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Infrastructure Services in Developing Countries: Access, Quality, Costs and Policy Reform

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1. Introduction

Along with supportive economic and financial policies, infrastructure—including electricity to power industry, telecommunications to support commerce, and roads, railways, and ports to transport goods—has long been recognized as a key element of the enabling environment for economic growth. More recently, the development community has also emphasized that by promoting growth, reliable and affordable infrastructure can reduce poverty and contribute to the achievement of the Millennium Development Goals (MDGs).[i] It can contribute directly by providing and supporting the delivery of key services, such as those seeking to increase households' access to safe drinking water, basic sanitation, and secure tenure. Similarly, the goals related to human development (education and health) rely on services that require supportive infrastructure—water and sanitation to prevent disease, electricity to serve schools and health clinics, and roads to access them.

While the needs are increasingly well recognized, in many developing countries key infrastructure services are still in serious short supply and of poor quality. Although these problems are most severe in low-income countries, they remain sizable in most middle-income countries. Moreover, coverage is typically much lower in rural areas, where most poor people live in developing countries. But urban coverage is also under pressure, partly because of rapid rural-urban migration in many countries.

Improving access and quality will require significant increases in investment and in associated spending on operation and maintenance (O&M). Efforts are needed to improve the enabling environment for private investment in infrastructure, which has plummeted in recent years from a high of $128 billion in 1997 to only $48 billion in 2003. In addition, public investment will need to reverse its decline of the past decade. This will require stronger domestic resource mobilization—as well as increased foreign assistance.

To ensure effectiveness and sustainability, increased investment must be underpinned by better policies and governance. Many countries have made progress in this regard by implementing policy and regulatory reform. But progress on reform has been uneven across regions and income groups, with Africa and low-income countries lagging behind in many areas. Among sectors, telecommunications is generally well ahead of the reform curve; electricity, transportation, and housing are at intermediate stages; and water and sanitation are falling behind.

This paper reviews the emerging evidence on the state of infrastructure with an emphasis on the investment needs and on the emerging policy issues. This assessment is seriously constrained by gaps in data which are slowly starting to be addressed by the international community as a result of a growing demand for effective monitoring of the impact of aid and policy reform. The assessment is thus preliminary and is based on work in progress regarding the generation of policy relevant information on the sector.

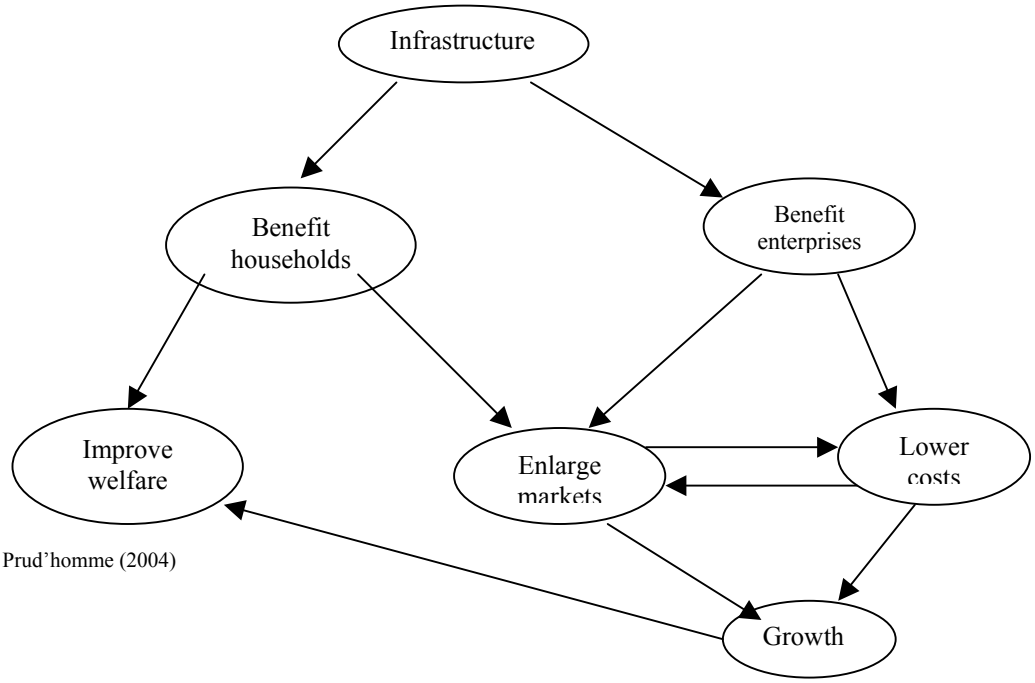
The paper is organized as follows. It first reviews the evidence on the macroeconomic importance of infrastructure in terms of growth and other MDGs. It then reviews some of the aggregate evidence available on access and quality of infrastructure services. Next, it

provides a "macro" view of the financing of infrastructure. Finally, it reports on progress in policy reform before providing some rough estimates of investment needs.

2. Infrastructure, Growth and the Millennium Development Goals

The links between infrastructure services, growth and social outcomes like the Millennium Development Goals operate through multiple channels as depicted in figure 1. The delivery of services like water, sanitation, transportation and energy directly benefit households and can dramatically improve their welfare. But many of the benefits of infrastructure services accrue to firms – in France, for example, that input-output tables reveal that firms consume two-thirds of all infrastructure services (Prud'homme, 2004). Thus it is through this channel that costs are lowered and, most importantly, market opportunities are expanded (especially through telecommunications and transport). The resulting gains in competitiveness and production are what drive the gains in economic growth and ultimately welfare.

Figure 1 – How Infrastructure Contribute to Development



Source: Prud'homme (2004)

There have been many recent attempts to quantify these linkages between infrastructure and growth, poverty reduction, and achieving related development goals.[ii] Of 102 studies conducted over the past 15 years, few find that infrastructure investment has a negative effect on productivity or growth (table 1). The sample includes 30 studies of multiple countries (including developing countries), 41 studies on the United States, 19 on Spain, and 12 on individual developing countries (Argentina, Brazil, Colombia, India, and the Philippines).

