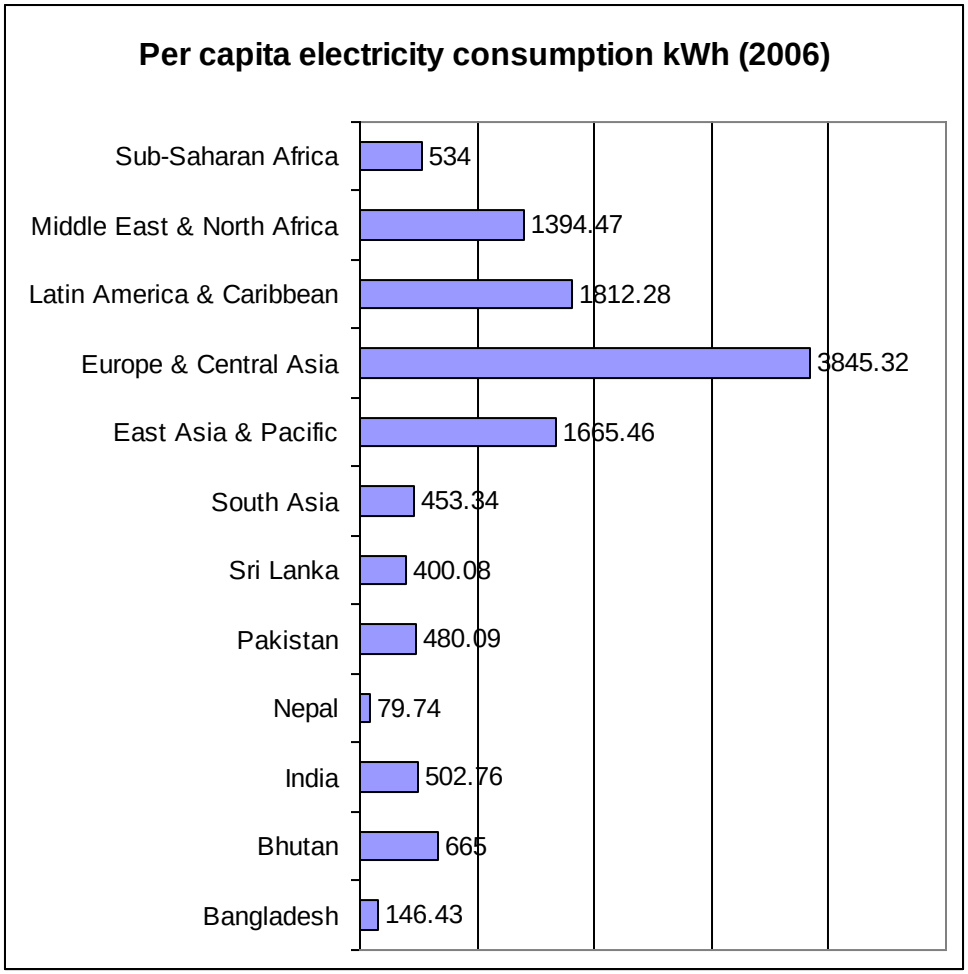
26. Telecommunications and internet infrastructure can be developed to promote trade in services which would help improve education, innovation, and health (tele-medicine) and the flow of ideas, technology, and investment.

iii. Power

27. Electricity, of course, is critical to the socioeconomic development of any country. The availability of reliable and quality power at competitive rates is imperative for a competitive industry. It is also a critical input to other infrastructure services such as internet and telecommunications. Power consumption varies widely across South Asia, however, with the region as a whole consuming less than 500 kWh per person compared to the consumption of more than 1,600 kWh per person in East Asia and the Pacific (Figure 6). Out of 1.6 billion people without electricity in the world, South Asia hosts 706 million, Sub-Saharan Africa 547 million, and East Asia 224 million.[3]

[3] Please see http://www.globalissues.org/article/26/poverty-facts-and-stats

Figure 6. Regional variations in electricity consumption per capita



Source: World Bank, World Development Indicators.

28. Bhutan and Nepal have hydropower resources far in excess of their requirements, indicating the vast potential for interregional trade in electricity (Table 7). However, the percent of the population with access to electricity is only around 40% in these countries, compared to 73% in Sri Lanka and 55%–60% in India and Pakistan. Although installed capacity in all the countries in the table exceeds the corresponding peak demand, power shortages occur due to "forced outages" (unforeseen events in power plants forcing a halt in power generation) and non-availability of fuel (gas/oil), resulting in low plant load factors.

Table 7. Electricity: Demand, supply and access

	Total installed generating capacity (MW) (hydro in parentheses)	Peak demand (MW)	Access to electricity (% of population)
Afghanistan	475 (261)	363	26
Bangladesh	4,120 (218)	3,592 (2005)	38
Bhutan	481 (469)	105 (2003)	40
India	124,287 (32300)	93,255 (2006)	55.8
Nepal	684 (627)	557 (2005)	40
Pakistan	19,505 (6500)	14,091 (2005)	55-60
Sri Lanka	2,426 (1247)	1,516 (2003)	73.4
South Asia	151,978	113,479	
World			

Source: World Bank (2008), Table 2.2; World Development Indicators

29. The limited addition of new power producing capacity, coupled with rising demand for electricity implies a severe power shortage across India. As per Census 2001, about 44% of households do not have access to electricity. In India, Pakistan, Bangladesh, and Sri Lanka energy demand growth is far outstripping domestic supply, and all of them currently face electricity shortages (SRETS, 2008). Coal, oil, natural gas and hydel power are the main energy sources used in electricity generation. Power generation is primarily thermal-based in Bangladesh, India, and Pakistan, and hydro-based in Bhutan, Nepal, and Sri Lanka. The region as a whole is deficient in energy fuels and imports large quantities of crude oil and petroleum products. Both India and Bangladesh have excess demand for natural gas. Although Pakistan currently has excess supply of natural gas this is unlikely in the future as its energy requirements grow (SRETS 2008). Thus it appears that the potential for inter-regional trade is greater than intraregional trade as countries neighboring the region (Iran, and Myanmar and in Central Asia) have large reserves of oil, natural gas, and coal. But realizing the potential for trade in energy requires infrastructure to transfer energy: electricity transmission lines, pipelines for natural gas, crude oil and petroleum products calling for substantial financial investment and regional cooperation. There are also intraregional trade opportunities in energy due to the seasonal variations in demand and supply. For example, electricity demand in India and Bangladesh is lower in winters, when it is higher in Bhutan and Nepal due to greater heating requirements, providing scope for trade.

30. South Asia has traditionally displayed minimal cross-border trade in energy sources such as electricity and natural gas. While the region has a good resource base and remarkable scope for energy cooperation, most current cooperation is in the form of bilateral arrangements between countries (Srivastava and Misra 2007). However, common economic interests in energy are now gaining ground for the diversification of an affordable and reliable energy supply. The Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC)—the first formal link between South Asia and South East Asia—identified energy as a key area for cooperation at its first summit level meeting, held in July 2004 to bring together India's Look East Policy and Thailand's Look West Policy (Roy 2005). In particular, Roy (2005) emphasizes the need for forging ties under BIMSTEC to address the issues of hydroelectricity and natural gas supply from Nepal and Bangladesh.

31. The cross-border electricity trade between Bhutan and India is an ideal example of cross-border investment producing win-win situations. The India-Bhutan partnership in hydropower started with the 336 mw hydroelectric plant at Chukha financed by India through grants and loans. About 70% of power generated by this project is exported to India. India also financed the 1020 mw Tala hydroelectric project, the biggest cross-border power project in South Asia; all of the electricity it produces is exported to India. Similar potential exists for developing hydropower resources in Afghanistan and Nepal, which have water resources to generate electricity.

32. Despite Bhutan's net power surplus, only around 40% of the population had access to electricity as of 2007. This highlights the role of complementary investments required to achieve poverty goals through cross-border investments.

33. The above discussion identified the potential for cross-border infrastructure to reduce trade costs and encourage trade in electricity. As a public good, building cross-border infrastructure networks requires formal frameworks for regional cooperation, but such cooperation can be expected if economic incentives and commercial interests are in place. The benefits of such investment may, in turn, foster greater RCI. As poverty reduction is a key policy goal among all South Asian nations, it is of particular interest to analyze the impact of these investments on the poor.

III. LINKING CROSS-BORDER INFRASTRUCTURE TO POVERTY REDUCTION

34. Cross-border or regional infrastructure can be defined as infrastructure that connects two or more countries (through rail/road, electricity transmission, or high-speed communication links) involving cooperation and coordination between the governments. It could also include national infrastructure projects with significant cross-border effects. For example, air and sea ports in one country help in the movement of people and goods, the benefits spilling over to trading partners.

35. The link between cross-border infrastructure and poverty is complex—the direct impacts are mostly greater trade, investment and migration, while the impacts on poverty are mostly indirect.

A. Direct Links to Poverty

36. What are the direct benefits to the poor from cross-border infrastructure? The development of regional infrastructure increases opportunities for income-generating economic activities for local people. The extent of the benefits to the poor depends on the cross-border livelihood interaction at the local level. Direct links to poverty include, for example, creation of employment in the construction of infrastructural facilities during project implementation and, later, in the operation and maintenance of such investments. From infrastructural services, poor households can gain better access to markets for their produce and to electricity and telecommunications at lower costs (Figure 7).

i. Transport infrastructure and poverty

37. Road infrastructure can reduce transport costs and make remote areas more accessible through transit routes in neighboring countries,[4] while new roads bring new economic activities, helping development to spread. A rural road, if complemented by other investments, can boost agricultural productivity and employment and therefore rural income. And transport corridors can reduce poverty by opening up development opportunities, especially if feeder roads are developed. By contrast, a lack of adequate access to transport facilities implies high transport costs, limited market access for agricultural produce, and losses due to spoilage, resulting in low incomes. Inadequate road connections and communication facilities imply poor agricultural extension services and low awareness of modern cropping practices and technology, resulting in low agricultural productivity (Moon and Roehrl 2005).

38. The direct impacts of cross-border transport infrastructure on poverty include a reduction in the prices of goods the poor consume and higher prices for goods they produce.[5] Better infrastructure reduces transport costs not only by reducing travel time, thus easing access to markets, but also through greater fuel economy and lower tire and truck maintenance. The impact on poverty thus depends on the type of trade encouraged, that is, whether it includes goods that form a large share in poor consumers' budgets (food) or that are labor-intensive, generating employment. For example, cross-border trade in staple foods with neighboring countries involves least-cost transportation, lowering food costs for the importing country and raising farm-gate prices for the exporting country. This would reduce government expenses on price support for surplus food producing countries, such as India.

39. Cross-border infrastructure also facilitates labor migration, which reduces unemployment and increase wages, lowering poverty. In general, the poor benefit due to an increase in the value of the assets they own and higher wages as labor demand rises. There are also direct benefits to the poor in the form of employment at project sites and through the provision of services such as public transportation once projects are completed.

40. Poverty reduction is enhanced by complementary infrastructure that addresses the constraints the poor face in benefiting from the new opportunities thrown open by expanding regional and global markets. For example, the poor could benefit if cross-border road infrastructure is complemented by constructing feeder roads and providing public transportation services. Rural roads help rural households access nearby markets for a greater variety of goods and facilitate access to schools and health facilities. That said, as connectivity improves to regional markets in neighboring countries industries do tend to cluster in border areas, increasing provincial level inequality. Complementary connectivity infrastructure may therefore be needed to connect interior provinces to the border. Regional imbalances are created as leading or high-growth regions exploit geography (e.g. coastal, urban areas connected to domestic and external markets) whereas lagging or low-income regions lack adequate infrastructure and are not well integrated with national, regional, or global markets (WDR 2009). Physical infrastructure that improves the mobility of goods, factors, and ideas can ensure that inequality among individuals does not increase even when spatial inequality rises.

