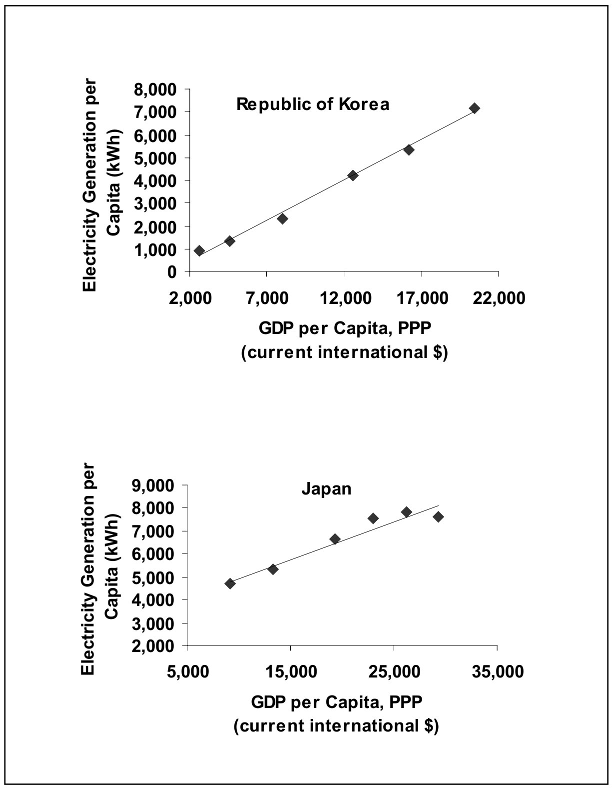
II

Infrastructure in Asia and the Pacific

Infrastructure plays an important and diverse role in the economy. Because infrastructure demonstrates characteristics of both intermediate and final products, defining its role is not an easy task. As an intermediate good or service, infrastructure generally facilitates the mobility of factors of inputs to production and the flow of information, thereby reducing market imperfections, improving productivity, and stimulating growth. As a final good, consumption of infrastructure services directly affects the quality of people's lives. While it is difficult to quantify how much infrastructure affects growth (or production) and how much infrastructure (as a final good or service) results from (or is demanded due to) growth, the association of infrastructure with growth is unmistakable. This is illustrated by Figure 1, which shows the increasing quantity of electricity generation with rising income levels in two Asian Organisation of Economic Co-operation Development (OECD) countries—the Republic of Korea and Japan.

Infrastructure development is also directly linked to poverty reduction. In particular, market imperfections resulting from a lack of adequate infrastructure leads to monopolistic pricing, particularly in rural areas, that hurt the poor. Inadequate infrastructure also hinders the market participation of the poor, thereby, perpetuating their poverty. Moreover, the growth of infrastructure in Asia lags behind that of its economic growth. DMCs' development plans give a high priority to infrastructure, which shows their clear recognition that inadequate infrastructure constrains their potential for growth, reduces their international competitiveness, and undermines their poverty reduction efforts.

Figure 1: Electricity Generation versus Income Level in the Republic of Korea and Japan, 1980–2004



GDP = gross domestic product; kWh = kilowatt-hour; PPP = purchasing power parity.
Sources: Energy Information Administration, International Energy Annual 2004 (http://www.eia.doe.gov/pub/international/iealf/table63.xls); and World Bank, World Development Indicators Online (http://devdata.worldbank.org/dataonline/).

A. Status and Growth Rate

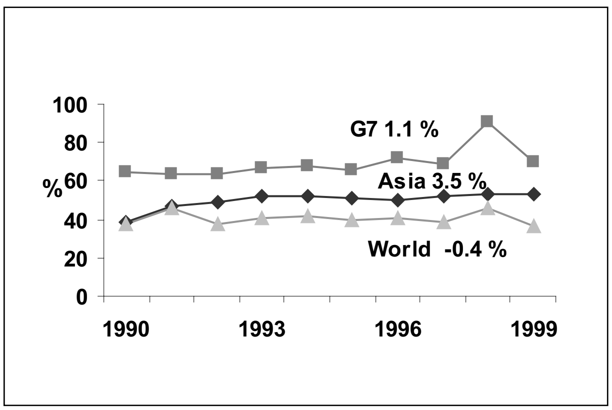
During the last few decades, the Asia and Pacific region has shown a mixed pattern of development of infrastructure (Table 1 and Appendix tables 1.1–1.16).

Table 1: Comparing Infrastructure in Asia, Industrialized Countries, and the World

Infrastructure Indicator	Latest Year	Asia [a]	Average Growth Rate, 1990–Latest Year	G7 [b]	Average Growth Rate, 1990–Latest Year	World	Average Growth Rate, 1990–Latest Year
Total Road Network (1,000 km)	1999	5,663.02	1.80	10,609.98	0.29	26,072.04	0.60
Rail Lines (1,000 total route-km)	2003	162.26	0.02	308.54	-1.40	…	…
Net Electricity Generation (bn kWh)	2004	4,002.58	8.41	7,274.63	1.69	16,599.09	2.77
Proportion of Population with Access to an Improved Water Source (%)	2004	81.40	0.90	100.00	-	82.75	0.55
Proportion of Population with Access to Improved Sanitation (%)	2004	45.00	4.20	100.00	-	57.17	1.68
Irrigated Land as a Proportion of Arable Land (%)	2003	38.16	1.00	11.88	0.90	19.76	0.91
Telephone Lines and Cellular Subscribers (millions)	2004	991.17	25.80	934.82	7.90	2,965.00	12.61

… = Data not available; - = Magnitude equals zero; km = kilometer; kWh = kilowatt-hour.
[a] Asia refers to ADB's developing member countries.
[b] G7 includes Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States.
Sources: World Bank, World Development Indicators Online (http://devdata.worldbank.org/dataonline/); International Road Federation, World Road Statistics CD-ROM 2004; Energy Information Administration, International Energy Annual 2004 (http://www.eia.doe.gov/pub/international/iealf/table63.xls); United Nations Statistics Division, Millennium Development Goals Indicators (http://mdgs.un.org/unsd/mdg/Data.aspx); United Nations, World Urbanization Prospects—the 2005 Revision Population Database (http://esa.un.org/unup/); Food and Agriculture Organization of the United Nations, FAOSTAT database online (http://faostat.fao.org/, downloaded 10 August 2006); and International Telecommunication Union, Key Global Telecom Indicators for the World Telecommunication Service Sector (http://www.itu.int/ITU-D/ict/statistics/ at glance/Key Telecom99.html).