Table 1 Distribution of study findings on impact of infrastructure investment on productivity or growth

Area studied	Number of studies	Percentage showing a positive effect	Percentage showing no significant effect	Percentage showing a negative effect
Multiple countries	30	40	50	10
United States	41	41	54	5
Spain	19	74	26	0
Developing countries	12	100	0	0
Total/average	102	53	42	5

Source: de la Fuente and Estache 2004.

The studies of multiple countries and the United States offer mixed results: half or more find that infrastructure investment does not have a significant effect on productivity or growth, and some find that it has a negative effect. The results for the United States reflect the effects of higher infrastructure endowments in a mature economy. Findings of negative effects can often be explained by diminishing returns to some types of infrastructure, so-called "white elephants," or by negative externalities. For example, a new transport project in one U.S. state may lead to an exodus of workers or industries from other states, slowing growth in those states. Similar conclusions emerge from the cross-country data.

The studies of Spain, a country which has used EU cohesion funds to overcome both inter-regional and intra-regional disparities, make a much stronger case for investment in infrastructure. There, infrastructure has generally been found to be a major determinant of growth and productivity convergence across regions. The studies of developing countries further confirm infrastructure's role in promoting growth and productivity and reducing disparities between rich and poor regions. Together these results suggest that the returns to infrastructure investment are probably highest during early stages of development, when infrastructure is scarce and basic networks have not been completed. Returns on infrastructure investment tend to fall—sometimes sharply—as economies reach maturity.

Measuring the elasticity of output to improvements in infrastructure quantity and quality gives a better sense of the potential impact of infrastructure investment and associated policies. Depending on the sector, country (or country group), and period covered, elasticity estimates range from 0.14 to 1.12. But the lower bound is not as small as it may seem. For example, in Latin America, the elasticities estimated for the region in the 1990s imply that a 10 percent increase in infrastructure stocks would have increased output by 1.4–1.6 percent—quite dramatic, because a 1 percentage point increase in per-capita income reduces the share of people living in poverty by 0.5 of a percentage point (Estache et al., 2002).

Another recent study of Latin America estimates that inadequate investment in infrastructure during the 1990s reduced long-term growth by 1–3 percentage points, depending on the country (Easterly and Servén 2003). This assessment also suggests that infrastructure insufficiencies account for about one-third of the difference in output per worker between Latin America and East Asia.

The story for Africa is similar. One of the most extensive multi-country studies suggests that if Africa had enjoyed growth rates in telecommunications and power generation infrastructure comparable to those in East Asia in the 1980s and 1990s, its annual growth rate would have been 1.3 percentage points higher (Ramirez and Esfahani, 2000). The authors conclude that while the importance of each infrastructure sector varies by country and over time, the overall quantity and quality of infrastructure are critical determinants of growth in developing and transition economies.

A test of the robustness of these aggregate results is provided by the rates of return calculated for specific projects. All multilateral and most bilateral donor agencies rely on cost benefit analysis to generate estimated returns. Though very little information is available on outcomes, the large data sample on economic returns can potentially be exploited for analytical purposes. The large diversity of methods used across sectors might raise doubts about the strict comparability of the information. This is a valid concern, but, within a sector, the methodologies applied are much more consistent and hence reliable.

The sector-specific estimates of the social rate of return provided in the table below report the evidence from Bank infrastructure projects for which 95% or above of the loan commitments had been disbursed between 1960 and 2000. Table 2 provides unweighted averages of the ex-post rates of return achieved by World Bank projects as calculated by the World Bank's Operations Evaluation Department[iii]. This gives a global quantitative sense of the contribution of infrastructure investment to poverty reduction efforts. The average rate is particularly high considering that it is often closer to a financial rate of return than to a true economic rate of return. This is because many externalities are not

being taken into account and prices are generally assessed at market levels rather than at their shadow level.

Table 2. Social rates of return on World Bank Projects
Unweighted Average 1960-2000

Region	Energy/Mining	Telecoms & Information	Transport	Urban	Water & Sanitation
Africa	14.1	20.6	25.5	21.3	7.5
East Asia	18.3	19.5	24.8	20.3	10.5
Eastern Europe	30.9	31.1	25.8	15.7	9.8
Latin America	12.8	16.6	22.4	19.2	11.0
Middle East	12.3	26.9	25.1	16.5	7.8
South Asia	23.2	22.0	24.1	14.9	9.8
Developing World	18.4	21.5	25.4	19.2	9.2

Source: World Bank- Operations and Evaluation Department Database

There are several other striking results – first, the returns to the "market enlarging" sectors – ICT and transport – are considerably higher than the more service/welfare-oriented sectors, like water and sanitation, which is roughly consistent with the conclusions derived from macroeconometric assessments of sectoral impacts.[iv] Second, the regional distribution of returns suggests a more complex pattern. Within each sector, projects in Eastern Europe have tended to have the highest returns, while projects in Latin America have tended to have among the lowest (except in urban and water and sanitation for both regions). There is no other clear pattern emerging from the data. Finally, the relatively high rates of return observed support the value of independent screening and technical assessment provided by an organization such as the World Bank.

Another body of literature has examined the impact that infrastructure improvements have on poor people and social outcomes. An extensive survey of the literature by Brenneman and Kerf (2002) finds strong evidence of positive impacts of infrastructure on education (particularly for transport and energy services), and on health outcomes (especially for water/sanitation, energy and transportation, although less so for telecommunications). Datt and Ravaillon (1998) find that between 1960 and 1990 rural poverty levels changed considerably in Indian states—and that states starting with better infrastructure and human resources saw significantly higher long-term rates of poverty reduction. Deninger and Okidi (2003) obtain similar results in exploring factors underlying growth and poverty reduction in Uganda during the 1990s. Their work indicates the importance of improving access to basic education and health care, but progress also depends on complementary investments in electricity and other infrastructure. Fan et al. (2002) document the critical role of infrastructure development, particularly roads and telecommunications, in reducing rural poverty in China between 1978 and 1997. The authors show that poverty fell because of the growth in rural non-farm employment that followed expansion of infrastructure.