[4] There can also be negative impacts: displacement of households from project sites, routes becoming conduits for communicable diseases, and trafficking of drugs and people. The poor can also be hurt by reduced accessibility due to displacement of non-motorized vehicles and higher pedestrian fatalities. However, the positive benefits are likely to far outweigh the negative and extend beyond project areas to the broader economy.

[5] The caveat here is of course that unless there is competition in the provision of transport services, the reduction in transport costs due to better infrastructure may not be passed on to consumers. Deregulation of the transport industry would be necessary for increased competition.

41. Appropriate intervention is also needed to deal with possible negative consequences, such as the spread of communicable diseases (e.g. HIV/AIDS) and trafficking in drugs and people.

42. Poverty is a multidimensional phenomenon covering not just lack of income to satisfy basic needs, but also lack of education and skill, and inadequate access to health services, and water and sanitation, among other things. Reliable transport and communication services are known to be the key reason that maternal mortality rates have fallen in many countries. Poor children's (mainly girls) school attendance—particularly in secondary education—is highly dependent on affordable transport services, with manageable distances and times from their homes (OECD 2006). The United Kingdom's Department for International Development (DFID 2002), for example, discusses how each of the millennium development goals (MDGs) would be influenced by transport infrastructure (Box 2).

Box 2. Transport Infrastructure and the Millennium Development Goals

Goal 1 (Eradicate extreme poverty and hunger):
Transport infrastructure provides access to markets for farmers and small-scale artisans, thereby increasing economic access to food for those who do not produce food themselves. Food security depends on households' ability to earn income by selling their labor or the non-food products they produce. The transport sector itself can be a source of employment (e.g. operating motorized and non-motorized three-wheeler rickshaws in most of South Asia). Transport infrastructure projects themselves can be effective measures for anti-poverty programs, as in the case of public works programs (e.g. the EGS in India).

Goal 2 (Achieve universal primary education):
Remote areas cannot attract teachers because of poor infrastructure facilities. Distant schools reached only after long walks or located beyond walking distance are a major cause of school drop-outs.

Goal 3 (Gender equality and empowerment of women):
Transport intervention can reduce the time women spend on domestic chores such as fetching water and firewood, the time saved used productively in cultivating fields or in girls' education.

Goal 4 (reduce child mortality); Goal 5 (improve maternal health):
A large percentage of the poor lives far from health facilities, meaning access to health facilities can be improved through road infrastructure and affordable transport services (e.g. ambulances).

Goal 6 (combat HIV/AIDS, malaria, and other diseases):
Transport facilities can help in the timely delivery of immunization and other disease control programs (such as the safe and timely delivery of vaccines under a marketing cold chain).

Goal 7 (ensure environmental sustainability):
Construction of roads can harm the environment, for example, in the need to clear virgin forest, displace people, and affecting the livelihoods of poor. Congestion, and air and noise pollution are other problems that the poor are relatively ill equipped to cope with.

Source: DFID (2002)

ii. Access to electricity and poverty

43. Access to electricity can improve the quality of life in general through better quality local and regional health and education services. Mani et al. (2009), for example, find that the provision of electricity is positively associated with schooling outcomes in rural Ethiopia. Affordable access to electricity also helps households shift away from kerosene for lighting. Without access to modern energy sources, the poor, especially in rural areas, depend on biomass (fuel wood, charcoal, and animal dung) to meet cooking and heating needs. Access to electricity and clean fuels helps avoid the severe health and environmental problems associated with the use of such inefficient traditional sources which, burned indoors, cause chronic respiratory problems, lung cancer, pneumonia, and other health complications.

44. Access to reliable electricity is a key aspect of poverty reduction, particularly for women, for whom it eases the daily chores. Poor women in South Asia generally shoulder the responsibility for securing household energy supplies, for example, while evidence from Bangladesh indicates that women's socioeconomic status improves with rural electrification. Indeed, the poor in electrified households were found to be better off than the rich in non-electrified villages (Barkat 2004).

45. A major barrier to electricity access is the upfront cost of connecting to the network, such as the cost of meter and cables, switches, and so on. But the obstacle can be overcome: a project funded by the ADB in Bhutan, for example, provided electrification kits to the poorest households, benefitting villagers in several ways. Electricity allowed households to switch from biomass fuels for cooking, and heating, meaning fewer women suffered from eye and respiratory ailments caused by kerosene lamps and wood fires, while electric lighting allowed men and women to work longer hours and children and adults to study after sundown, improving education.[6]

iii. Communication infrastructure and poverty

46. Connectivity infrastructure, such as fiber optic cable links, is essential for ICT. Use of ICT as a complement to physical infrastructure, private sector development, and rural livelihoods in particular has the potential to enhance pro-poor growth (see Box 3). It improves trade through better planning and monitoring of cargo movements and for expediting the transactions involved in moving down the supply chain. The OECD (2006), for example, identifies ICT as a powerful tool for promoting pro-poor growth: it saves time and money through more efficient communication, and supplies strategic information on market prices, risk warnings, and job and learning opportunities. It helps in e-governance, and better planning and delivery of economic and social services. Electronic cash systems in remote areas, weather forecasting systems for poor fishermen, and electronic price systems allowing poor farmers to compare commodity prices in different markets, are just some of the uses of ICT most relevant to the poor. The example of Grameen Phone in Bangladesh shows that phones are used for a variety of purposes: keeping in touch with family members abroad, organizing remittance transfers, inquiring about market prices, consulting doctors, and so on. The ADB started a three-year information highway project under the South Asia Subregional Economic Cooperation (SASEC) program aiming to integrate member countries through cross-border connectivity and reduce internet costs, particularly for landlocked Bhutan and Nepal.[7] Village networks built to expand

[6] See http://www.adb.org/Documents/Feature-Stories/2008/Bhu-Lighting-Lives.asp

[7] SASEC was established in 2001 by Bangladesh, Bhutan, India, and Nepal with ADB's support, to promote the subregion's economic cooperation in priority areas, including transport, tourism, and ICT.

broadband wireless connectivity to rural communities would enable them to better access services such as tele-medicine, distance learning, and e-government services through *community e-centers*.

Box 3. ICT and Poverty

ICT allows the sharing of information across traditional barriers and gives voice to marginalized stakeholders. ICT indirectly affects poverty through its impact on growth. However, as experience from Asia in the 1990s shows concentrating ICT on production and service sectors would benefit the poor proportionally less than the non-poor. Many developing-country economies are largely based on the production of raw materials and subsistence agriculture, which may not improve efficiency through the application of ICTs.

However, access to telephones makes markets more dynamic, provides faster movement of products, resulting in product diversification, and benefits whole communities. In the Lao People's Democratic Republic, an impact study on mobile phone network extensions exclusively to rural areas found that 80% of users were the poor earning less than $1 a day. By using a phone call to contact family members and government offices, instead of taking one trip per month, they could save up to $77 per year. Telephones are also creating new opportunities for gender equality—such as through equal use among men and women in Africa or through the use by Grameen Phone to empower women in small businesses

Pro-poor growth requires the extension of telecommunication services to rural areas, where a majority of the poor live. Recent evidence indicates large rural demand, which will make investment in these services profitable, even in remote rural areas. The use of phones will enable farmers and small businesses to select markets more efficiently by accessing market data and agricultural options, and to conduct remote transactions. This will reduce transaction costs and help mitigate risk. ICT also provides the poor with educational opportunities, health information, and governance options. ICT can hasten the achievement of the Millennium Development Goals by enhancing livelihoods, improving efficiency in the delivery of services, and giving local stakeholders a voice in the planning process.

For the implementation of ICT projects, the selection of appropriate technology will depend on the circumstances, and should focus on cost-effectiveness. Content and applications are more important than technology and innovative methods of access will be required for pro-poor applications.

Source: OECD (2005)

B. Indirect Links to Poverty

47. Cross-border infrastructure affects poverty indirectly through its effects on trade expansion, foreign direct investment (FDI) and the productivity increases and economic growth that comes with them. The indirect links between cross-border infrastructure and poverty are of two types. In one, infrastructure affects productivity growth and income growth, which in turn reduces poverty. In the other, infrastructure affects trade and FDI, which affect poverty directly or through their impact on productivity and economic growth. Connectivity infrastructure reduces trade transportation costs, boosting extra- and intraregional trade volumes. The cost

advantages work even better if trade volumes are large and capacity high. A 10% increase in trade costs, for example, reduces trade volumes by 20% (WDR 2009).

48. Trade affects poverty directly by affecting employment in the tradable sectors and indirectly through economic growth induced by trade. Regional integration through good quality transportation and ICT facilities encourages both intra and extra-regional FDI, creating avenues for growth and employment creation. Lower transportation and logistics costs reduce margins between producer and consumer prices and improve economic welfare.

49. Economic growth also leads to poverty reduction. Although there is concern about the inequality that can accompany growth, so long as the incomes of the poor grow in proportion to per capita income, there will be a reduction in poverty (Dollar and Kraay 2001). For example, despite rising income inequalities, high growth rates (over 10% per year) in the PRC have led to a large decrease in poverty (Sala-i-Martin 2006). Using cross-country data, Sala-i-Martin finds that, overall, aggregate growth explains up to 63% of the variability in poverty rates and an increase in growth of 1 percentage point leads to a reduction in poverty rates of about 3 percentage points. Ravallion (2004) demonstrates the dependence of the growth elasticity of poverty on initial inequality. According to his estimates, depending on the initial level of inequality, a 1% increase in income levels could result in a reduction in poverty of as much as 4.3% (very low inequality countries) or as little as .6% (high inequality countries). As suggested by Easterly (2000), in the context of structural adjustment programs, low growth elasticity of poverty can arise due to the poor being ill placed to take advantage of the new opportunities created by greater trade openness. Lopez (2004) reviews the literature dealing with policies for successful poverty reduction and finds that education, infrastructure, and macroeconomic stability have positive influence on both growth and the distribution of income.

50. A simple framework is provided below for examining the complex links between cross-border infrastructure investment and poverty, identifying the links to poverty for each type of infrastructure: transport, power, and telecommunications (Figure 8).