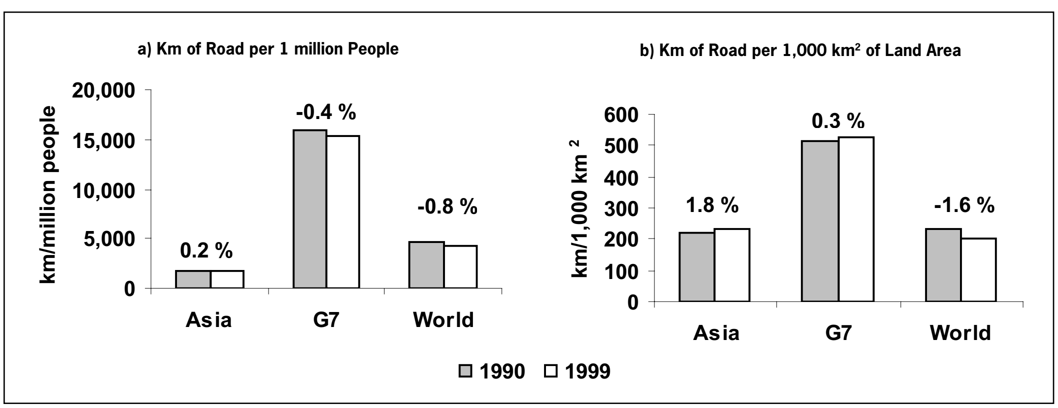
Figure 2: Paved Road as a Proportion of the Total Road Network in Asia, Industrialized Countries, and the World, 1990–1999



Notes: Asia refers to ADB's developing member countries. G7 includes Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States. Growth rates during 1990–1999 are given in %.
Source: World Bank, World Development Indicators Online (http://devdata.worldbank.org/dataonline/).

Roads.[5] In 1999, the region's total road network comprised 5.66 million kilometers (km) (Appendix tables 1.2-1.5), 53.4% of which was paved. This is significantly lower than the 69.6% in industrialized countries (Figure 2 and Appendix tables 1.2-1.5).[6] The region has 1,786 km of road network per 1 million people, whereas the world has 4,356 and industrialized countries have 15,304 (Figure 3). With 235 km of road network per 1,000 square kilometers (km^2), the region compares better with corresponding figures for the world at 201 and industrialized countries at 529.

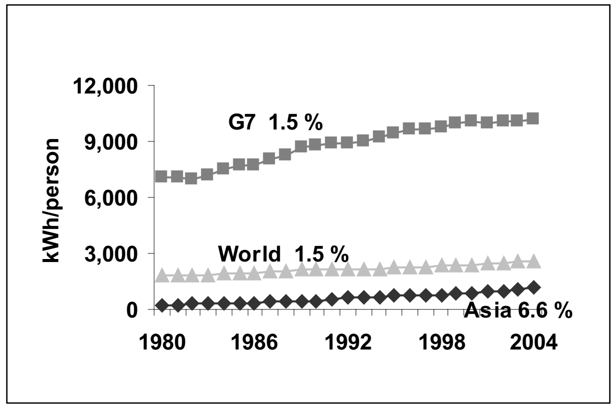
Figure 3: Road Network Indicators in Asia, Industrialized Countries, and the World, 1990 and 1999



km = kilometer; km^2 = square kilometer.
Notes: Asia refers to ADB's developing member countries. G7 includes Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States. Growth rates from 1990 to 1999 are given in %.
Source: World Bank, World Development Indicators Online (http://devdata.worldbank.org/dataonline/).

During 1990–1999, the total road network in Asia and the Pacific grew at a higher average annual rate (1.8%) than that of the world (0.6%) or industrialized countries (0.3%).[7] The total road network in Asia and the Pacific also grew faster per person (at 0.2% per annum) and per land area (1.8%) than in industrialized countries and the world (Figure 3). During this period, the proportion of paved road in the total network increased at the impressive average annual growth rate of 3.5%, which was also higher than the industrialized countries' and global averages (Figure 2). These higher growth rates reflect the region's low bases. However, at the current growth rate, the region would take about 45 years, to have the current level of road per land area in industrialized countries,[8] and this would involve building about 7 million km of additional roads, more than doubling the present coverage.

Figure 5: Net Electricity Generation per Capita in Asia, Industrialized Countries, and the World, 1980–2004

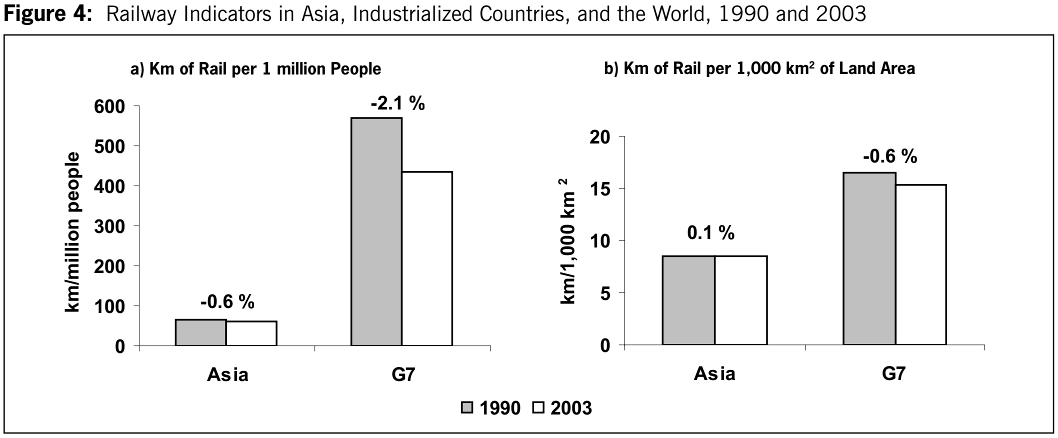


kWh = kilowatt-hour.
Notes: Asia refers to ADB's developing member countries. G7 includes Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States. Growth rates during 1980–2004 are given in %.
Sources: Energy Information Administration, International Energy Annual 2004 (http://www.eia.doe.gov/pub/international/iealf/table63.xls); and World Bank, World Development Indicators Online (http://devdata.worldbank.org/dataonline/).

Railways. In 2003, the region's total rail network measured 162,258 route-km. The gap in the rail network per person and per land area between the region and the industrialized countries, without taking into account the difference in geography and population distribution, is significant. In 2003, the region had 59 route-km per 1 million people, which was less than one seventh of the industrialized countries' level at 434.7 (Figure 4 and Appendix tables 1.6-1.8). The region's rail network per 1,000 km^2 of land was 8.6 route-km; this compared better with industrialized countries, as it was about half their level of 15.4 route-km. In 1980, the region's total rail network measured 145,018 route-km. Only 16,797 route-km were added during 1980–1990 and 443 route-km during1990–2003, or an average annual growth rate of 1.1% during 1980–1990 and 0.02% during 1990–2003. Thus, the total increase was only 17,240 route-km in about 2.5 decades. The growth stagnated after 1990 in terms of land area, but declined by an average 0.6% per person due to population growth. In industrialized countries, the rail network declined on both measures. Since railways need a minimum traffic volume, particularly in freight transport, most viable routes may already be connected by rail. Rapid growth and technological advancement in alternative transport options, including road and air, has generated considerable competition for railways. Much of the development in the region's railways has been in route capacity, rolling stock, technology, and efficiency rather than in creation of new routes.