Access to infrastructure can have little effect, however, if services are not affordable, and appropriate pricing of services often has been the most controversial aspect of sector reform. Governments must bear this in mind when setting service prices—particularly when average prices must cover average costs to support private sector participation. In the past, cross-subsidization was the most common method for dealing with this issue, but this created perverse incentives against networks expanding to serve poor households. More recently, other solutions have been pursued. A large body of experience across

regions—particularly with water supply and sanitation, rural electrification, and secondary roads—demonstrates the effectiveness of offering households and businesses a range of service levels at a range of costs, allowing them to choose according to their preferences and ability to pay (Estache et al., 2002). Another solution is to design price structures that include explicit and well-targeted subsidies, ensuring that users do not spend an unreasonable share of their incomes on infrastructure services. A common rule of thumb is that poor individuals should spend no more than 15 percent of their income on utilities and transportation.[v] Required subsidies can then be targeted and minimized via negative concessions (where bidders compete on the basis of the least subsidy needed to deliver the service) or performance-based grants for connections or specified service levels.[vi]

Recent research emphasizes the importance of core infrastructure inputs for the achievement of the MDGs and other development goals.[vii] Drawing on 43 countries, Leipziger et al. (2003) estimate that differences in access to safe water explain about 25 percent of the difference in infant mortality between the poorest and richest quintiles, and 37 percent of the difference in child mortality. In other words, increasing the poorest quintile's level of access to piped water to that of the richest quintile (that is, from 3 percent to 55 percent) would eliminate more than a quarter of the difference in infant mortality between the two groups, and more than a third of the difference in child mortality. Similarly, the difference in access to sanitation between the poorest and richest quintiles accounts for 20 percent and 10 percent, respectively, of the difference in the prevalence of malnutrition. In rural India, Jalan and Ravallion (2001) find that the average prevalence and duration of diarrhea among children under five were significantly

lower for families with piped water. Finally, Calderon and Serven (2004) show that that in developing countries, between 1960 and 2000, not only was growth positively affected by the stock of capital, but in addition, income inequality declined with higher infrastructure quantity and quality.

3. Infrastructure services—access, quality and fiscal cost

The monetary value of the world's infrastructure stock, at average prices and excluding housing, is about $15 trillion (Fay and Yepes, 2003).[viii, ix] Of this, about 60 percent is in high-income countries (which contain 16 percent of the world's population), 28 percent is in middle-income countries (with 45 percent of population), and 13 percent is in low-income countries (with 39 percent of population). Electricity and road assets account for about 80 percent of the total.

This section assesses infrastructure services in developing countries in terms of access and quality, as well as the evolution of the allocation of public expenditures in the sector. This assessment is constrained by major gaps in data. The international aid community has initiated an effort to develop a more systematic database of core infrastructure indicators.[x] As seen below, the most serious data gaps occur in the transportation sector, where the world's poorest people spend half the resources they allocate to public services.

Access to services

Urban residents in low-income countries have much lower access to the main infrastructure services—electricity, water, sanitation, telecommunications, and transportation—than do their counterparts in middle-income countries (table 3). Thus any

effort to catch up will require major investments. And rural populations, which make up more than 60 percent of the population in low- and middle-income countries, have access rates about 30 percent lower than do urban populations (table 4). This discrepancy does not mean that investment requirements are significantly larger for rural areas, however, because the costs of delivering services are lower in rural areas.

Table 3 Access of urban populations to infrastructure services, by country income group

	Electricity (1997-01)	Water (2000)	Sanitation (2000)	Telecoms (1999-02)	Transport (1994-01)
Income group	Percentage of urban population			Telephone subscribers per 100 people	Percentage of population within a 20 minutes walk of public transport
Low	62.4 (24)	76.9 (56)	74.6 (55)	4.6 (65)	90 (7)
Lower middle	95.1 (8)	90.8 (40)	90.5 (37)	22.0 (52)	n.a.
Upper middle	n.a.	92.3 (23)	92.5 (22)	53.9 (36)	n.a.

Note : Figures in parentheses indicate the number of countries for which data are available.

Source: USAID Demographic and Health Surveys; World Bank, *World Development Indicators*, various years; International Telecommunication Union; Roberts, 2003 .

Table 4: Access of rural populations to infrastructure services, by country income group

	Electricity (1997-01)	Water (2000)	Sanitation (2000)	Telecoms (1997-02)	Transport (1994-01)
Income group	Percentage of rural population			Main lines per 100 people	Percentage of rural population within 2 km of an all-season road
Low	20.3 (24)	52.7 (54)	41.8 (52)	1.7 (55)	61 (21)
Lower middle	67.3 (8)	75.0 (40)	59.8 (37)	8.7 (43)	n.a.
Upper middle	n.a	76.4 (23)	81.3 (22)	22.5 (24)	n.a.

Note : Figures in parentheses indicate the number of countries for which data are available.

Source: USAID Demographic and Health Surveys; World Bank, *World Development Indicators*, various years; International Telecommunication Union; Roberts, 2003.

However humbling these figures are in terms of achievements thus far, these aggregate figures also hide major disparities between low-income slums and better-off areas within the same city. For example, in Mysore, India, 33 percent of households have water

connections, compared with just 8 percent of households in informal settlements. And in Accra, Ghana, more than two-thirds of the poorest households share a toilet or latrine with more than 10 other households (World Bank, Water Supply and the MDGs, 2003). Such disparities have clear effects on health outcomes: in urban Kenya the under-five mortality rate averages 84 per 1,000 (and 62 in Nairobi), while in the country's two largest slums it averages 187 (Kibera) and 254 (Embakasi; Africa Population and Health Research Center 2002).

Quality of services

Although data on access are more meaningful when combined with data on service quality, most access data are not adjusted for quality. Access data usually include individuals with all-day access as well as individuals with access for just a few hours a day. But quality matters. A recent study of seven Latin American countries suggests that because of poor quality, the effectiveness of public infrastructure in the region is only about 74 percent of that in industrial countries (Roja, 2003). According to the same study, the long-run cost of this underperformance is equivalent to about 40 percent of real per capita income. Thus, raising infrastructure effectiveness to industrial country levels would reduce the per-capita income difference between Latin America and the United States from ten-fold to about seven-fold.