Figure 7. Regional infrastructure: Direct links to poverty

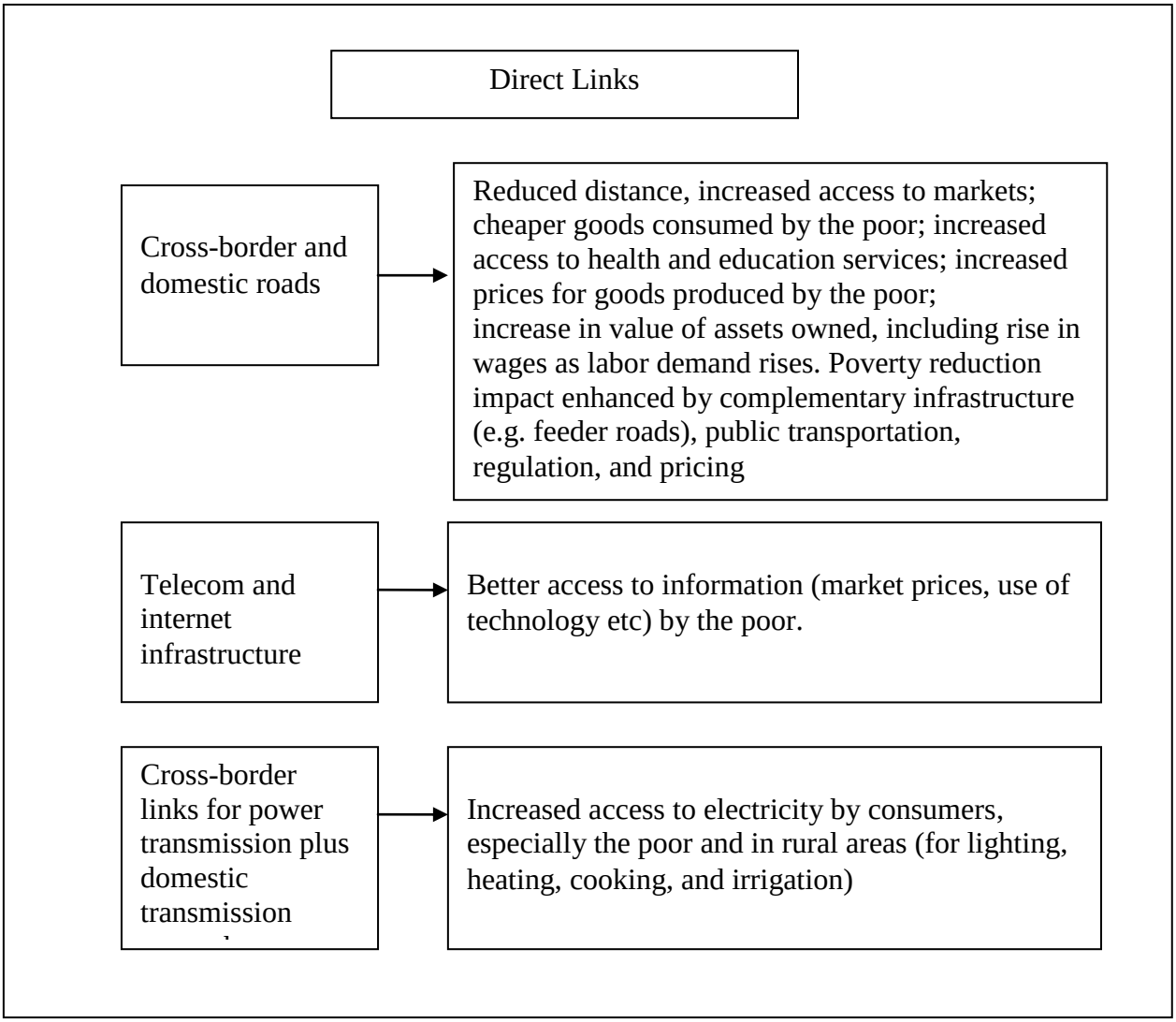
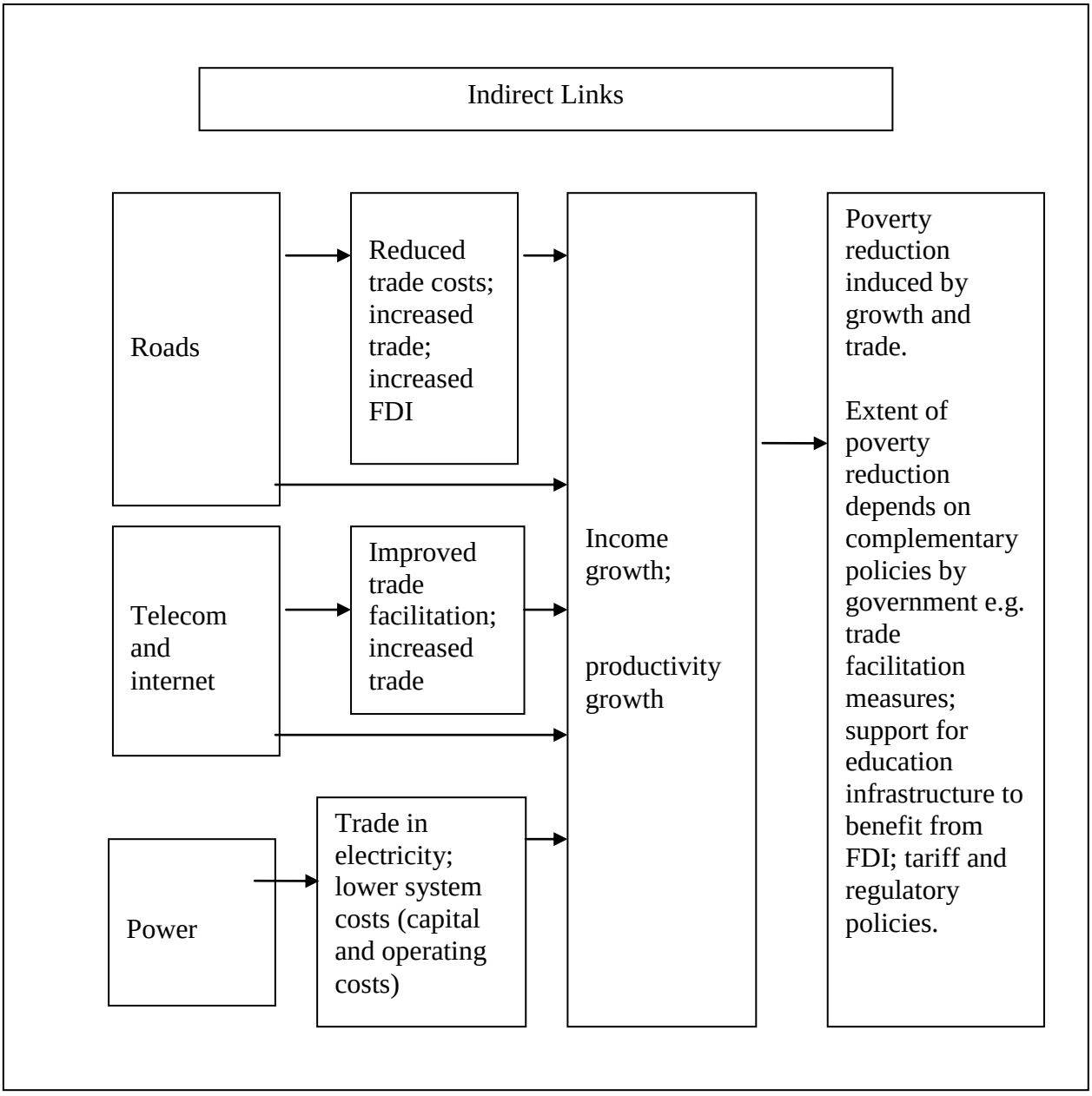


Figure 8. Regional infrastructure: Indirect links to poverty



i. Impact of cross-border infrastructure on trade and FDI

51. Cross-border transport links affect the movement of goods (final and intermediate) and factors of production (people and capital). As barriers to the flow of goods and services and capital decline through regional integration, firms choose locations with the lowest costs of operation, and efficiency in the production process is achieved through greater competition and technological innovations.

52. If transport constraints are severe and the costs are prohibitive, no amount of tariff reduction is enough to generate greater trade volume. Thus, the easing of infrastructural constraints can maximize the benefits from preferential tariffs. Limao and Venables (2001) find that domestic infrastructure explains 40% of trade transportation costs for coastal countries, while for landlocked countries domestic and transit country infrastructure account for 60% of trade transportation costs. Their estimate of the elasticity of trade with respect to transport costs ranges between -2 and -3.5.

53. High transport costs act like non-tariff barriers. A reduction in transport and trade costs arising out of cross-border infrastructure improvements is equivalent to a uniform reduction in tariffs across the board for all countries within and outside the region. There is thus no possibility of trade diversion, as in the case of preferential tariffs. That is, unlike the case of tariff reduction, which can be applied selectively on some sectors, a reduction in trade costs due to cross-border infrastructure eases non-tariff barriers uniformly for all sectors. Regional cooperation and integration, especially through regional trade agreements (RTA), may increase intraregional trade. However, this could be due to the creation of additional trade or the diversion of trade from outside the region to within the region. In the case of trade creation, trade replaces domestic production, benefiting the consumers and hurting the producers, and the net impact on poverty depends on the percentage of the poor among the losers and gainers. In the case of trade diversion, intraregional trade replaces trade from the rest of the world. In this case the importing country loses out on tariff revenues due to preferential tariff rates, whereas the exporting country benefits from market access with lower tariffs.[8] In the case of SAFTA, since the SAARC countries are in general highly protectionist, it is highly likely that there would be trade diversion due to preferential tariffs (Panagariya 2007).

54. If trade infrastructure is improved the importables sector may not be protected by high transport costs acting like non-tariff barriers, although the exportables sector would be at an advantage. Thus, labor employed in the former sector loses out, whereas those employed in the latter sector gain. Imperfect mobility of labor from the importables to the exportables sector implies a need for safety nets and re-skilling programs. Thus, government policies play a significant role in determining the effect of trade on poverty as they redistribute income through taxes and provide public goods and safety nets.

55. Cross-border infrastructure can help realize the full potential of growth in trade only if there are complementary improvements in trade logistics and trade facilitation and efficiency at the border crossings. Among the difficulties at land borders, Arnold (2007) identifies requirements of back-to-back exchanges of cargo and poor communication/coordination across the border. Trade and transit agreements also present limitations. In Nepal, for example, transit goods are limited to routes connected with Haldia and Kolkata, denying Nepal access to more efficient ports in India. For Bhutan's exports to Bangladesh, transport costs are high because

[8] In developing countries, tariffs form a major source of revenue for the government. Connectivity infrastructure, by boosting trade, can offset the revenue reduction caused by lower preferential tariffs.

India requires that goods be transshipped at the Indian-Bangladesh border. Cross-border trade between India and Bangladesh is made difficult by the requirement that goods be transferred at the border between Indian and Bangladeshi trucks.

56. RCI initiatives for regional infrastructure are few in number compared to RTAs, of which there has been a proliferation since the early 1990s, with over four hundred agreements notified to GATT/WTO by the end of 2008, with around 230 in force. The main objective of the South Asian Association for Regional Cooperation (SAARC) is economic integration through the South Asia Free Trade Area.

57. Empirical work on the impact of regional integration focuses mainly on trade and FDI, whether RTAs are trade creating or trade diverting. A key element in the RTAs is the setting of preferential tariffs lower than the most-favored nation (MFN) tariffs. Empirical results in the literature indicate substantial gains in trade due to RTAs.[9] But the potential gains can be much higher than indicated by these results if non-tariff barriers are also reduced or removed.

58. The gravity model and the computable general equilibrium model (GTAP) are most commonly used to determine the impact of RTAs. In the gravity model, bilateral trade is explained using control variables such as the incomes of the two countries, distance between the countries, whether they have common borders, language, and so on. Under the gravity models, most studies incorporate dummy variables for regional trade agreements or other regional cooperation initiatives to obtain the impact of RCI on bilateral trade. But such studies do not reveal how the different aspects of an agreement affect trade. There are usually several elements in RTAs, the key component being a lowering of tariffs to parties of agreement compared to MFN tariffs. Agreements also deal with rules of origin (i.e. treatment of products partly procured outside the region) and non-tariff barriers, such as customs control procedures, technical barriers to trade, sanitary and phytosanitary measures, labor, and environmental standards.[10]

59. As one of the explanatory variables in the gravity model, the ADB/UNCTAD (2008) study uses the tariff rate faced by the exporting member country of SAFTA vis-à-vis the bilateral member partner country. The estimates of elasticity of trade with respect to tariffs suggest that a 1% reduction in tariff rate leads to a 0.22% increase in exports. It is also estimated that a 1% tariff reduction would lead to 0.3% increase in FDI from outside the region into the South Asian region. The elasticity estimates can be used to make predictions regarding potential trade impacts due to tariff reductions. They can also be used to estimate the potential impact of improved transport/trade infrastructure if such improvements can be expressed in tariff equivalents.

60. The GTAP model is widely used to obtain the impact of trade policy reforms at the global or regional level by linking the national CGE models. Bandara (2009) provides a survey of the studies based on the GTAP model that quantify the impact of South Asia regional cooperation and integration. He finds wide variation in the estimates of welfare impacts from regional integration and attributes it to the differences in model specifications and assumptions. Although the magnitudes vary, there is overall gain in welfare due to regional integration, with relatively small losses for some countries.