Electricity. In 2004, the region generated over 4,000 billion kilowatt-hours (kWh) of net electricity, or 1,181.4 kWh per person (Figure 5 and Appendix

Figure 4: Railway Indicators in Asia, Industrialized Countries, and the World, 1990 and 2003



km = kilometer; km^2 = square kilometer.
Notes: Asia refers to ADB's developing member countries. G7 includes Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States. Growth rates during 1990–2003 are given in %.
Source: World Bank, World Development Indicators Online (http://devdata.worldbank.org/dataonline/).

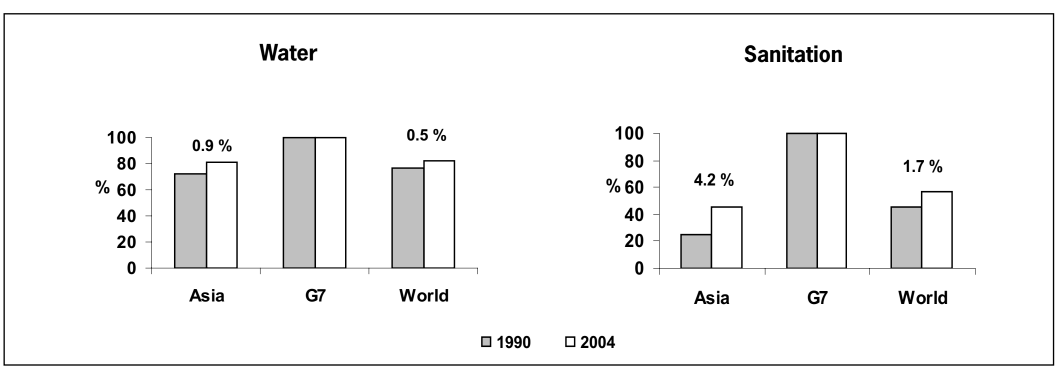
tables 1.9-1.10). The latter is much lower than in industrialized countries (10,192.4 kWh per person) and the world (2,607.9). However, given the low base, the growth of electricity generation in Asia and the Pacific in the last few decades has generally been impressive. During 1990–2004, the total and per capita net electricity generation in the region grew at average annual rates of 8.4% and 6.7%, respectively, both nearly tripling. Further, both growth rates accelerated slightly during 1990–2004 compared with 1980–1990. As energy is a key input to growth and poverty reduction, it is imperative that electricity generation in the region should rise quickly. However, at the current rate of growth, it will take 34 years for the region to reach the 2004 level of per capita net electricity generation in industrialized countries. This huge challenge, is further complicated by the potential impact on local and global environments, which has implications for the energy sector's sources, energy's uses, and technology.[9]

Water. In 2004, only 81% of the region's total population had access to improved water source (Figure 6 and Appendix tables 1.11-1.12). About 638 million people had no access to an improved water source. In the industrialized countries 100% of the population has had access to improved water source for several decades; the global figure is 82.7%. During 1990–2004, the percentage of population with access to an improved water source increased at a modest average rate (0.9% per annum). The significant gap and slow progress in this vital service, which is particularly important for the health and well-being of the poor, poses a major challenge. The magnitude of the challenge is illustrated by the fact that, at the current rate of growth, Asia and the Pacific would only achieve 100% access to improved water source in about 23 years. The actual time could be longer, as the pending tasks are more difficult to achieve than those already accomplished.

Sanitation. In 2004, only about 45% of the region's total population or 1.5 billion people had access to improved sanitation (Figure 6 and Appendix tables 1.11-1.12)—a whopping 1.9 billion people in the region were without access to improved sanitation. This is major concern, especially given the impact on the health and well-being of the poor. The region's access to improved sanitation compares poorly with both industrialized countries (100% of the population), and the world (57.2%). Given the very low level, the task ahead is a very serious challenge. During 1990–2004, the proportion of population with access to improved sanitation increased at a faster pace (an average annual growth rate of 4.2%) than that for access to improved water source, largely reflecting the lower initial coverage for improved sanitation. At the current rate, it will take about 19 years to achieve 100% access to improved sanitation, but it may be difficult to maintain this rate.

Irrigation. In 2003, Asia and the Pacific had 169.2 million hectares of irrigated land—38.2% of the total arable land (Appendix tables 1.13-1.14). During the last 2.5 decades, the region's irrigated land area has increased only modestly—the average annual growth rate was 1.4% during 1980–1990 and 1.8% during 1990–2003, or a 0.5% increase in the proportion of irrigated land in 1980–1990 and 1.0% in 1990–2003. Because the need for irrigation is largely governed by each country's geography and climate, a comparison with industrialized countries is not very meaningful.

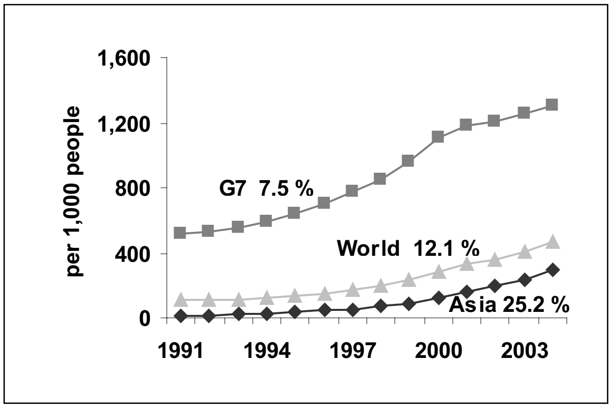
Figure 6: Proportion of Population with Access to an Improved Water Source and Improved Sanitation in Asia, Industrialized Countries, and the World, 1990 and 2004



Notes: Asia refers to ADB's developing member countries. G7 includes Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States. Growth rates from 1990 to 2004 are given in % and exclude countries with no data in reference year. The G7 countries with data have 100% access to improved water source and sanitation in both 1990 and 2004.

Sources: United Nations Statistics Division, Millennium Development Goals Indicators (http://mdgs.un.org/unsd/mdg/ Data.aspx); World Bank, World Development Indicators Online (http://devdata.worldbank.org/dataonline/); and United Nations, World Urbanization Prospect—The 2005 Revision Population Database (http://esa.un.org/unup/).

Figure 7: Telephone Density in Asia, Industrialized Countries, and the World, 1991–2004



Notes: Asia refers to ADB's developing member countries. G7 includes Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States. Growth rates during 1991–2004 are given in %.
Sources: United Nations Statistics Division, Millennium Development Goals Indicators (http://mdgs.un.org/unsd/mdg/Data.aspx); International Telecommunication Union, Key Global Telecom Indicators for the World Telecommunication Service Sector (http://www.itu.int/ITU-D/ict/statistics/at_glance/KeyTelecom99.html); and World Bank, World Development Indicators Online (http://devdata.worldbank.org/dataonline/).