Despite growing recognition of the economic and social significance of service quality, there is no indicator of the combined dimensions of quality. So, in the short run, the only option is to rely on partial indicators. In some cases, for example, quality must be inferred from associated health indicators. Although this approach is not satisfactory, analysis

based on partial indicators provides a global sense—for each sector and country group—of the importance of objective quality indicators.

The amount of information available on the technical quality of infrastructure varies enormously by sector (table 5). Reasonable technical indicators are widely available for electricity and telecommunications. The usual approximation for transport, the ratio of paved roads to total roads, is useful, but it may be somewhat misleading because paving roads is not necessarily a priority for the poorest countries. Most worrisome is the water supply and sanitation sector, which does not systematically generate indicators such as water losses, number of hours of service per day, water quality, or volume and quality of treated sewage.

As expected, available data suggest an extremely high correlation between income and technical quality across countries and across country groups. Higher income groups, as well as richer countries within a country tend to have better infrastructure. The main practical consequence of that correlation is that the difference in investment requirements across income groups is probably much more significant than access data alone would suggest. Not only must access be improved, but major rehabilitation efforts and capacity building are probably also needed to address weak technical performance in the poorest countries.

Table 5. Technical quality of infrastructure services, by country income group

	Electricity (1999)	Water (1997-01)	Telecoms (1997-00)	Transport (1997-00)	Housing (1994-00)
Income group	*Transmission and distribution losses as percentage of total output*	*Percentage of urban households with water access that get water from piped or well water source*	*Reported phone faults per 100 main lines*	*Percentage of total roads paved*	*Percentage of structures built to last 20 years*
Low	24.1 (33)	89.4 (48)	77 (48)	28.6 (59)	76
Lower middle	16.2 (31)	84.5 (18)	42.9 (38)	46.9 (46)	94
Upper middle	13.6 (23)	n.a.	25.3 (27)	55.1 (33)	97
Best practice in OECD	8–12	100	<5	>80	100

Note : Figures in parentheses indicate the number of countries for which data are available.

Source: USAID Demographic and Health Surveys; World Bank, *World Development Indicators*, various years; International Telecommunication Union; Angel, 2000.

New investment also requires policy changes to ensure that service quality is improved and maintained at a reasonable level, and that assets are effectively operated and systematically maintained. Preventive maintenance lowers operating costs, reduces adverse external impacts, and extends asset life—savings that are generally underestimated when maintenance budgets are cut to meet fiscal targets. There is evidence that shifting resources toward maintenance can have positive consequences for GDP and welfare. For example, Rioja (1999), using data for seven Latin American countries, found that they allocate two-thirds over their resources to new infrastructure investment and only one-third to maintenance, a pattern that was exacerbated by international donors. Shifting just 20% of donor aid away from investment and toward maintenance would raise GDP and welfare by about 15% in the long run.

The only data available on the perceived quality of infrastructure services reflect commercial and industrial perspectives (table 6). No systematic effort has been made to collect comparable data from residential users—a clear information gap.

Table 6. Commercial users' views on the quality of infrastructure services, by country income group

	Electricity (2001-02)	Water (2001-02)	Sanitation (2001-02)	Telecoms (2001-02)	Roads (2000)	Railroads (2001-02)	Ports (2001-02)	Airports (2001-02)
Income group	*Quality of services*		*Quality of water pollution regulation*	*Quality of telephone infrastructure*	*Quality of services*			
Low	2.6 (9)	4.0 (27)	2.3 (9	3.4 (9)	3.4 (27)	2.7 (9)	2.6 (9)	3.6 (9)
Lower middle	4.2 (25)	4.8 (24)	3.1 (25)	4.9 (25)	4.2 (24)	2.6 (25)	3.5 (25)	4.2 (25)
Upper middle	5.1 (20)	5.0 (18)	4.0 (20)	5.6 (20)	4.1 (18)	2.9 (26)	3.8 (20)	4.5 (20)

Note: Ratings are on a scale of 1 to 7, with 7 indicating the highest quality. Figures in parentheses indicate the number of countries for which data are available.

Source: World Economic Forum 2003; World Bank 2003.

The evidence suggests that:

- Perceived quality is higher in higher-income countries in all sectors (except roads, and there the difference is minor).
- Even in upper-middle-income countries, perceptions are lower than best practice, which is rated at 7 on the scale used in the World Economic Forum (2003).
- Water and telecoms are generally perceived to be the highest-quality service. These favorable perceptions reflect the bias introduced by indicators collected from the business community. For instance, water may not be a major issue for many businesses, many of which have their own supplies and do not depend on urban utilities. But many households, urban and rural, suffer from poor-quality water supplies.

4. How was the infrastructure sector financed in the 1990s?

Infrastructure is financed from three main sources: the public sector, ODA and the private sector. According to DFID calculations, during the 1990s, government or public utilities financed 70% of actual total infrastructure spending from own resources—which included cost recovery and subsidies—while official development assistance (ODA)