[9] See te Velde et al. (2006) for a review of empirical studies examining the link between RCI and trade/FDI.
[10] Origin is granted, for example, when a processed good falls under a different tariff classification or when it meets the percentage criterion for domestic content (a minimum percentage of total value must have been added in the exporting country or a maximum percent value for import content).

ii. Trade and poverty

61. Increased trade can have direct impacts on poverty through changes in price and employment depending, for example, on whether there is an increase in the price of products produced by the poor or a reduction in the price of goods consumed by the poor. It also affects poverty indirectly through macroeconomic (increased growth) and distributional effects. Greater openness to trade due to cross-border infrastructure may increase efficiency in production, permitting specialization according to comparative advantage, which in turn leads to income growth. But the distributional effects need not be in favor of the poor. Chen and Ravallion (2003) explore the welfare impact of changes in goods and factor prices that might result from liberalizing trade, and find that while at the aggregate level and on average they are likely to have negligible impact on inequality and poverty, a number of diverse impacts emerge across households and regions. Ravallion and Lokshin (2004) obtain the welfare impacts of price changes associated with different agricultural trade reforms for de-protecting cereals. They find that, at the aggregate level and on average, the effects are small, though the rural poor could be worse off after de-protection calling for compensatory policies. In a similar vein, policy changes such as RCI may bring abrupt changes in sectoral output and employment and the poor are the most vulnerable as they have the least ability to adjust to change. Governments may therefore need to have institutions to provide safety nets (income protection or insurance schemes) to redistribute income during the adjustment process.

iii. FDI and poverty

62. Greater regional integration through regional infrastructure and free trade agreements can boost extra and intraregional FDI. FDI is affected by the different provisions in RTAs, such as trade and investment rules, apart from conditions such as the free movement of people and the free transfer of profits. Regional agreements can also bring greater predictability and stability to national policies (regarding regulation, competition, property rights, and contract enforcement) as they are locked into regional treaties giving investors additional security against policy reversals. Empirical evidence suggests that membership in RTAs and other regional integration initiatives increases FDI stocks (see Chapter 2, Table 2.6, te Velde 2006).

63. Greater FDI can lead to economic growth and hence poverty reduction. But direct impacts on poverty are weak because FDI mostly leads to skill-intensive employment. FDI is in general seen as a source of capital by capital-poor countries. Spillover benefits or learning effects on local firms, in terms of superior technology and skills, are possible. But the evidence is not clear if the increase in productivity is due to FDI locating in high value-added industries or due to spillover effects on domestic firms. The experience varies widely across countries, with some able to upgrade domestic firms while others not (see te Velde 2006 for references).

64. FDI can potentially reduce poverty through its contribution to economic growth through export and productivity growth. It can also help the poor by indirectly influencing the wages of less skilled labor. As demand for skilled labor increases, the wage rates of skilled workers increase, and due to the substitution effect, leads to an increase in the wages of low-skilled labor, indirectly helping the poor. Government can play a supportive role in enhancing the impact on poverty through education and training programs, in that better-educated workers are more able to learn. Government can also actively support sectors with links to foreign firms as they can source their inputs from these firms.

iv. Impact of cross-border infrastructure on growth

65. Calderón and Serven (2004) provide an empirical evaluation of the impact of infrastructure development on economic growth and income distribution using a large panel data set encompassing over 100 countries spanning 1960–2000. They find that growth is helped by the stock of infrastructure assets and income inequality declines with higher infrastructure quantity and quality, suggesting that infrastructure development can be highly effective in combating poverty.

66. Infrastructure saves time by reducing distances. The economic value of time would be higher in highly productive economies. This implies that the distribution of benefits is skewed in favor of the richer economies. Nevertheless all countries involved benefit from connectivity infrastructure and can hope to see poverty reduction through direct and indirect links.

67. Wider access to markets implies that firms producing differentiated products benefit from economies of scale. The size of the market itself grows as many firms choose to locate there. The mobility of firms and workers increases the size of market, which in turn attracts more firms, leading to agglomeration effects (Krugman 1991). The forces of agglomeration are, nonetheless, balanced by dispersion forces such as the bidding up of prices of immobile factors (land and labor to some extent). Straub (2008) suggests that the long-run effect of agglomeration forces on the periphery or the lagging regions may not be bad if industrial agglomeration leads to faster overall growth.

68. Salai-Martin (2007) lists several channels through which trade and economic integration affect the overall growth rate of the economy: (i) increased specialization according to comparative advantage; (ii) greater exploitation of increasing returns; and (iii) importing ideas, knowledge and technological capacities and increased competition, all leading to increased factor productivity. He also suggests, that "The element of openness that has the greatest economic impact is the positive effect that openness has on institutions, policies and the political process itself. For example, economic integration leads to coordination of banking regulations, transportation and energy networks. By seeing how their neighbors operate, locals can improve their social attitudes towards the economy and towards work in ways that enhance their overall economic performance." He cites a paper by Venables and Winters (2004), who argue that the political and institutional gains obtained from integration in the case of the European Union are much greater than direct gains from trade.

IV. EMPIRICAL EVIDENCE ON POVERTY IMPACTS OF CROSS-BORDER INFRASTRUCTURE

69. Considering the complex links between cross-border infrastructure and poverty, measuring the poverty impacts of a particular investment is a daunting task. Poverty impacts can be analyzed at the macro or micro level. Macro-level studies are generally cross-section or time-series econometric studies based on secondary data. Micro-level studies are mostly based on household survey data in the form of project evaluations of particular projects or evidence based on project areas vis-à-vis the non-project areas, controlling for factors other than those related to the project. Several factors act synergistically to produce growth and poverty reduction. It is difficult to isolate the impact due to a particular infrastructure project as it is not easy to control for the myriad factors that affect poverty. Nevertheless, the macro-level approach of using econometric analysis is attractive in determining if infrastructure variables

have significant direct and indirect impact. The micro-level approach, based on household surveys, is most useful in obtaining the direct impacts of a particular project.

70. There is also evidence based on ex-ante project appraisals. ADB/UNCTAD (2008), for example provides a cost-benefit analysis of four different projects upgrading existing cross-border infrastructure facilities. In one of the projects considered, upgrading a section of the Kolkata-Dhaka road corridor, the benefits identified include reduced trade costs and increased trade, and direct employment benefits during the time of project implementation due to the labor-intensive component of road projects. There are also resettlement costs of people along the roads, such as retail service shops, food kiosks, and small businesses. Assuming plausible scenarios for GDP and trade growth before and after the completion of the project and evaluating the time savings from better access to markets and other facilities, such as education, at market wage rate the net present value of the project is estimated to be positive, with an internal rate of return of 37%. The upgrading of Bagdogra Airport to an international airport is also found to be viable where the identified benefits include increased tourism potential in Bhutan, Nepal, Sikkim and the northeastern states of India, employment benefits associated with travel and tourism, and GDP growth.

A. Micro-Level Evidence

71. This section reviews evidence obtained from household survey data and project evaluation reports that discuss project impacts on livelihoods. Most of the evidence available is for road projects, with the finding that benefits to the poor are significant, not only in higher incomes, but also better access to health and education services.

72. Jacoby (2000), for example estimates household-level benefits from hypothetical rural road projects in Nepal. Using the 1995–1996 Living Standards Survey data he shows that lower transport costs from expanding access to roads increase farm values and wages, and benefit both landowners and workers. Although extending road access creates substantial gains to households on average, most of the benefits accrue to the poor because they tend to live in more remote areas.

73. Using a panel of farm household data over 1985–1990 for the rural PRC and applying a dynamic consumption growth model, Jalan and Ravallion (2002) find a highly significant positive effect of higher road density on consumption growth: for every 1% increase in kilometers of roads per capita, household consumption rises by 0.08%. They also arrive at a critical minimum level for road density (6.5 square km per 10,000 people) that is required for positive growth in consumption.

74. Table 8 presents findings from ex-post assessments of some infrastructure projects in the region. Mu and van de Walle (2007) found the following upon evaluation of a project involving rehabilitation of 5,000 kms of rural roads in Viet Nam. About 10% more new markets were created in project communes than in non-project communes over 1997 to 2003. Improved roads resulted in a 2% decline in households relying on farming as their main source of income, while 1.7% of households diversified income by shifting to the service sector for alternative livelihoods. There was also sustained and robust impact on primary school completion rates.

75. Warr (2005) analyzes the relationship between poverty incidence and road development in the Lao People's Democratic Republic (Lao PDR) and finds that about 13% of the poverty reduction between 1997–98 and 2002–03 can be attributed to improved road access alone.

Table 8. Poverty reduction through infrastructure projects in Asia and the Pacific

Study Country/Region	Project	Findings
Mu and van de Walle 2007 Viet Nam	Rehabilitation of 5,000 kilometers of rural roads	Improved roads provided greater access to markets resulting in a 2% decline in households relying on farming as their main source of income. 1.7% of households diversified income by shifting to the service sector for alternative livelihoods. Sustained and robust impact on primary school completion rates.
ADB 2004 Gujarat State (India)	Rural roads	Improved market access changed cropping patterns from food crops to cash crops and to declines in prices of agricultural inputs. Improvement of the village economy, higher prices, increased sales, employment and wages.
ADB 2004* Shaanxi Province, People's Republic of China	Rural roads	Rural roads completed in Shaanxi over 1998–2001 had a high rate of poverty reduction. Rural people strongly associated transport with increased production of cash crops, vegetables and livestock, employment, and access to technical services.
ADB 2004 Lao People's Democratic Republic	Road improvement	The projects made the roads usable in all weather conditions and ensured secure passage to users. Benefits included reduced travel times, greater access to health and educational services. Expanded economic activities to the poor and increased opportunities for wage employment.
Warr 2005 Lao PDR	Rural roads	Rural poverty incidence declined by 9.5%. 13% of this decline in poverty can be attributed to improved road access alone.

76. Similar results were obtained by a number of other studies, summarized in ADB (2008) and ADBI (2009). Due to the Phnom Penh–Ho Chi Minh City Highway Improvement Project between Cambodia and Viet Nam, completed in 2004, travel time to reach local healthcare services was reduced by 30% and to schools and markets by 40% (Phyrum et al. 2007). The cost of transport fell substantially as well. Savings in time and lower travel costs increased annual trade between Cambodia and southern Viet Nam by 40%, the number of tourists crossing the border by 53%, and vehicles by 38% during 2003 and 2006. Closer economic links also spurred development, such as the Trang Bang Industrial Park on the Vietnamese side along the Southern Economic Corridor, generating jobs for the local population. Moreover, low transport costs are attracting FDI, mainly in agriculture, providing work for villagers in activities such as silk and cotton production, weaving, and handicrafts, increasing their agricultural output for sale at local markets and significantly increasing incomes and living standards.

77. Completion of the East-West Economic Corridor in Lao PDR multiplied the number of passenger buses along the corridor 2.5 times and doubled the number of freight operators between 2000 and 2005 (Rattanatay 2007). It also reduced the incidence of poverty by 35% during 1998–2004, while per capita income increased from $371 in 2001 to $425 in 2005 in Savannakhet Province. These magnitudes were significantly higher than the national averages.

The value of FDI and joint ventures also increased, from $17.5 million in 1995–2000 to almost $200 million in 2001–2005. Similarly, the Champasak road improvement project, linking Lao PDR with Thailand and Cambodia, cut travel time in half, reduced the cost of public transport by 20%, and increased traffic at an average annual rate of 22%. It also allowed about half of agricultural households to increase their incomes by selling larger amounts of their output at local markets.