Telecommunications.[10] In 2004, the region had about 991.2 million telephone lines and cellular subscribers ("telephone coverage"), or about 295 per 1,000 people ("telephone density"), as indicated in Figure 7 and Appendix tables 1.15-1.16. This is much lower than the 1,310 telephone density of industrialized countries. During the recent past, this sector has shown the most dramatic growth in Asia and the Pacific. During 1990–2004, the region's total telephone coverage grew at an average annual rate of 25.8%, which is above a 20-fold increase in telephone density in less than 1.5 decades. Telephones also attracted substantial private investment and successfully demonstrated the potential of private sector participation in infrastructure. Reflecting the spectacular growth, the gap between the region and industrialized countries declined sharply but remains significant. At the current growth rate it will take less than 7 years for the region to match the current density in industrialized counties; however, given the current high baseline, it may be difficult to maintain this impressive growth rate.

Conclusion. Despite modest to good growth in infrastructure during the last few decades, the region continues to lag significantly behind the industrialized countries in most infrastructure services. At the current rates of growth, Asia and the Pacific will take close to half a century to broadly reach the levels of infrastructure currently enjoyed by the industrialized countries.

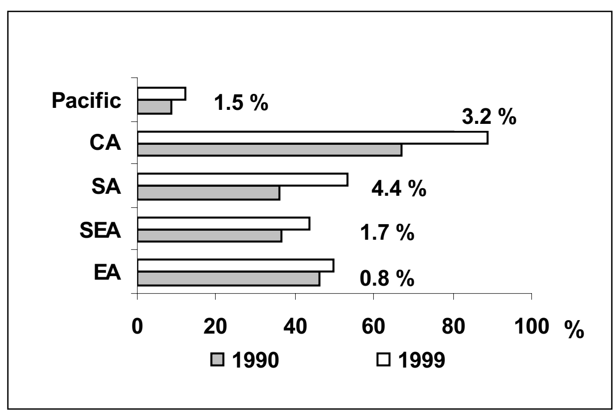
B. Diversity

Country data vary considerably in quality, coverage, reliability and timeliness. Accordingly, comparisons of the data between countries should be treated with a degree of caution. Nevertheless, the data in Appendix tables 1.1–1.16 clearly show a wide diversity in the stock and growth of infrastructure across Asia and the Pacific.

Roads.[11] In 1999, Central Asia had the highest proportion of paved road to total road network at 88.8%, while the Pacific had a low ratio of 11.9% (Figure 8 and Appendix tables 1.2-1.5).[12] Most Central Asian DMCs had a high proportion of paved roads (above 80%). Other countries with a substantial proportion of paved roads include Thailand (97.5%) and Malaysia (75.3%). However, several large countries, including India (57.4%) and Pakistan (55.0%), had only slightly more than half their total road network paved, and Indonesia was lower at 46.3%. Several DMCs have a very low proportion of paved roads, e.g., Philippines (20%), Cambodia (16.2%), Afghanistan (13.3%), Bangladesh (9.5%), and Mongolia (3.5%). Several Pacific DMCs had a very low proportion of paved roads.

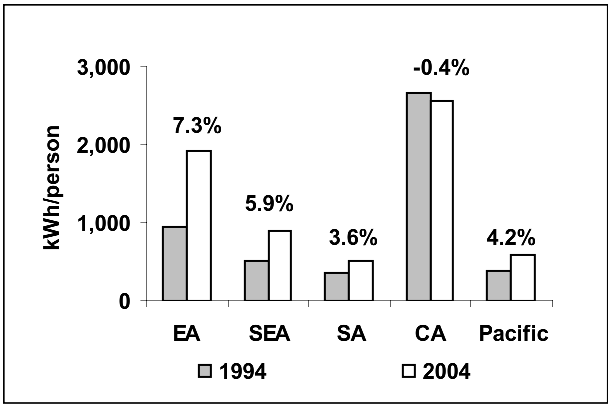
In 1999, in terms of road network per 1,000 km^2 of land, South Asia (635.3 km/1,000 km^2) presented the best picture and the other extreme was the Pacific (53.9). At the same time, Central Asia (4,507) and the Pacific (3,947) had a more extensive road network per 1 million people, while East Asia (1,146) had the lowest among the five subregions.

Figure 8: Paved Road as Proportion of Total Road Network in Asia by Subregion, 1990–1999



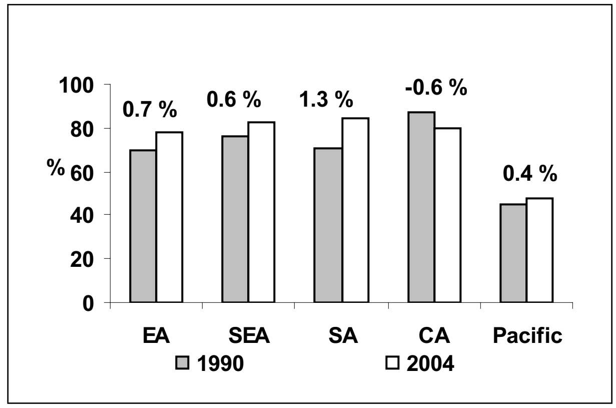
CA = Central Asia; EA = East Asia; SA = South Asia; SEA = Southeast Asia.
Note: Growth rates during 1990–1999 are given in %.
Source: World Bank, World Development Indicators Online (http://devdata.worldbank.org/dataonline/).

Figure 9: Net Electricity Generation per Capita in Asia by Subregion, 1994–2004



CA = Central Asia; EA = East Asia; kWh = kilowatt-hour; SA = South Asia; SEA = Southeast Asia.
Note: Growth rates during 1994–2004 are given in %.
Sources: Energy Information Administration, International Energy Annual 2004 (http://www.eia.doe.gov/pub/international/iealf/table63.xls); and World Bank, World Development Indicators Online (http://devdata.worldbank.org/dataonline/).

Figure 10: Proportion of Population with Access to an Improved Water Source in Asia by Subregion, 1990 and 2004



CA = Central Asia; EA = East Asia; SA = South Asia; SEA = Southeast Asia.
Note: Growth rates during 1990–2004 are given in % and exclude countries with no data in reference year.
Sources: United Nations Statistics Division, Millennium Development Goals Indicators (http://mdgs.un.org/ unsd/mdg/Data.aspx); World Bank, World Development Indicators Online (http://devdata.worldbank.org/ dataonline/); and United Nations, World Urbanization Prospects—The 2005 Revision Population Database (http://esa.un.org/unup/).

During 1990–1999, the total road network in East Asia and South Asia expanded at more than 2% per annum on average, while the total road network in Central Asia shrank by more than 2%. Individual countries also showed a substantial diversity in growth of road network. For example, that in Pakistan (3.2%) and India (2.6%) showed good growth but several Central Asian countries experienced decline. The growth of total paved roads displayed a similar pattern. The fastest growth among the five subregions was in South Asia (average 4.4% per annum) and the slowest in East Asia (average 0.8% per annum).