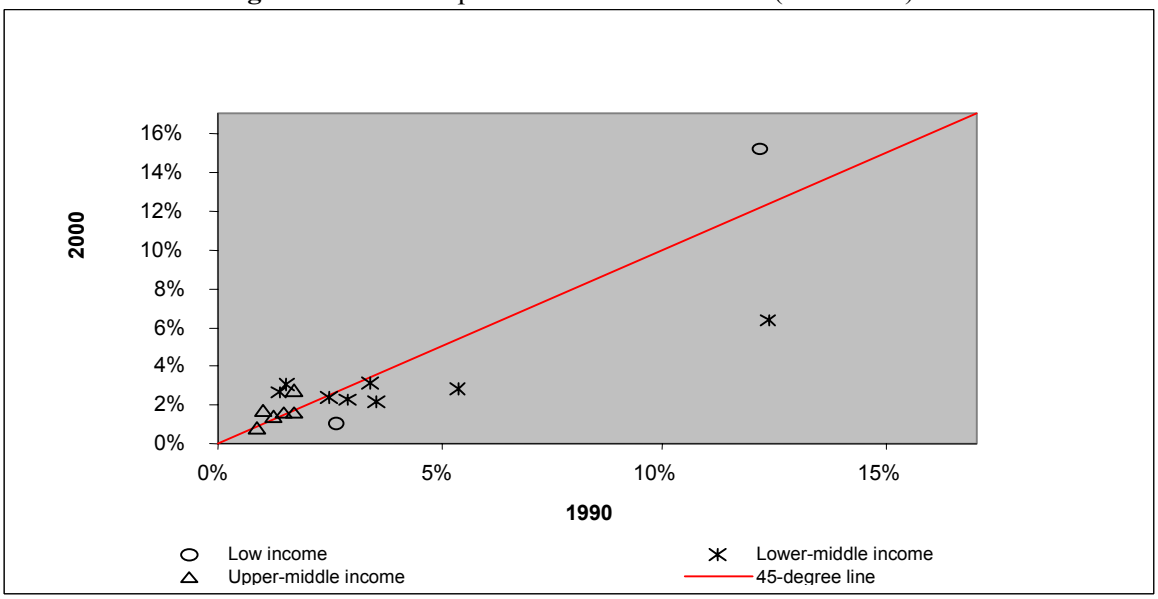
financed only around 5%-10%. The private sector contributed during the 1990s roughly between 20%-25% of investment in the sector.[xi]

Currently, in developing countries, the public sector, the largest contributor to the financing of infrastructure, is spending roughly between around 2% (in high middle income countries) to around 4% (in low income countries) of GDP on infrastructure. For the low and low middle income countries, this is up to 3% lower than the estimates of their investment needs. During the 1990s, the public sector has tended to reduce its own participation in the sector as a result of: (i) an unmet hope for a major financing of infrastructure by the private sector, (ii) fiscal adjustment programs, and (iii) decentralization resulting in mismatches between resources and needs. There is indeed growing evidence that more often than not fiscal retrenchment has resulted in a disproportionate reduction in public investment expenditures, particularly in infrastructure, as a result of the use of the current budget deficit to GDP ratio as the single yardstick to assess fiscal performance. Easterly and Serven (2003) find that for Latin America, the contribution of the reduction in public infrastructure investment to the fiscal adjustment of the region varied between 31.5% in Mexico to 174.3% in Brazil. But the problem is more generalized. In India for instance, total investment in infrastructure was 5.4% in 1990, including 4% of public sector money. By 1998, total investment in infrastructure had dropped to 4.6% with a decline in public investment by 1%. Private investment had only increased by 0.2%, not nearly enough to offset the drop in public investment.

For most countries, the trend in public sector financing has thus been downward as seen in Figure 2 representing data from the IMF Government Finance Statistics for a sample of

16 developing countries. By comparing public expenditures as a percent of GDP in 1990 and 2000, it is easy to see that at best resource allocation stayed almost constant, but in most countries it fell. A much more systematic study of the evolution of the public sector role in financing infrastructure by Calderon and Serven (2004) shows that for eight Latin American countries, public sector investment dropped from 3% of GDP to 0.8% during the 1990s.

Figure 2: Public Expenditure in Infrastructure (% of GDP)



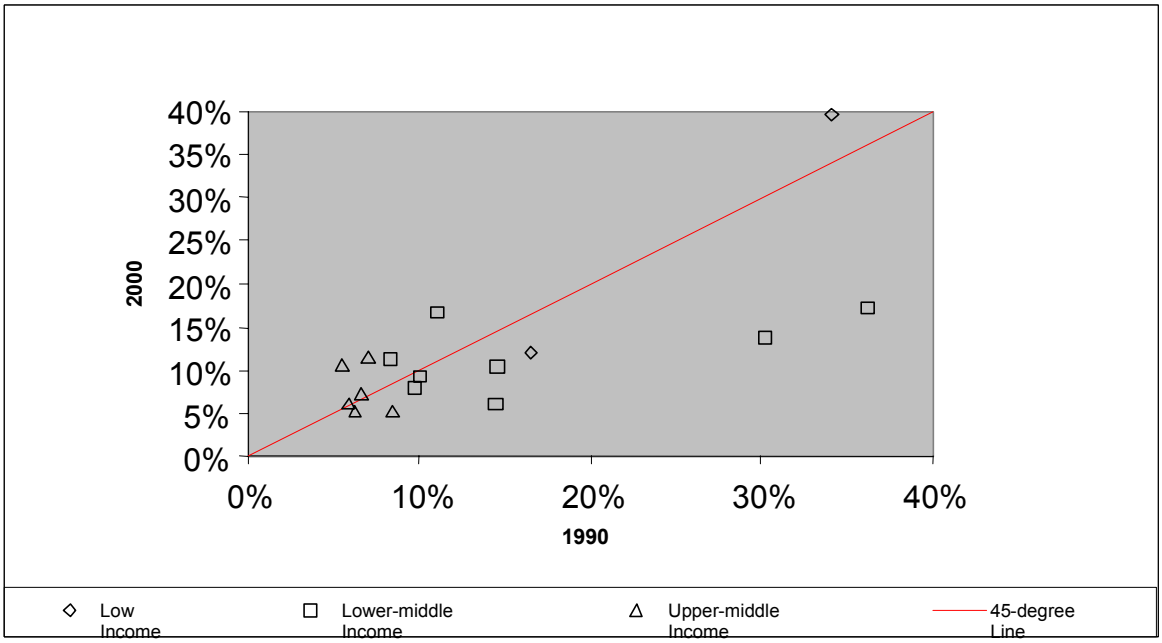
The political economy of this larger than average contribution of the infrastructure sector to fiscal adjustment is not difficult to understand – postponing large and costly infrastructure investments is far easier for a Ministry of Finance than cutting current expenditures such as wages and debt service. Figure 3 shows that in the 16 countries sample, the relative share of infrastructure in total public expenditures has declined.