78. ADB (2007) reviews an ongoing study that is examining, among other things, the nature, extent, and distribution of border poverty in the Greater Mekong Subregion (GMS) and the impact and distribution of costs and benefits from regional integration to make the process more pro-poor. Its initial findings suggested that regional integration has converted border provinces into hubs of economic activity, which is attracting the rich with resources for investment. This, in turn, is creating alternative livelihood opportunities for the poor, both at and across the border, such as porters and cart pushers, petty trade, cross-border farm jobs, and other activities. In particular, households headed by women and those from ethnic minorities have more choices. However, the integration may bring with it risks and vulnerabilities, including threatening the survival of the poor and marginal groups due to rising property prices and increased demand for limited common property resources and illegal activities, such as smuggling, gambling, human trafficking, child labor, and drug abuse.

B. Macro-Level Evidence

79. At the macro level, cross-border infrastructure affects poverty mainly indirectly. It reduces trade costs, leading to expansion in trade and investment, which can result in increased employment and higher income growth. The effect on poverty depends on how inclusive such growth is and the policies in place to promote the participation of the poor in this growth process. There are very few econometric studies on the impact of cross-border infrastructure on trade/FDI or poverty due to a lack of suitable data. There are some macro-level studies examining the impact of particular projects using a computable general equilibrium (CGE) framework.

80. Stone et al. (2009) combine a multi-region CGE model (GTAP) and household-level data for the GMS countries, to analyze the links between regional road infrastructure and poverty reduction. The countries studied are Cambodia, the PRC, Lao PDR, Myanmar, Thailand, and Viet Nam. Their results demonstrate strong gains from infrastructure development and trade facilitation, with national poverty headcount down 4%–5% in the countries examined. In Cambodia, Lao PDR, Thailand, and Viet Nam more than 400,000 people are lifted out of extreme poverty and 1.75 million rise above the $2/day poverty line. In most countries, factor earnings rise relative to the cost of living given by the poverty line. Distributional impacts vary across different factors and areas of residence. The largest increases in earnings occur for non-agricultural factors. In all countries, demand for skilled labor increases more than for unskilled as labor shifts to manufacturing, especially electronics. Even though skilled wages rise by more than unskilled wages, which benefits urban more than rural households, there is strong evidence that road improvements and better connectivity benefit the rural poor in the region, with rural diversified households accounting for almost half of the poverty reduction at both $1-a-day and $2-a-day poverty levels.

81. Applying a multisector CGE model, ADB (2006) shows that increased regional cooperation in transport and customs transit in the CAREC region would generate substantial benefits for all partners. It would, in particular, double poor households' incomes in the Kyrgyz

Republic over 2006–2015 compared to no regional cooperation. Increased regional cooperation would also lower external transportation costs and domestic distribution margins which, when combined with a 35% rise in 2006 in world cotton prices (a major export item for the Kyrgyz Republic), would lead to a cumulative increase in household incomes of 150% for the poor and 130% for the non-poor over 2006–2015.

82. Gilbert and Banik (2008) use a multiregional competitive CGE model—covering Bangladesh, India, Nepal, Pakistan, and Sri Lanka—and consider the effects of reduction in the road transport component of trade costs for intra-SASEC transport margins, assuming that improved roads and transit would reduce the time spent on transport and processing by 20%. The results indicate that doing so would generate higher GDP, trade, and welfare. In particular, it would create benefits for all households in Bangladesh and Sri Lanka, marginally pro-poor benefits in India and Nepal, and a drop in absolute poverty levels in Pakistan.

83. The indirect impacts on poverty due to cross-border transport and ICT infrastructure is mostly felt through its impacts on trade expansion and economic growth. Some of these links can be traced based on a review of empirical estimates of the impact of infrastructure on trade and growth. While several studies using gravity models analyze the impact of regional trade agreements on intra and extra-regional trade and FDI, not many examine how cross-border connectivity infrastructure affects trade and FDI or poverty directly. Nonetheless, some studies examine the effect of infrastructure variables on trade. For example, Weerahewa (2009) uses a gravity model to assess how trade facilitation helps improve food and agricultural trade flows in South Asia. The World Bank's LPI was used in this case as an indicator of trade facilitation; it was found that a one point increase in the LPI score in both the exporting and importing country led to a 25% increase in agricultural exports. Felipe et al. (2009), in the case of Central Asian countries, find that improvements in trade facilitation, as measured by the LPI, leads to substantial gains in the form of intraregional trade. A 1% increase in LPI in an exporting country increased exports by 5.5%; a 1% increase in LPI in an importing country increased imports by 2.8%. The largest gains are from improvements in the quality of infrastructure as opposed to customs and logistics, the other components of LPI.

V. EMPIRICAL ANALYSIS BASED ON CROSS-COUNTRY DATA

84. The empirical analysis in this section obtains the impact of infrastructure variables on poverty based on cross country data. In particular, it examines how these effects are different for landlocked countries than for coastal ones. The dataset used for this purpose is obtained mainly from the World Bank's World Development Indicators.

85. The use of poverty headcount measures as an explanatory variable produces many missing values in the cross section data. Since poverty data is available only for very few countries (39 out of 209) correlates of poverty can be used as proxy dependent variables in place of poverty. The possible variables include life expectancy at birth, infant mortality, or primary school enrolment, and births attended by skilled staff.

A. Estimation with Cross-section Data

86. Cross country data for the year 2005 is used to estimate the ordinary least squares model below. Life expectancy at birth is chosen as the dependent variable as this has the least number of missing values. As seen from the matrix of correlation coefficients, the linear

correlation between life expectancy at birth and poverty is high (-0.75) and significant. Table 9 provides the correlation coefficient matrix for the proxies used for poverty as well as the correlation between the different infrastructure variables. All the infrastructure variables, except for road density, are highly correlated with each other and with the per capita GDP variable (correlation coefficient close to or greater than 80%). Use of all these variables in the regression would thus lead to multicollinearity, giving rise to unreliable coefficient estimates. Therefore, apart from per capita GDP, the following are used as explanatory variables: road density and a dummy variable for landlocked countries and an interaction term of dummy variable with road density.

Table 9. Correlation matrix for the variables used in regressions with cross-country data

Variable	Lifeexp	births	enrol	HCR2	HCR125	roads	Pcelec	phones	internet	GDP
Lifeexp	1.000									
Births	0.83*	1.000								
Enrol	0.22*	0.2373	1.000							
Hcr2	-0.75*	-0.7958*	-0.2468	1.000						
Hcr125	-0.7383*	-0.6385*	-0.1932	0.9595*	1.000					
Roads	0.4676*	0.2458	0.0776	-0.5919	-0.5751	1.000				
Pcelec	0.5495*	0.5044*	-0.1057	-0.7066*	-0.6334*	0.1290	1.000			
Phones	0.7611*	0.6609*	0.1119	-0.8190*	-0.7332*	0.5002*	0.7177*	1.000		
Internet	0.6720*	0.5504*	0.0210	-0.7208*	0.6574*	0.4698*	0.7843*	0.8614*	1.000	
GDP	0.6339*	0.4974*	0.0540	-0.7768*	-0.7066*	0.4759*	0.8473*	0.8116*	0.7934*	1.000

* Indicates statistically significant at 5% confidence interval.

Lifeexp = life expectancy at birth; births = births attended by skilled personnel; enrol = primary enrolment; HCR2 = poverty head count with $2 poverty line; HCR125 = poverty head count with $1.25 poverty line; roads = road density (km/ sq km); pcelec = per capita electricity consumption; phones = landline and mobile phone users per 100; internet = internet users per 100; GDP = per capita GDP in PPP.

The estimated regression results are given in Table 10.

Table 10. Coefficient estimates for impact of infrastructure on life expectancy at birth

Dependent variable: Life expectancy at birth			
Independent variables			
Constant term	39.75834 (6.33**)	42.22883 (7.10**)	41.75809 (7.13**)
Log(road density)	1.664276 (3.54**)	1.103406 (2.31*)	1.049168 (2.25*)
Log(per capita GDP)	3.769185 (5.92**)	3.476243 (5.76**)	3.509952 (5.87**)
Dummy for landlocked countries	-3.187203 (-2.61*)	-.8133899 (-0.59)	--
Interaction term: Landlocked X log(road density)	--	2.167282 (3.03**)	2.403652 (4.10**)
Adj R-squared	0.7408	0.7725	0.7750
No. of observations	63	63	63

Estimated from 2005 cross-country data (World Development Indicators)
** Indicates statistically significant at 1% level; *Indicates significance at 5% level. -- = not available.

87. Road density is found to be a significant explanatory variable for life expectancy at birth. The data fits the model well when logarithmic values of road density and GDP per capita are used, with more than 70% of the variation in life expectancy at birth explained by the independent variables. The statistically significant negative coefficient for the dummy variable in the first regression estimate indicates that life expectancy in landlocked countries is lower in general.

88. The positive statistically significant coefficient for the interaction term of the dummy variable with road density indicates that similar percentage changes in road density yields larger improvements in social indicators for landlocked countries.

B. Panel Data Estimation

89. To make use of all the information available the linear regression model is estimated using panel data from the years 2000–2006. The panel data model is written as $Y_{it} = a + X_{it} \beta + v_i + u_{it}$ where t is the index of time periods and i is the index of countries. Y is the dependent variable and X is a k-vector of stochastic explanatory variables and β is a kx1 vector of parameters; u_{it} is a normally distributed disturbance

term with constant variance and zero mean. The v_i can either be assumed to be constants (fixed effects model) or random, drawn independently from some probability distribution (random effects model).

90. A list wise deletion approach is used to deal with missing data on some variables for certain countries and certain years. This results in a substantial decrease in the sample size available for the analysis. However, since it is reasonable to assume in this case that data are missing completely at random, unbiased parameter estimates can be obtained.

91. Below are the coefficient estimates from panel data regressions (Table 11). The results obtained are similar to those obtained with the cross section data for the single year 2005. The Breusch-Pagan test indicates that the random effects model is more appropriate for the given data and this model yields statistically significant coefficient estimates.