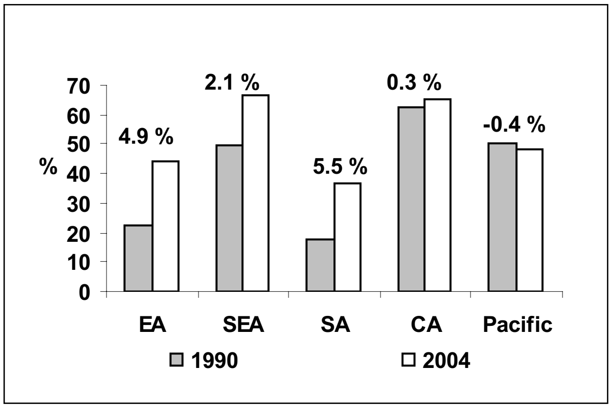
In summary, in terms of proportion of paved road, Central Asia has good coverage but total road network is decreasing; and in South Asia and East Asia it is growing, partly reflecting the low bases from which they began. In four subregions, ADB could support expansion of the road networks. The main challenge in Central Asia is to maintain and upgrade the previously centrally managed road network.

Railways. Few countries in Asia and the Pacific have a sizable railway network. In 2004, India with 63,122 route-km, the People's Republic of China (PRC) with 60,446, and Kazakhstan with 13,770 accounted for 85% of the region's railway network (Appendix tables 1.6-1.8). About half the DMCs, including all Pacific DMCs, have no or very little rail network. The PRC was the only country with a sizable railway network to record growth above 1% per annum during 1993–2003. In terms of railway network per 1,000 km^2 of land, only Azerbaijan (25.7 km), Armenia (25.2 km), and India (21.2 km) in developing Asia exceed the average level in industrialized countries.[13] In summary, the development of railways in the region is quite skewed. The PRC and India alone account for over three-fourths of the total rail network in the region.

Electricity. In 2004, while Central Asia's net electricity generation per capita was 2,573.6 kWh, the corresponding figures for the Pacific were only 583.5 kWh per person and for South Asia, only 514.7 kWh (Figure 9 and Appendix tables 1.9–1.10). The DMCs show a wide diversity in net electricity generation per capita. While Bhutan, Malaysia, Nauru, Thailand, and most Central Asian countries had net electricity generation per capita of 2,000–4,000 kWh, countries such as Nepal (88.64 kWh), Afghanistan (31.65), and Cambodia (9.49) presented the other extreme.

All subregions of Asia and the Pacific except Central Asia experienced an average growth rate in net electricity generation above 5.5% per annum during 1994–2004. East Asia (8.2%) and Southeast Asia (7.5%), which showed good economic growth, were also the two best performers in net electricity generation, while Central Asia was nearly stagnant with average growth in net electricity generation at 0.4% per annum and a decline in per capita terms (-0.4% per annum). The Lao People's Democratic Republic (Lao PDR) (16%), Maldives (13.3%), and Viet Nam (12.8%) showed very high growth rates while net electricity generation in most Central Asian countries and Afghanistan grew at less than 1%. Cambodia experienced a decline in net electricity generation of 3.1%. On a related issue, the Asia and Pacific region's strong reliance on fossil fuel and energy related environmental neglect is serious

Figure 11: Proportion of Population with Access to Improved Sanitation in Asia by Subregion, 1990 and 2004



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Sources: United Nations Statistics Division, Millennium Development Goals Indicators (http://mdgs.un.org/unsd/mdg/Data.aspx); World Bank, World Development Indicators Online (http://devdata.worldbank.org/dataonline/); and United Nations, World Urbanization Prospects—The 2005 Revision Population Database (http://esa.un.org/unup/).

and is drawing strong global attention in relation to greenhouse gas (GHG) emission and climate change. In particular, the fossil fuel (particularly coal) use and high growth rate of energy consumption in the PRC and India is of serious concern to the global community.

In summary, the development and growth of electricity generation in the region is uneven showing differences in investment levels and policies. Central Asia has a high level of electricity generation per capita, but this has declined recently. Other subregions and countries generally showed good growth in electricity generation. The growth and level of net electricity generation also reflect a strong link with economic growth. Further, access to energy, particularly electricity, is a key factor affecting the achievement of the Millennium Development Goals (MDGs).

Water. Wide diversity in access to an improved water source[14] occurs among subregions and DMCs. The region's extremes in 2004 were South Asia, where 84.8% of the population have access to improved water sources and the Pacific, with only 47.8% (Figure 10 and Appendix tables 1.11-1.12). While in some DMCs (e.g., Armenia, Cook Islands, Federated States of Micronesia [FSM], Malaysia, Nepal, Pakistan, Thailand, Tonga, and Tuvalu) over 90% of their population had access to an improved water source, many other DMCs (e.g., Afghanistan, Cambodia, Tajikistan, and some Pacific DMCs) provided such access to less than 60% of their populations. In 2004, India at 86% had better access to an improved water source, while the corresponding proportion in the PRC was 77%, despite the PRC's higher per capita income.

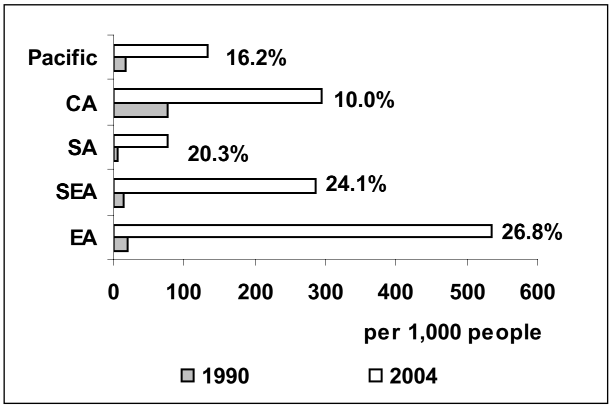
During 1990–2004, access to an improved water source in South Asia grew at average rate of 1.3% per annum, while in Central Asia the proportion of population with such access declined at an average rate of 0.6% per annum. Growth of access to an improved water source also varied significantly among DMCs. While Viet Nam (1.9%), Nepal (1.8%), and India (1.5%) showed modest per annum growth rate during this period, several countries experienced declines, including Kazakhstan, Kyrgyz Republic, Maldives, Philippines, Uzbekistan, and some Pacific DMCs.

Sanitation. In 2004, Southeast Asia at 66.6% had the region's highest proportion of population with access to improved sanitation and South Asia the lowest at 36.8% (Figure 11 and Appendix tables 1.11-1.12). Excluding the relatively more developed DMCs (Malaysia and Thailand), low access to improved sanitation was widespread in the region. In four of the eight South Asian DMCs, only less than 40% of their populations have access to improved sanitation; some DMCs (e.g., Cambodia, Lao PDR, and FSM) were below 30%. Even large countries like the PRC (44%) and India (33%) had more than half their population without access to improved sanitation.