It is possible that some of the decline in public investment in infrastructure was financed by subnational governments (which may not be captured in the Government Finance

Statistics). But this should not change the aggregate story very much as seen in the more detailed analysis available from Easterly and Serven (2003), which suggests that, at best, decentralization (as well as privatization) compensated for the decline in central government expenditure. In fact, there is a widespread sense that the fact that most urban infrastructure (secondary roads, drainage, sanitation) is increasingly the responsibility of local governments has probably contributed to the drop in public investment. Local governments increasingly depend on local taxation because, with fiscal decentralization and consolidation, many countries have cut central government transfers. To put this discussion in historical perspective, it is worth remembering that in many of the developing countries, total public expenditure levels in the 1970s and 1980s were in the 10-15% of GDP range.

But the decline in public sector financing has been compounded by a sharp fall in ODA. For instance, the commitment level for infrastructure of multilateral development banks (MDBs) all together have somewhat declined since 1995, fluctuating between $18Bn in 1996 and a low point of $13.5 Bn in 1999. These commitments had recovered somewhat to about $16 billion in 2002, and some multilaterals are expanding their support to infrastructure.[xii] Similarly, bilateral development aid declined from $15 billion in 1996 to about $8 billion in 2002 which also represented a decline in the relative share of infrastructure in their total commitments from 27% to 14%.[xiii] The main issue, however, is that the numbers, even at their peak, are too small in relation to the needs. The best that can be hoped for is a significant counter-cyclical effect, at least sufficient enough to offset swings in the expected contribution of the private sector, as well as to leverage funds from private sources.

Figure 3: Public Expenditure in Infrastructure (% of total expenditure)



Source: IMF Government Finance Statistics, various years

Ultimately, many of the adjustments in public financing and ODA largely reflect the fact that the expectations of private sector participation in the financing of infrastructure needs were overoptimistic. The private sector commitments during the 1990s amounted to about $807 billion in developing countries or about $67 billion/year with strong fluctuations during the 1990s.[xvi] This is 20-22% of the investment realized and only 10-15% of the estimated annual needed investments in developing countries. Moreover, as seen from the estimates of private sector commitments to invest in infrastructure in less developed countries (LDCs) during the 1990s summarized in table 7, the bulk of this commitment went to energy and telecoms in Latin America, East Asia and, to a lesser extent, Eastern Europe. These investments were also highly concentrated – over the 1990s, about 70% of private participation in infrastructure occurred in just 10 countries –

Argentina, Brazil, China, India, Indonesia, Malaysia, Mexico, Philippines, Republic of Korea, and Thailand.

Table 7: Cumulative Private Investment Commitments from 1990 to 2002 (2002-US$ billion) (*)

Region	Telecom	Electricity	Natural Gas	Airports	Railways	Seaports	Toll-roads	W&S	Total
East Asia & Pacific	56.2	68.3	6.8	2.8	10.3	11.2	26.8	17.0	199.4
Europe & Central Asia	68.1	21.1	11.3	1.5	0.3	1.8	2.6	3.5	110.2
Latin America and the Caribbean	182.9	100.4	19.5	7.5	18.3	6.9	40.6	21.3	397.4
M. East and North Africa	10.6	8.4	3.9	0.9	0.2	1.2	-	1.3	26.5
South Asia	19.7	22.6	0.2	0.2	-	2.1	0.8	0.2	45.8
Sub-Saharan Africa	18.5	5.0	1.3	0.4	0.3	0.4	2.0	0.2	28.1
Total	355.9	225.7	43.0	13.2	30.3	22.6	72.8	43.6	807.4

(*) Numbers might not exactly add up, due to rounding

Source: World Bank, PPI Project Database

5. Progress on policy reform

The 1990s saw an impressive array of reforms in the way the sectors were being managed ranging from corporatization to full divestiture. They also included many efforts to promote competition whenever possible and to create independent sector regulators when necessary. Reliable data on infrastructure policies are, however, no easier to come by than data on access and quality. Still, available indicators show that infrastructure policy and regulation have been improving—though much remains to be done. The picture varies enormously across regions, countries, and sectors.

A 1998 "scorecard" compared the electricity sectors in 115 countries by asking experts in each country whether a variety of reforms had been completed, including commercialization, restructuring, regulation, legal reform, and private investment. The experts were also asked to grade reforms on a scale of 1 to 5 (from low to high progress).

At the time, less than half the steps considered necessary for fully effective reform had been taken in the countries studied. But reforms have progressed significantly since then, as the forthcoming update of the scorecard is expected to show.

Updated indicators are available for nearly 20 low-income countries (table 8). All but one have a new electricity law, and all but three have or will soon have an independent regulator. Progress on commercialization and restructuring is less uniform. Even more disparate is the presence of the private sector—except perhaps in the form of independent power producers.

A recent survey of urban water issues found that 65 percent of the developing countries had achieved separation between operator and government, yet only 17 percent had a functioning regulatory body (World Bank 2002) in place. Still, a growing number of countries were using more appropriate policies, governance, and management arrangements. But the challenge remains formidable, especially in low-income countries. Out of a maximum score of 7.0, low-income countries averaged 1.8, compared with 3.1 for lower-middle-income countries, and 3.9 for upper-middle-income countries. These findings show that despite progress in the past decade, most countries have a long way to go in establishing an environment that will stimulate increased investment.

A similar recent survey for the transport sector conducted for a sample of 20 low-income high potential developing countries shows that 70.6% of these countries are reforming the port sector, 68.4% the airport sector, and 55% the railways sector (Ouedraogo (2004)). The survey points out that the selected developing countries tend to encourage private sector investment in the port, airport and railway sectors but that competition level has

usually been low because of the market size. It also highlighted significant differences among the sectors concerning the appropriate balance between private and public participation in ownership of assets and provision of services. The survey points to a low level of commitment to the creation of regulatory agencies in the sector.