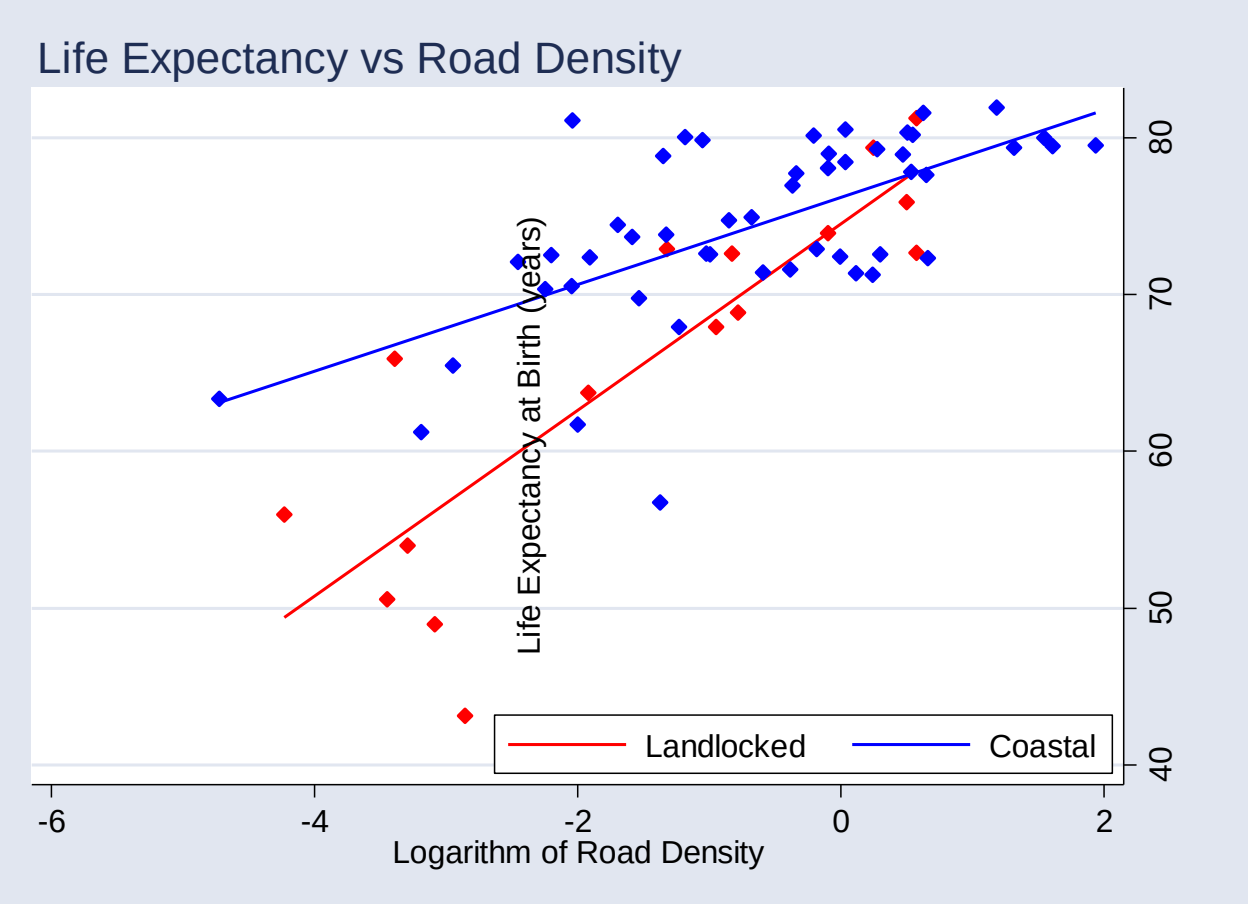
Table 11. Coefficient estimates from panel data regressions (2000–2006)

Dependent variable: Life expectancy at birth				
Independent variables	Fixed effects		Random effects	
	Coefficient	t-value	coefficient	z-value
Constant term	45.38879	19.80	38.59022	18.62**
Log(road density)	.3350904	0.99	.8628445	3.30**
Log(per capita GDP)	2.912463	12.24	3.581579	16.50**
Interaction term: Landlocked X log(road density)	.2612938	0.27	1.209087	2.55*
Number of observations	426		426	
Breusch Pagan test for random effects (H_0: variance of fixed effects=0)	$chi^2(1)$ = 85.32 Prob > chi^2 = 0.0000			
Hausman test (H_0: $E(v_i/X_{it})$ =0, i.e. no correlation between regressors and fixed effects)[11]	$Chi^2(3)$=80.8 Prob>chi^2 = .0000			

[11] Note: If there is no correlation between regressors and fixed effects (i.e. if the null hypothesis is not rejected), then fixed effect (FE) and random effect (RE) estimators are both consistent, but FE is inefficient. If not (i.e. if there is correlation), then, both FE and RE are inefficient but FE is consistent and RE is inconsistent. In our results, the Hausman test rejects the null hypothesis of no correlation, which means that random effects estimators are inconsistent. However, the Breusch-Pagan test rejects the hypothesis that variance of country specific effect v_i is zero, implying that random effects is the appropriate model.

92. The statistically significant positive coefficient on the interaction term indicates that social indicators (life expectancy at birth) are more responsive to infrastructure variables (road density) in the case of landlocked countries (Figure 9). One reason for this is that landlocked countries have a smaller base value of the indicator. Life expectancy in landlocked countries is on an average lower by almost ten years than others. It may also be the case that infrastructure constraints are severe and more binding in the case of landlocked countries and thus a relaxation of the constraint at the margin yields greater results. As noted in Ahmed and Ghani (2008), most of the poorer or lagging regions (i.e. regions with income lower than the national average) in South Asia are either landlocked countries or border provinces.

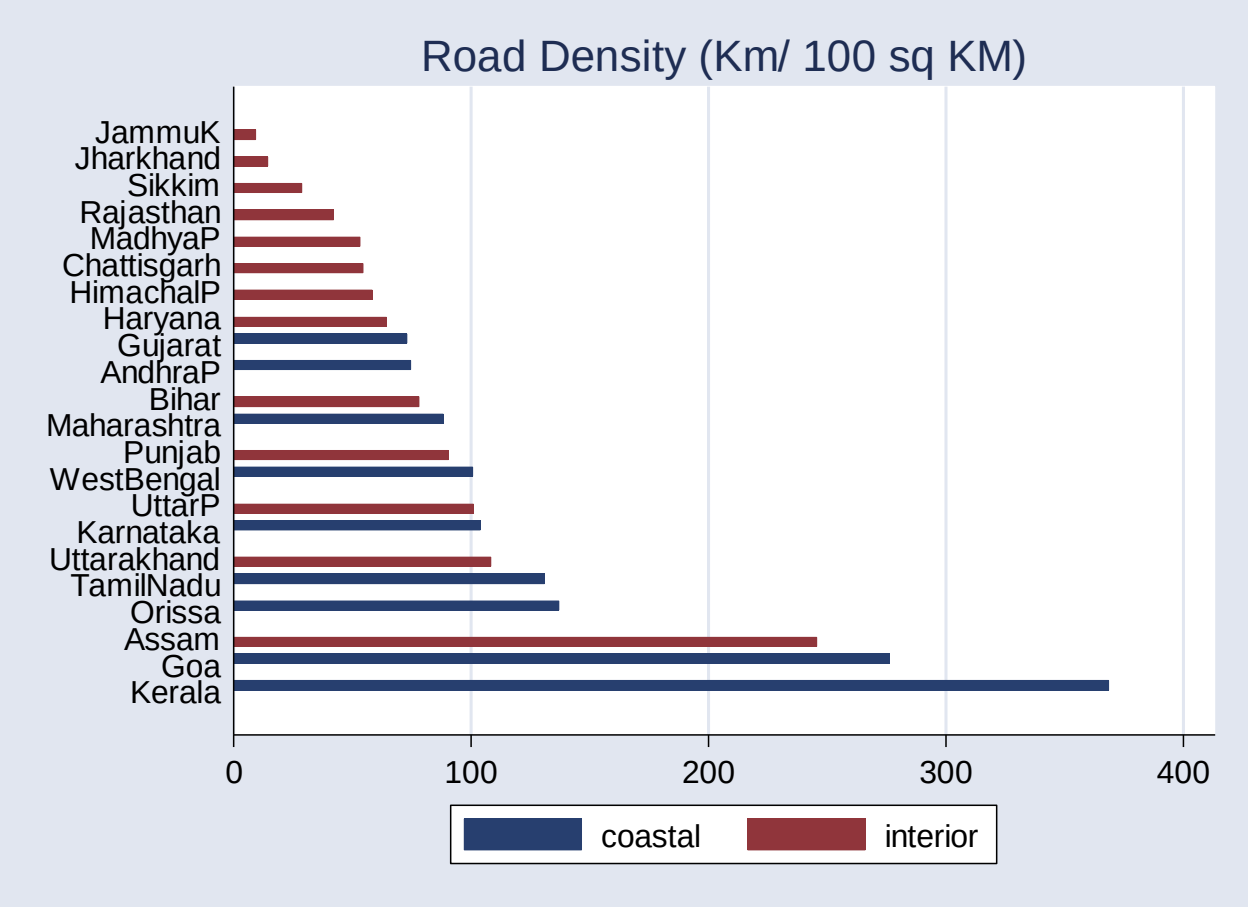
Figure 9. Relationship between road density and life expectancy at birth



C. Cross Section Estimation with State-Level Data

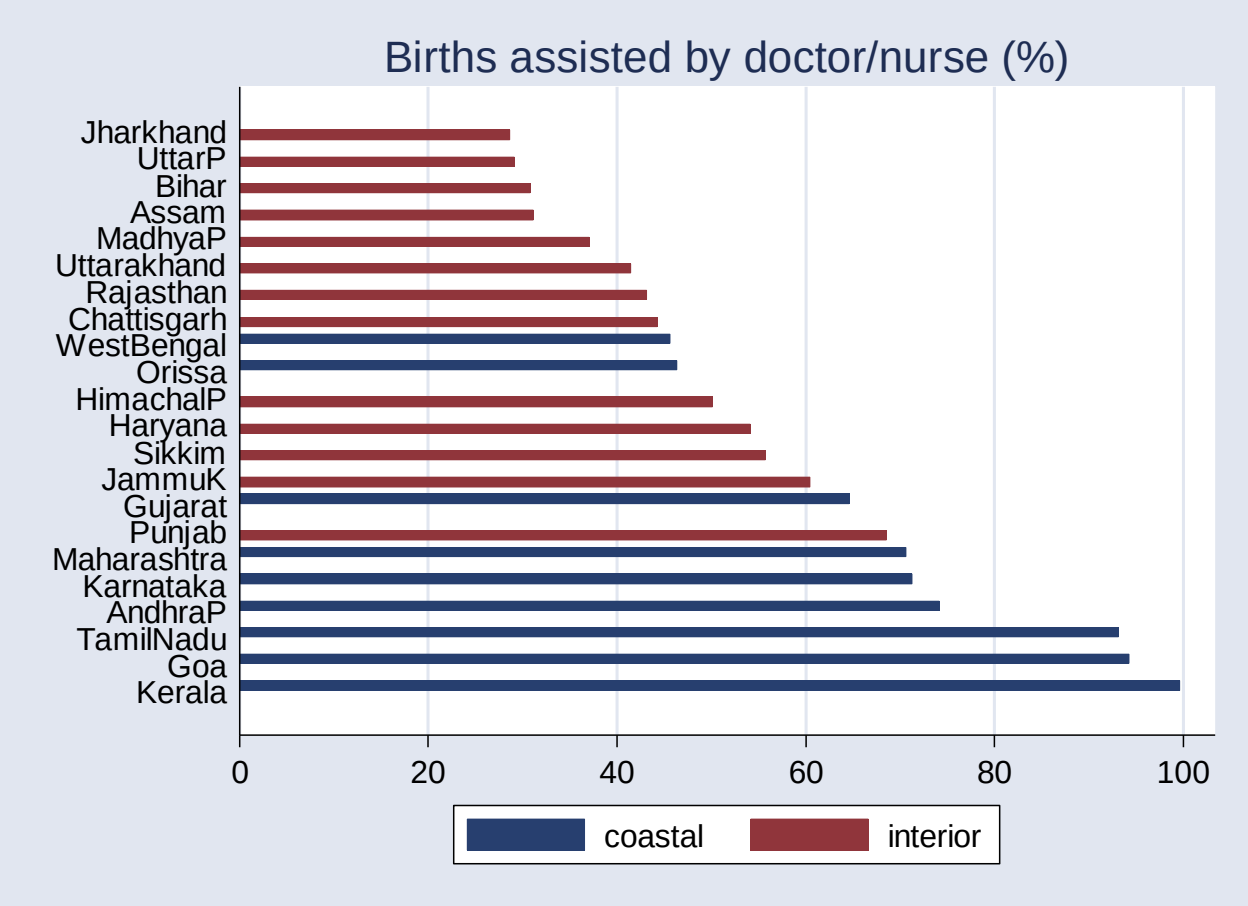
93. This section examines whether infrastructure variables can explain the variations in poverty across different states in India, the largest among the South Asian nations. Similar to the cross country case, within country differences in infrastructure stocks and poverty indicators are found between the coastal and interior regions (Figures 10–12).