Reflecting their low bases, South Asia and East Asia showed the fastest growth in proportion of population with access to improved sanitation, at 5.5% and 4.9% per annum, respectively, during 1990–2004. Pacific DMCs declined at 0.4% per annum. In individual countries, the PRC (4.7%), Myanmar (8.7%), and a majority of countries in South Asia (above 5%) showed good growth. However access to improved sanitation declined in the Kyrgyz Republic and FSM.

Telecommunications. Telecommunications coverage and density varies widely across subregions and countries (Figure 12 and Appendix tables 1.15-1.16). In 2002, telephone density was 366 in East Asia, which was about eight times higher than the corresponding figure (about 44) in the Pacific. Further, while the densities in the PRC, Malaysia, Maldives, the Philippines, and Thailand were 445–765, densities in about half of ADB's DMCs were below 100. Countries with very low telephone density included Nepal (20.1), Solomon Islands (16.1), and Myanmar (10.3). Except for Maldives and Sri Lanka in South Asia and Fiji Islands and Tonga in the Pacific, most countries in South Asia and the Pacific had densities below 100.

Figure 12: Telephone Density in Asia by Subregion, 1990–2004



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Note: Growth rates during 1990–2004 are given in %.
Sources: United Nations Statistics Division, Millennium Development Goals Indicators (http://mdgs.un.org/unsd/mdg/ Data.aspx); International Telecommunication Union, Key Global Telecom Indicators for the World Telecommunication Service Sector (http://www.itu.int/ITU-D/ict/statistics/at_ glance/KeyTelecom99.html); and World Bank, World Development Indicators Online (http://devdata.worldbank.org/dataonline/).

During 1994–2004, the average annual growth rate of telephone coverage in East Asia (30.3%), Southeast Asia (27.9%), and South Asia (24.4%) was very impressive (Appendix table 1.15). Most countries in the three subregions showed similar high annual growth rates. Conversely, the annual growth rate in the Pacific was modest (about 11% per annum) and in Central Asia was low (4.9%).

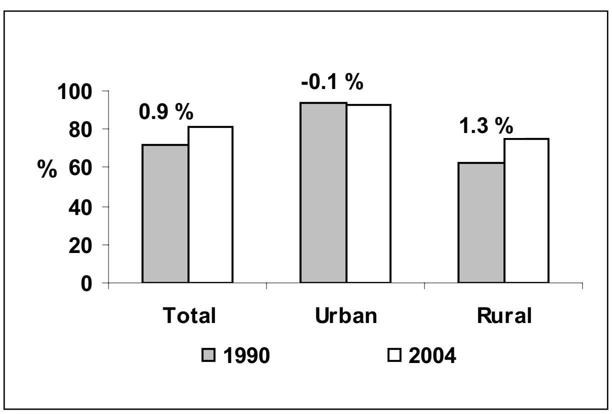
The growth rates do not reflect the existing telephone densities in these subregions. In 2003, East Asia's telephone density, at 448.7 was twice that of Southeast Asia (212.4) and eight times that of South Asia (56.3). However, all three subregions showed comparable growth rates. Further, the rapid expansion in three subregions was largely led by the private sector, reflecting major reforms undertaken in the DMCs. Conversely, telecommunications in Central Asia, with density of about 139, and the Pacific, with about 152, grew much more slowly. While the development in the Pacific may partly reflect small markets that constrain economies of scale, the weak performance in Central Asia largely reflects lack of an enabling environment. Low growth in two subregions and about half of ADB's DMCs amid high growth rates in the remaining countries clearly suggests differences in conditions required to facilitate commercialization and growth of telecommunications. Countries wishing to improve their telecommunications should take advantage of the successful models available within the region.

Overall, South Asia lags behind East and Southeast Asia, while the Pacific and Central Asia face specialized challenges in infrastructure development. The PRC and India are the two largest countries in the region and are among ADB's largest borrowers. Their infrastructure development is compared separately in Box 1 and Appendix 2.

C. The Rural-Urban Divide

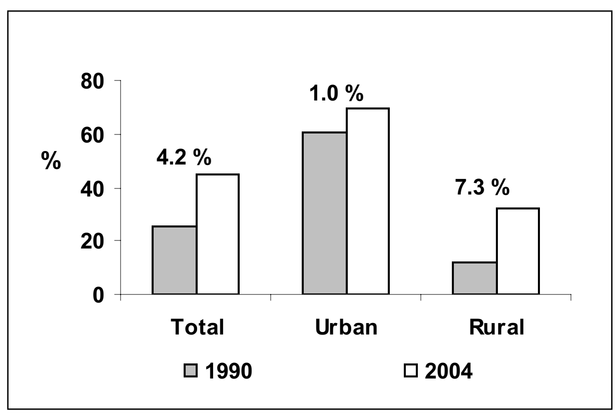
A substantial gap exists in development of infrastructure between the rural and urban areas of Asia and the Pacific. For example, in 2004, while 93% of the region's urban population had access to an improved water source, only 75% of rural people had access (Figure 13 and Appendix tables 1.11-1.12). The same pattern is true of most countries individually. In most countries in the region, over 90% of the urban population had

Figure 13: Asia's Access to an Improved Water Source in Urban and Rural Areas, 1990 and 2004



Note: Growth rates from 1990 to 2004 are given in % and exclude countries with no data in reference year.
Sources: United Nations Statistics Division, Millennium Development Goals Indicators (http://mdgs.un.org/unsd/mdg/Data.aspx); World Bank, World Development Indicators Online (http://devdata.worldbank.org/dataonline/); and United Nations, World Urbanization Prospects—The 2005 Revision Population Database (http://esa.un.org/unup/).

Figure 14: Asia's Access to Improved Sanitation in Urban and Rural Areas, 1990 and 2004



Note: Growth rates from 1990 to 2004 are given in % and exclude countries with no data in reference year.
Sources: United Nations Statistics Division, Millennium Development Goals Indicators (http://mdgs.un.org/unsd/mdg/ Data.aspx); World Bank, World Development Indicators Online (http://devdata.worldbank.org/dataonline/); and United Nations, World Urbanization Prospects—The 2005 Revision Population Database (http://esa.un.org/unup/).