Table 8: Status of electricity industry reforms in selected developing countries [2003]

Country	Commercialized/ corporatized	Law	Independent regulator	Independent power producers	Restructured [a]	Private generation	Private distribution
India [b]	No	Yes	Yes	Yes	Yes	No	No
Pakistan	Yes	Yes	Yes	Yes	Yes	IP-3	IP-3
Bangladesh	Yes	Yes	IP-4	Yes	IP-2	No	No
Indonesia	Yes	Yes	IP-4	Yes	Yes	Yes	No
Vietnam	Yes	No	No	Yes	IP-3	No	No
Albania	Yes	Yes	Yes	No	IP-1	No	No
Benin	No	Yes	No	No	Yes	No	No
Bolivia	Yes	Yes	Yes	Yes	Yes	Yes	IP-4
Burkina Faso	No	Yes	No	No	No	No	No
Ethiopia	IP-3	Yes	Yes	No	No	No	No
Honduras	No	Yes	Yes	Yes	No	No	No
Kyrgyz Republic	Yes	Yes	Yes	Yes	Yes	No	No
Madagascar	IP-4	Yes	IP-5	Yes	No	No	No
Mali	No	Yes	Yes	IP-1	IP-4	Yes	Yes
Mauritania	No	Yes	Yes	No	No	No	No
Mozambique	Yes	Yes	IP-2	Yes	IP-2	No	IP-1
Tanzania	IP-4	IP-3	IP-4	1	IP-3	0	IP-4
Uganda	Yes	Yes	Yes	Yes	Yes	Yes	IP-4

Source: Interviews of World Bank Task Managers.
Note: IP means "in process." IP-1 indicates an early stage of implementation; IP-5 indicates that implementation is almost complete. a. A state-owned utility is deemed to have been restructured if it has successfully completed accounting on unbundling. b. Some Indian states have reformed much more than others.

As for the telecoms sector, the monitoring is done on a more systematic basis by the International Telecommunication Union (ITU). According to ITU, by the end of 2002, more than half of the world's countries had fully or partly privatized their telecommunications operators. Another quarter—although retaining state-owned incumbents—had introduced private participation by licensing new fixed, international,

or mobile operators. Thus less than a fifth of countries have no form of private participation in their telecommunications sectors. Most are low-income countries.

The introduction of competition has been uneven, with most countries retaining monopolies for fixed-line services, such as local and long-distance telephony. But an overwhelming majority of countries now allows competition in their mobile and Internet markets. Competition in international long-distance markets also grew dramatically in the 1990s. By mid-2003, 73 countries gave users a choice among facility-based operators for international phone calls—up from just eight countries in 1992.

There has also been progress in telecommunications regulation -- the number of telecommunications regulatory agencies has increased dramatically in recent years. In 1990, only 12 countries had regulatory agencies that functioned separately from telecom operators. By mid-2003 that number had increased to 123—and another 28 countries intend to establish a separate regulator in the next few years.

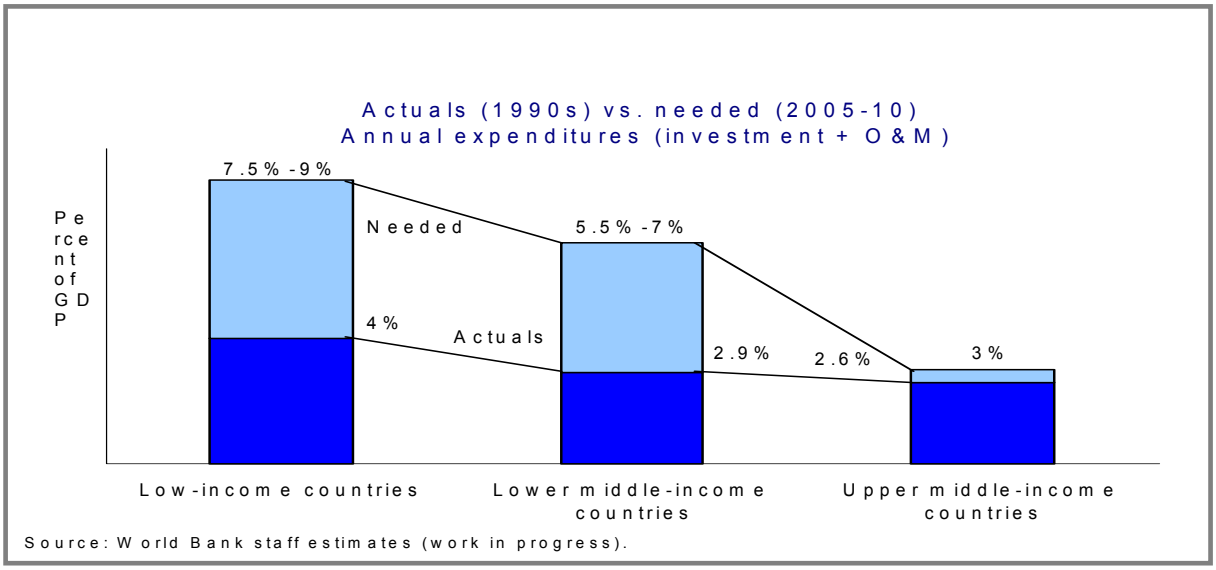
6. The agenda ahead

Addressing the large gaps in infrastructure access and quality will require actions on many fronts. Although substantial new investment will be needed, that is only part of the challenge. Policies and governance must also continue to improve, building on past gains, to ensure that new investments translate into better infrastructure services for underserved segments of the population and economy.

It is difficult to estimate the amount of investment needed to fill gaps in access and quality. Such estimates should reflect the needs of both households and businesses in agriculture, industry, and commerce, and thus must be related to the economy's broad

growth prospects. One set of estimates developed on this basis shows that the required investment is large. For 2005–10, estimates of annual investments and operations and maintenance expenditure requirements, including the main networks (roads, rail, electricity, water and sanitation, telecoms) functioning at current efficiency levels are around $550-650 billion.[xvii] This is 6.5-7.7% of the annual GDP for all developing countries. Three sectors—electricity generation, roads, mobile phones—account for four-fifths of the investment needs. Electricity generation is expected to absorb 30 percent of total (including maintenance) investments. The needs are, on average, split evenly between investment expenditures and operation and maintenance (O&M). [xviii] Improving efficiency in the sector by 15-30% would probably reduce the needs to closer to $400 billion while reducing corruption in these sectors would reduce the investment needs to about $450 billion.