Figure 10. Road density in the Indian states (km/100 square kilometers)



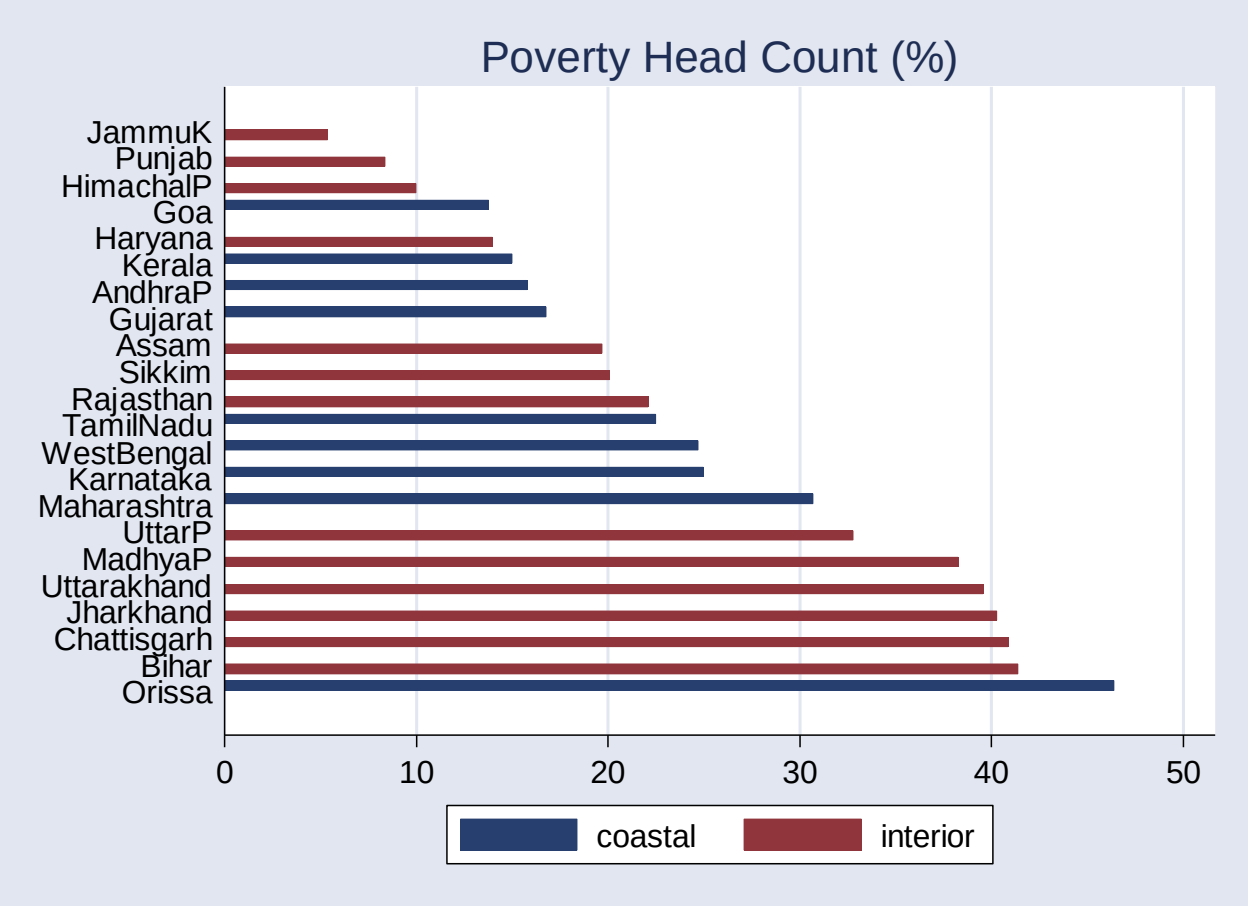
Source: Indiastat.com (Compiled from the statistics released by: Ministry of Shipping, Road Transport and Highways, Govt. of India)

Figure 11. Births assisted by doctor/nurse: variations across Indian states (%)



Source: National Family Health Survey (NFHS3:2005-06) (Based on the last 2 births in the 3 years before the survey)

Figure 12. Poverty in the Indian states (poverty head count, %)



Source: Planning Commission of India (calculated from NSS round 61based on uniform Recall Period consumption in which the consumer expenditure data for all the items are collected from 30-day recall period)

94. Domestic trade in India faces several constraints on interstate movement of goods. Trade facilitation measures (reducing time at check posts, and so on) will have a bearing not only on the smooth movement of goods across state borders but also on international trade. The impact of road density on poverty can be obtained by estimating cross-section regressions using state-level data.

95. For the explanatory variables, apart from per capita state domestic product, we use road density and a dummy variable for coastal states and an interaction term of dummy variable with road density. As seen from the matrix of correlation coefficients (Table 12), there is a high degree of correlation between poverty and state domestic product, but poor correlation between poverty and road density. As the road density variable fails to be a significant explanatory variable for poverty, density of surfaced roads is used as the explanatory variable to account for quality of roads. However, as seen in the third regression estimate, density of surfaced roads has a statistically significant impact on the variable “births attended by skilled staff”, indicating that transport infrastructure improves access to health services. The results are given in Table 13. The positive coefficient for the dummy variable indicates that coastal regions have better access to health services, as depicted by births attended by skilled staff.

Table 12. Correlation matrix for variables used in regression with state-level data

Variable	LNSDP	HCR	lrdens	srdens	lsrdens	births	enrol
LNSDP	1.000						
HCR	-0.6281*	1.000					
lrdens	0.3018	-0.0042	1.000				
srdens	0.5984*	-0.3337	0.7012*	1.000			
lsrdens	0.5237*	-0.2349	0.8271*	0.8352*	1.000		
Births	0.7409*	-0.5501*	0.3957	0.7669*	0.6196*	1.000	
enroll	0.2203	0.1133	0.0712	0.0688	0.1265	0.1722	1.000

* indicates statistically significant at 5% confidence interval
LNSDP = logarithm of net state domestic product; HCR = poverty head count; births = births attended by skilled personnel; enroll = gross primary enrolment; lrdens = logarithm of road density (km/sq km); srdens = surfaced road density; lsrdens = logarithm of surfaced road density

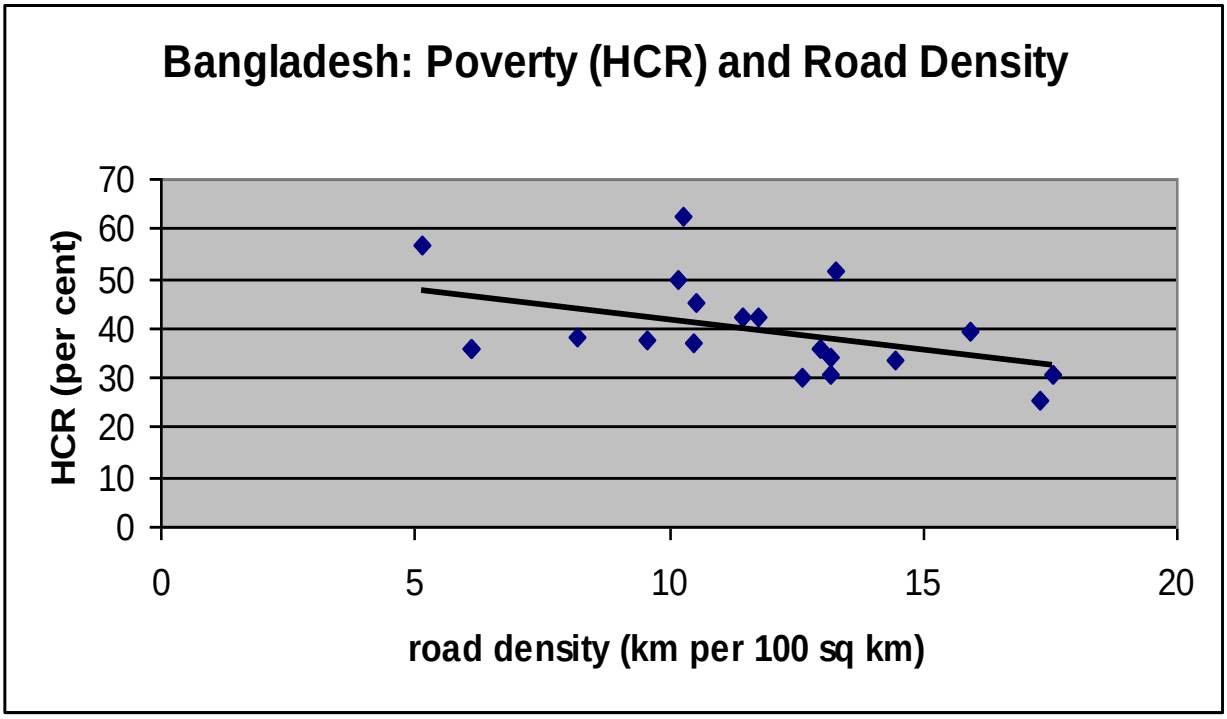
Table 13. Coefficient estimates from regressions with state-level data

	Dependent variable: HCR	Dependent variable: Births attended by skilled personnel	
Independent variables			
Constant term	213.5093 (3.64**)	-200.7764 (-3.12**)	-144.0488 (-2.23*)
Road density		.0361187 (1.05)	NA
Surfaced road density	-.0001256 (-0.22)	NA	.0014602 (2.29*)
Log(per capita NSDP)	19.03279 (-3.15**)	24.6083 (3.74**)	18.62013 (2.80*)
Dummy for coastal regions	5.984682 (1.13)	16.66469 (2.68*)	13.2247 (2.27*)
Number of observations	22	22	22
Adj R-squared	0.3434	0.6819	0.7386

NA = not available

96. While there is not enough data for regression analysis for Bangladesh, we do find that regional variations in poverty there are highly correlated with road infrastructure (Figure 13).

Figure 13. Road density and regional poverty (HCR) in Bangladesh



Source: Bangladesh: Regional Poverty Profile 1999, Focus Study No. 4, MIMAP, IDRC.
idl-bnc.idrc.ca/dspace/bitstream/10625/27441/1/118893.pdf

96. In general, cross-section data fails to capture well the negative relationship between roads and poverty. For example, using an econometric model for the determination of rural poverty based on data from 1957–58 to 1990–91 on 15 Indian states, Datt and Ravallion (1998) do not find a statistically significant relationship between rural road density and poverty. However, they do find that initial endowments of other physical infrastructure play a major role in influencing trends in poverty reduction.

97. Some studies based on cross section analysis find a significant negative relationship between poverty and roads. Kwon (2000), for example, for Indonesia estimates a growth elasticity of poverty of -0.33 for provinces with good roads and -0.09 for those with bad roads. That is, 1% growth in provincial GDP leads to a .33% decrease in poverty in the good-road provinces.[12] Similarly, Fan et al. (2002) find that roads reduce poverty by increasing agricultural productivity and non-agricultural employment. They estimate elasticities with respect to road density as 0.08 for agricultural GDP per worker, 0.10 for non-agricultural employment, and 0.15 for wages of non-agricultural workers in rural areas.

[12] Ali and Pernia (2003) summarize the findings of several such studies.

VI. POLICIES AND COMPLEMENTARY INVESTMENTS FOR MAXIMIZING IMPACT ON THE POOR

98. The discussion so far has indicated a strong relationship between infrastructure and poverty. But the extent of the impact depends on policies and complementary investments that encourage the efficient use of infrastructure facilities. Moon and Roehrl (2005), for example, suggest that the development of physical infrastructure is likely to be successful in delivering growth when there are strong non-physical supporting networks such as formal and informal communication channels within and between organizations, often commercial, social, economic, or political in nature. While infrastructure projects alleviate physical obstacles, man-made obstacles such as regulations, procedures, controls, and laws may reduce the savings in time and money generated by such projects. Harmonization and simplification of rules and elimination of inefficient procedures by following best practices is essential to exploit the potential benefits of regional infrastructure. For example, the usual obstacles, such as customs clearance, visa requirements, and restrictions on local people using their own vehicles in other countries have to be eased (Arvis et al. 2007). Legitimate security concerns and issues such as illegal trade in drugs need to be addressed without restricting trade too much. Excessive restrictions could lead to corruption and promote more informal and illegal trade. This is part of the reason why there is considerable informal trade between the South Asian countries. Informal trade between India and Bangladesh is as high as official trade; between India and Nepal it is found to be eight to ten times higher than official figures.