Box 1: Comparing Infrastructure Development in the People's Republic of China and India

There is a notable difference in stocks and growth of roads, telecommunications, and electricity generation in the People's Republic of China (PRC) and India. In 2002, the total road network in India (3.31 million km) was almost twice that of the PRC (1.76 million km). During 1990–2002, the average annual growth rate of total road network in India (4.3%) also exceeded that in the PRC (3.4%). Although this is subject to the quality of data available, the road network in India seems to be longer and expanding faster than that in the PRC. Conversely, telecommunications and electricity generation in the PRC are more developed than India. Beginning with the same number (6) of telephone lines and cellular subscribers per 1,000 people ("telephone density") in both countries in 1990, the PRC grew faster in this sector, leading to a vast difference between the two countries very quickly. In 2004, the PRC had about 6 times higher telephone density, at 499, than that India, at 85. The PRC (646.6 million) had 7 times more telephone lines and cellular subscribers (telephone coverage) than India (91.3 million) in 2004. Even in 1990, the PRC had higher net electricity generation in total and per capita than India. The gap expanded during 1990–2004. Net electricity generation in the PRC (9.4%) during this period grew much faster than in India (6.1%). As a result, in 2004, the total net electricity generation in the PRC (2 trillion kilowatt-hours [kWh]) was about 3 times that in India (631 billion kWh). In per capita terms also the PRC's electricity generation (1,605 kWh) was 3 times that of India (584 kWh). See Figure B1.1 and Appendix 2.

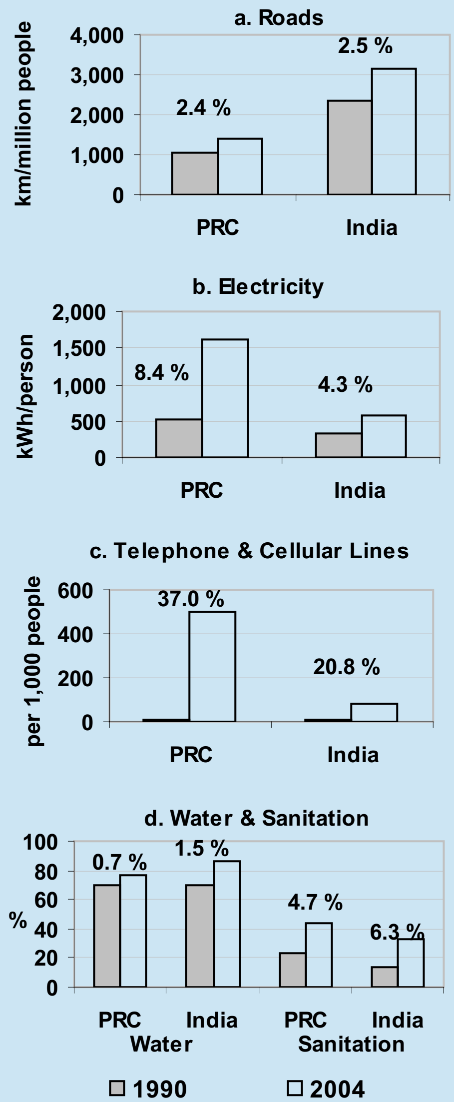
In other infrastructure areas, such as railways, water supply, and sanitation, the situation in the PRC and India is more comparable. In 2004, the total rail lines in the PRC and India were 60,446 and 63,122 route-km. The gap in railway lines was much wider in 1990, and closed quickly due to the faster per annum growth rate in the PRC (1.0%) compared to India (0.1%) during 1990–2004. In 2004, a larger proportion of population had access to improved water source in India (86%) than in the PRC (77%), but the PRC showed greater access to improved sanitation (44%) than India (33%). A similar pattern occurs with access to improved water source and improved sanitation in the urban and rural areas of two countries. India showed better growth than the PRC in access to both improved water source and improved sanitation during 1990–2004.

As indicated in Figure B1.2 and Appendix 3, the quality of overall infrastructure in the PRC is superior to that in India. The PRC also fares better than India in quality of electricity supply and port infrastructure. On the other hand, qualities of railroad, air transport, and telephone/fax infrastructures in India are better than those in the PRC. While a quality index for roads is not available, the quality of roads in the PRC, especially those connecting the special economic zones and other growth centers, is superior to that in India.

While India's economic growth during the last few decades and per capita GDP are significantly lower than that of the PRC, the same does not seem to be fully reflected in the previously noted infrastructure statistics. Further, infrastructure development (e.g., road per unit area or population) often also reflects the geography and population distribution in the country, which needs to be kept in view while interpreting statistical comparisons. At the same time, the striking features of the PRC include significantly higher electricity generation, telephone density, and overall infrastructure quality. The PRC has been generally proactive in building planned infrastructure, particularly to cater to special economic zones and other growth centers. India's infrastructure has more often been built in response to existing demand.

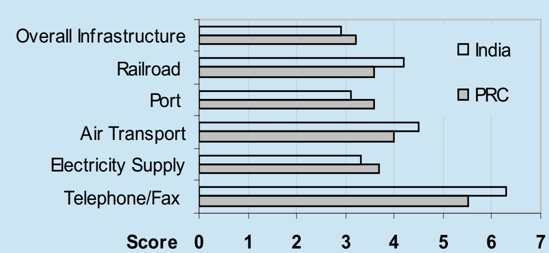
During 1984–2005, private sector investment in infrastructure in the PRC ($77.1 billion) was significantly higher than in India ($51.6 billion). However, during 1996–2005, private sector investment in infrastructure in India improved to average $4.4 billion per annum, compared to the PRC at $5.7 billion.

Figure B1.1: Infrastructure in the PRC and India, 1990 and 2004



km = kilometer; kWh = kilowatt-hour.
Note: Growth rates during 1990–2004 are shown in % inside each graph, except for roads where latest available data is 2002.

Figure B1.2: Infrastructure Quality in the PRC and India



access to an improved water source. On the other hand, less than 50% of the rural population had such access in several countries, including Afghanistan, Cambodia, the Lao PDR, Mongolia, Papua New Guinea (PNG), and Tajikistan. A much wider difference in access to improved sanitation occurs between rural and urban populations. In 2004, about 70% of the region's urban population, but only about 32% of the rural population, had access to improved sanitation (Figure 14 and Appendix tables 1.11–1.12). Even at the country level, the access to improved sanitation was generally poor in most rural areas. The two most populous countries—the PRC (28%) and India (22%)—had a very low proportion of rural population with access to improved sanitation. The level of access to improved sanitation in the rural areas was appalling in Cambodia (8%), FSM (14%), and Solomon Islands (18%).

The rural-urban gap in improved sanitation (about 40%) was much higher than in access to improved water sources (less than 20%). Compared with 0.36 billion in the urban area, a whopping 1.5 billion people in the region's rural areas did not have access to improved sanitation in 2004.

Lack of infrastructure, particularly in the rural areas, has serious implications for poverty reduction and progress toward achieving the MDGs. The burden of the lack of infrastructure falls disproportionately on the poor, as their ability to pay higher prices is limited, and on women (e.g., women have to carry water from long distances in the absence of piped water supply), which is particularly onerous in rural areas.

D. Quality of Infrastructure

The discussion about quality of infrastructure is limited by data availability. Data about the quality of infrastructure is available only for 22 countries in Asia and the Pacific, and only for railroads, ports, air transport, electricity, and telephone/fax infrastructure (Appendix 3). This leaves out an important area of ADB operations: roads and highways.