99. A supportive policy framework is essential for realizing the full potential gains from cross-border infrastructure projects. Undue restrictions on the movement of goods across borders can be reduced by simplifying customs procedures through reduced paper work and harmonization of technical standards. Technological modernization of land customs stations at the borders—computerization and the e-filling of administrative documents, connecting all custom points via a common network, usage of e-business, and permitting single-window customs clearance at all border crossings—can bring savings in time and money. If trade intensity among the countries in the region increases due to these measures, regional cooperation becomes more attractive. Song (2005), for example, points to empirical evidence that regional integration agreements among open economies develop faster compared to closed economies.

100. Poor people living in remote border areas do not always have access to cross-border infrastructure and are isolated from economic activities and social services. Improving transport facilities, such as community access roads and their connections to the main network, raises these people's productivity by providing access to markets and income opportunities and by stimulating economic activities. Increasing access to the poor requires broadening the range of services that meet their preferences and the ability to pay. In designing infrastructure policies and programs, taking account of the poor's geographic location, topography and density; ethnicity, customs, literacy, preferences and ability to pay; and their ownership and special ways of managing resources and time would be essential for specifically reaching the poor. For example, it is easier to bring roads to the poor if road technology, construction, operation, and maintenance are chosen appropriately (Fay and Yepes 2003).

101. Appropriate pricing and regulatory mechanisms are also needed to make services accessible, particularly to the poor. Notwithstanding large public spending on basic infrastructure services, including under-pricing and subsidies, large numbers of poor people in developing countries do not have access to them. Utility subsidies usually do not reach the poor either because they are not connected to the networks or cannot pay high unit prices and fixed charges, or the subsidies are mostly quantity-based, benefiting the non-poor (Komives et al. 2005). World Bank (2006) for example notes that poverty-focused public infrastructure projects were not producing the intended benefits in many countries, often due to intractable institutional and policy constraints: subsidy schemes regularly failed to reach the intended beneficiaries, and block electricity tariffs benefited the middle class, while high fixed charges kept the poor away.

102. Switching in the 1980s and 1990s to new initiatives in infrastructure services with a direct impact on poverty (participatory approaches, pro-poor regulation of a wider range of service providers, and improved targeting of subsidies), World Bank (2006) drew the following lessons: (i) reduce service costs and improve service delivery in ways that specifically meet the needs of the poor; (ii) utilize local resources and improve targeting and administration of public spending to reduce costs; (iii) involve local communities to ensure accountability, ownership, and sustainability of infrastructure services; (iv) replicate at a larger scale when the commitment of local and national governments is sustained; and (v) create an enabling overall institutional and policy environment to expand the services for wider coverage.

103. Agreements between subnational and federal governments may be as important as those among transnational governments in raising the rate of return on cross-border infrastructure investments (Tanzi 2005). This is because regional infrastructure is built inside national boundaries and is used much more within the host country. Sustainability of benefits requires adequate operational and maintenance expenditure, which can be made possible by involving the local community, ensuring ownership and accountability. the World Development Report (WDR 2004) for example summarizes the lessons learned in making services reach the poor through systems of accountability. In short, governance and institutional mechanisms for operation and maintenance need to be strong for an effective link between infrastructure and poverty reduction.

104. A major challenge to the RCI process is to ensure reasonable benefits to all participating countries. If benefits from increased trade/FDI are highly skewed it may undermine regional integration efforts. The uneven spread of benefits from RCI can be further enhanced by agglomeration effects, which are realized when there is clustering of economic activities. There can also be efficiency gains due to scale economies and increased specialization in support services. This may lead to further divergence in income gains for countries within the region. However, for smaller landlocked countries regional integration may be the only way to attract greater FDI and increased trade.

105. Benefits from integration are better when national regulations and policies are conducive to raising productivity. Deriving greater benefits from regional infrastructure requires linking of lagging and leading areas within countries. Countries with better initial infrastructure will attract more industrial activities and may initially grow faster but lagging areas will eventually catch up as markets will drive factors of production to move to these neighborhoods. Network-externalities from transport corridors are greater as more areas (and hence users) are linked to the corridor. That is, the utility of a cross-

border connection multiplies as more and more local networks link to this corridor (Moon and Roehrl 2005).

106. The challenge is to balance political and economic considerations to sustain the integration efforts when gains and losses are uneven across countries. Appropriate cross-country compensation mechanisms can be designed to share the benefits between leading and lagging countries. This issue can be resolved if richer countries compensate the poorer ones, for example, by subsidizing their infrastructure development, sharing customs revenues, or running special aid programs. Such experience has been noted in the European Union and the Association of Southeast Asian Nations (World Bank 2009).

VII. SUMMARY AND CONCLUSIONS

107. This study has examined the potential for regional cooperation in terms of the efficient use of cross-border infrastructure and its poverty reduction potential. It has provided a framework to analyze the links between cross-border infrastructure and poverty and examined empirically how infrastructure affects poverty or its correlates. It has also discussed the complementary policies and investments that would be required to maximize the impact of regional infrastructure on the poor.

108. South Asia suffers from high levels of poverty and poor human development indicators. The region's poor infrastructural development poses a serious hurdle to productivity increase and competitiveness. The quality of transport infrastructure and access to electricity and communication infrastructure facilities are way below those of the industrialized nations. It is therefore not surprising that for most countries infrastructure development is a key element in poverty reduction strategies. The landlocked countries, Nepal and Bhutan, place particular emphasis on cross-border infrastructure. Because cross-border infrastructure has the potential to speed up the process of achieving MDGs national governments can incorporate RCI into their poverty reduction strategies.

109. The existing inefficiencies in transportation and trade facilitation indicate that the potential for regional cooperation is large and regional integration through connectivity infrastructure can help step up industrial investment levels and unlock the growth potential in the region. Poor quality trade and transport infrastructure results in high costs of trading hurting domestic and international trade. The region's share of world trade is as low as 2% and that of FDI is 1.5%, while only around 4% of its trade is intraregional. The region also scores low on the World Bank's Logistics Performance Index that is constructed based on various aspects of trade facilitation, including customs procedures and trade logistics. Trade costs are high, especially for landlocked Bhutan and Nepal. Lack of adequate regional cooperation leads to use of inefficient transport routes increasing the costs of trade in both time and money. There are large potential cost savings therefore through regional cooperation, while the scope for cross-border trade in electricity is remarkable, with Bhutan's and Nepal's hydropower resources far in excess of their requirements.

110. Cross-border infrastructure has direct and indirect impacts on poverty. The direct impacts include increased opportunity for income-generating activities for local people: creation of employment in construction and operation and maintenance activities.

Increased access to markets, health and education services, and price benefits through a reduction in transport margins are also some of the direct benefits. Road infrastructure affects poverty directly by increasing access to markets, schools, and health services. The development corridor approach encourages small business and other employment opportunities and, in general, raises the productivity of resources owned by the poor. Increased access to communication infrastructure directly influences poverty by reducing information and transaction costs for small farmers and small businesses and by lowering the necessity of traveling for communication purposes. Cross-border trade in electricity/energy can potentially increase the poor's access to cleaner fuels with associated health benefits and by increasing the quality of health and education services.

111. Apart from its direct influence on poverty, infrastructure affects poverty indirectly by increasing productivity and growth in the economy. Cross-border infrastructure, by reducing transportation/trade costs, increases trade and FDI flows in the region, leading to efficiency in production and growth and hence poverty reduction. Trade affects poverty by affecting the prices of goods consumed by the poor or the prices of goods sold by the poor. The construction of power transmission lines and interconnection of electricity grids of countries would help optimize the system capital and operating costs, leading to productivity improvements in the interconnected countries.

112. Both macro- and micro-level evidence in the literature (mostly relating to road infrastructure) suggests significant positive impact on poverty alleviation. Studies based on household survey data and evaluation studies of projects provide evidence of a substantial increase in market access and diversification of income sources for households from road improvements and better connectivity. There is also evidence that in addition to significant poverty decline, rural roads resulted in substantially improved access to health and education services. Macro-level studies based on CGE models also show that regional cooperation in transport and trade facilitation result in significant gains in GDP, trade, and welfare to countries involved.

113. In the empirical analysis conducted for this study, cross-country data were used to study the impact of road infrastructure on the social indicator, life expectancy at birth. A poverty variable could not be used as the dependent variable due to large number of missing observations. The coefficient estimates suggest that road density is a significant parameter in explaining the variation in life expectancy at birth across different countries. Social and infrastructure indicators are, on average, lower among landlocked countries. The coefficient estimates indicate that life expectancy at birth is more responsive to road density in landlocked countries. Both cross-country and panel data estimation give similar results.

114. Regression estimates using within-country, state-wise data for India indicate that surfaced road density has a positive impact on access to health services (births attended by skilled staff) that is statistically significant. As in the cross-country case, there is substantial variation within country in infrastructural stocks and social indicators. In general, coastal regions have better infrastructure and social indicators compared to other regions. Significant negative correlation between poverty and road density is also found across geographical regions within Bangladesh.

115. Though there is enough evidence on the positive impacts of infrastructure on poverty reduction, the extent of such benefits is determined by complementary policies and investment that are needed to make best use of the facilities. Maximizing benefits

would require within-country infrastructure development, for example, national feeder roads to improve transport links between industrial/commercial centers and the border. For power infrastructure, providing direct benefits to the poor is only possible if complementary investments are made to connect them. This is especially the case for rural people, a large fraction of whom lack access to electricity. Appropriate pricing, subsidy, and regulatory mechanisms are needed to make services accessible, particularly to the poor, and to ensure subsidies actually reach the poor. Governance and institutional mechanisms for operation and maintenance need to be strong for an effective link between infrastructure and poverty reduction.

116. To sum up, the potential benefits of regional cooperation can be large by making the best possible use of existing cross-border infrastructure and developing new connectivity infrastructure. Poverty is affected significantly through various direct and indirect channels. Currently, however, political considerations seem to outweigh the economic in the regional integration process, as exemplified by the inefficient trade routes used by some countries. By promoting cross-border infrastructure, multilateral financing agencies such as the ADB can foster greater RCI in South Asia. As a way of building trust, initial focus can be restricted to areas that are not politically sensitive. The region's substantial poverty mean that greater regional cooperation and integration would be in the interest of the poor.

117. The attractiveness of RCI is greater when the countries involved are more open to trade with each other. Therefore, in terms of program priorities, multilateral agencies can start by supporting complementary and related investments, such as trade facilitation measures, harmonization of standards, and simplification of customs procedures that can boost intraregional trade. To begin with, countries need to be encouraged to use existing connectivity infrastructure optimally, upgrading the infrastructure if necessary or starting with projects with low gestation periods. Multilateral agencies can play an important role in initiating regional integration processes by financing a single cross-border infrastructure project and demonstrating the potential benefits. To maximize the impact on poverty, financial support may be needed to build national governments' capacity to implement the required complementary policies. Finally, support would also be needed for corridor development (as seen in the GMS) and to set up links connecting remote and isolated border areas to cross-border infrastructure such as highways, railways, and communication links. This is especially useful for areas isolated from market centers but relatively closer to neighboring country's markets. With better cross-border connectivity in place, the focus can shift to building networks and reaping network externalities.

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