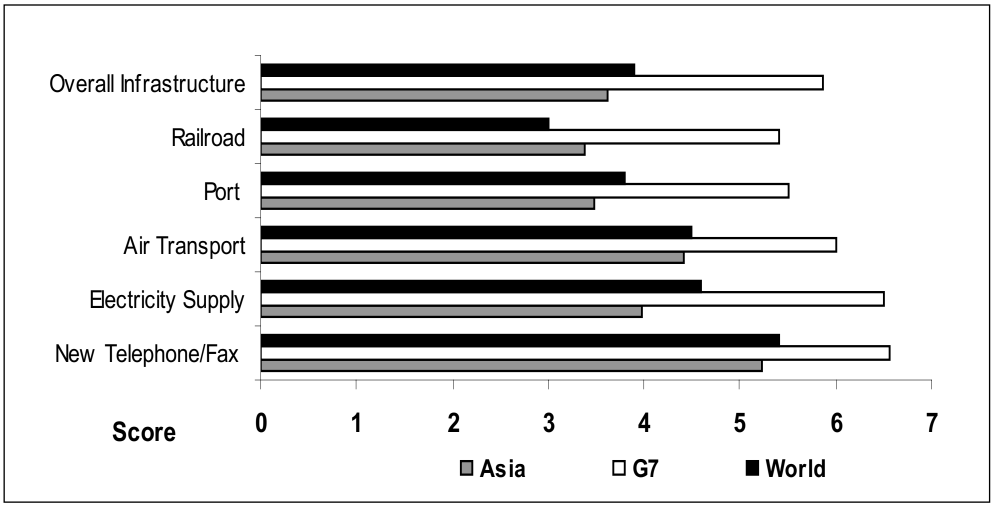
The quality of infrastructure in most DMCs falls below the global mean and is almost always significantly lower than that in industrialized countries (Figure 15). Overall, the average of the overall infrastructure quality indexes of the DMCs is lower than the corresponding global mean. Except for railroads, the DMCs' averages on the other available indexes are lower than the global means. The gap is much wider with the industrialized countries.

The overall quality of infrastructure in most of developing Asia is very poor (Appendix 3). Except in Malaysia and Thailand, the overall infrastructure quality index of each country in developing Asia is below the global mean. In particular, the overall infrastructure quality index of Mongolia (2.1), Timor-Leste (2.1), Kyrgyz Republic (2.3), and Cambodia (2.4) are very low compared to the global mean (3.9) and industrialized countries' average (5.9).

The quality of railroads in many DMCs (including the PRC and India) that have extensive networks is better than the global mean. Thus, these countries have knowledge and expertise that could be used by countries such as Cambodia and the Philippines that are lagging. At the same time, the gap between the region and the industrialized countries in railroad quality index remains very large. Given their level of development and the nature of their economies, the quality of ports in most graduate DMCs is high. However, except for Azerbaijan, Malaysia, and Thailand, the quality of ports in developing Asia and the Pacific is below the global mean, and well below that of industrialized countries. The gap in the quality index of air transport infrastructure in Asia and the Pacific is lower than both the global mean and the average of industrialized countries. Thus, a relatively lower emphasis on air transport in ADB operations does not seem out of place, although its origin lies in lower demand from DMCs given the greater scope of commercialization and private sector participation in this area. The quality of airport infrastructure in India is better than that in the PRC.

In terms of quality, electricity stands out as the most serious area of concern for Asia and the Pacific. The region's electricity supply has the lowest quality compared with industrialized countries or the world. Further, some very populous countries, like Bangladesh and India, have a very low electricity quality index. Thus, the challenges include both quantity and quality gaps. The quality of telephone/fax infrastructure in Asia is relatively better, and has some interesting features. For example, India is very close to industrialized countries in this index, the PRC is lower than many other DMCs, and Bangladesh has the worst index in Asia. Despite success stories, the region's development is uneven in telephone/fax infrastructure. Dissemination of knowledge and lessons within the region can be helpful, especially in large countries like Bangladesh and the PRC.

Figure 15: Infrastructure Quality in Asia, Industrialized Countries, and the World



Notes: Asia refers to ADB's developing member countries. G7 includes Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States.
Source: World Economic Forum. 2005. *The Global Competitiveness Report 2005–2006*. New York: Palgrave Macmillan.

E. Conclusion

Despite progress, the gap in infrastructure development between Asia and the Pacific and industrialized countries continues to be very large. Infrastructure development in the region also lags behind the world averages in most sectors, with only a few exceptions. Although some statistical comparisons, such as road per unit area or population, reflect differences in geography and population distribution among the countries, closing the gaps compared with the world and the industrialized countries is generally a high priority need for the region. The data presented in this section broadly confirm the positive relationship between quantity of infrastructure and per capita income level in the country. Given the strong relationship between infrastructure development and economic growth, the Asia and Pacific region has to build a substantial amount of new infrastructure to achieve high standards of living for its people.

In terms of quantity, the gap between the region and industrialized countries is smallest in telecommunications, with the ratio of the telephone density in the region and industrialized countries at about 1:4. The corresponding ratios for electricity generation per capita (about 1:9), road network per million people (about 1:8), and total rail network per million people (about 1:7) are much larger. Further, access to improved water source and improved sanitation in the region lags behind industrialized countries' standard significantly, with the situation in sanitation being very low.

After 1990, the highest infrastructure growth in the region was in telephone coverage (25.8%) and electricity generation (8.4%). Growth in other areas has been modest to slow—the proportion of population with access to improved sanitation was 4.2%; total road network was 1.8%; proportion of population with access to improved water source was 0.9%; and rail network route-km was about 0.02%. At the current rate of growth, the region would broadly reach the current levels of industrialized countries in about half a century. Estimates of infrastructure financing needed by the region for 2005–2010 have been based on economic growth projections rather than targeted quantity levels. Even if funding requirements are met, the region will lag substantially behind the industrialized countries in 2010. In addition to the quantity gap, the region also falls behind in overall quality of infrastructure, which adds to the challenge.

Infrastructure development varies widely across sectors, across countries, and between rural and urban areas in Asia and the Pacific. While some DMCs show economic features of middle income countries (MICs), other countries and some sectors are well below the global average and even match the worst in the world. Differences between urban and rural infrastructure are wide, which needs different response strategies. ADB effectively has to deal with more than one set of clients. ADB needs an adequate range of modalities and instruments to respond to such diverse needs effectively. The choice of design and financing arrangements will depend on the country, sector, market size, capacity, rural or urban focus, and other factors.

On the positive side, there is substantial successful experience in the region to learn from or scale up. The region's less developed countries can learn much from the more advanced ones. At the same time, the MICs and more advanced Asian countries need to innovate and draw lessons from OECD countries to move to higher levels and quality standards of infrastructure in the future.