For low-income countries, these rough and preliminary total estimated needs for 2005-2010 represent an increase over historical levels from 4% to 7.5-9% of GDP (figure 4), and the implied additional annual investment needed as compared to historical levels amount to around US$30 billion. For MICs, the total estimated needs represent an increase over historical levels from 2.9% to 5.5-7% of GDP (figure 4) and the implied additional investment needs as compared to historical levels of about $115 billion. The financing gap is significant and particularly large for the poorest countries. Traditionally, most investment in infrastructure has been publicly funded and is likely to remain so in the medium term, although some recovery of private flows can be expected.



Source: World Bank staff estimates (work in progress).

If developing countries are to achieve infrastructure investment levels consistent with their needs in a context of fiscal constraints and limited private investment, external assistance will need to increase. This is especially the case for low-income countries, but foreign assistance also plays an important catalytic role in middle-income countries. The impact of aid can be enhanced through reallocations that increase and better leverage private and local public resources. Better coordination between bilateral and multilateral donors would ensure maximum leverage of funding from all sources, including the private sector.

The use of resources, foreign and domestic, needs to be guided by clear country priorities. Access and quality deficiencies are typically much more serious in rural areas, implying the need for a special focus on the needs of such areas. At the same time, rapid urbanization will require attention to the infrastructure needs of migrating populations. Better planning of investment in infrastructure networks (secondary roads, sanitation, drainage) and protection of green spaces can help ensure economic, social, and environmental sustainability in the context of urban expansion.

In all infrastructure sectors, quality is crucial—as is the need to make adequate provisions for operation and maintenance when allocating resources. Underinvestment in operation and maintenance is common because it is generally easier to raise resources to finance new investment or major rehabilitation than to design service prices that cover operation and maintenance costs. These distortions should be corrected because the impact and productivity of investment depend on its quality and upkeep, and the returns to O&M often far exceed spending on new investment.

Affordability is a key determinant of poor people's access to infrastructure services. It is important to consider the extent to which the service prices and quality options offered to consumers are consistent with their ability to pay. Without affordability, expanded access is of limited use to the poorest consumers.

Institutional capacity building is a key cross-cutting element of the reform agenda. The quality deficiencies, misallocated resources, excessive costs, and declining interest of private investors seen in many countries can often be traced to insufficient institutional capacity. Capacity constraints can be especially severe at the local level. With urban growth and fiscal decentralization, public sector responsibilities for infrastructure planning, financing, and management are increasingly falling to local governments—many of which lack the required capacity. Effective delivery of infrastructure services at the local level calls for enhanced resource mobilization by local governments, stronger efforts to build local capacity, and adequate intergovernmental arrangements to share the investment costs of local public good infrastructure.

Increased private participation in infrastructure requires an adequate regulatory framework, including competent regulatory agencies. Though such agencies exist in many countries, they often lack adequate capacity. Coordinated efforts by governments and donors to provide the technical assistance needed to build capacity would have a high payoff. Governments and donors can also pressure the private sector to help improve governance—for example, by adopting a code of ethics for due process in regulatory interactions engaging all stakeholders. Making decision-making more transparent tends to minimize the risk of corruption as evidenced in the literature on disclosure rules.

Private-public partnerships (PPPs), which are increasingly popular in the wake of disappointments with privatization and concerns about inadequate fiscal space, are a promising alternative going forward but need to be approached with caution. Well-structured PPPs can enhance the efficiency of service delivery. Recent evidence from the UK's Private Finance Initiative found that, in a sample of 29 projects selected from a population of 250 projects done in the 1990s, all of them were delivered within budget and efficiency gains relative to the alternative of a purely public sector comparator average 17%.[xix] But PPPs cannot make uneconomic projects viable, nor will the private investor subsidize services – they will only provide financing and management expertise. Because of this, governments usually continue to face some fiscal liabilities (often contingent) under PPPs.

More information is needed to assess and monitor infrastructure needs and policies in these and related areas. Monitoring of service quality, affordability, fiscal cost, and governance quality is handicapped by major information gaps, and data are lacking even on basic access to some key infrastructure—especially transportation. The international

community should commit to supporting a systematic effort to develop a better information base, including statistical capacity building in developing countries.

The scale of the challenge ahead is huge. But no country has a chance at developing economically and eliminating poverty until it puts in place the infrastructure necessary to support human activity. Thus the response also requires increased international support—from bilateral donors and multilateral agencies as well as greater effort (in terms of investment and policy reforms) by developing countries. But these efforts are still at an early stage, and success will require sustained commitment.

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[i] The Millennium Development Goals are concrete targets endorsed by 189 countries at the September 2000 UN Millennium General Assembly in New York aiming at cutting by half the proportion of people in extreme poverty worldwide by 2015, provide education, improve health, and preserve the environment.

[ii] The World Bank's *World Development Report 1994: Infrastructure for Development* highlighted an emerging debate on the relationship between infrastructure access, productivity, and growth.

[iii] Independent entity that reports to the World Bank Board of Directors.

[iv] The literature review by Brenneman and Kerf (2002) also finds strong evidence of growth-enhancing impacts in all infrastructure sectors except water and sanitation.

[v] Households in Guatemala spend around 10 percent of their budgets on water, energy, and telecommunications services (Foster and Tre 2000; Foster, Gomez-Lobo, and Halpern 2000). More than half is spent on energy for cooking and heating, and more than a quarter on energy for lighting and powering appliances. Barely 0.5 percent of income is spent on water services. The overall budget share is relatively constant across consumption quintiles, although richer households spend less on cooking fuels and more on telecommunications. Only a tiny fraction of the poorest households have access to telephones, but those that do so spend as much as 5 percent of their income on the service. Such breakdowns, however useful for designing tariff structures to ensure affordability, are seldom available.

[vi] Brook and Smith (2001).

[vii] See Jalan and Ravaillon, 2001; Jayasuriya and Wodon, 2003; Leipziger et al., 2003; World Bank, 2004; and references cited therein.

[viii] Except where otherwise specified, the sources for the data in this section are as follows:

USAID Demographic and Health Surveys (1997–2001, depending on the country) available at http://www.measuredhs.com/: access to electricity services, proxy of water service quality, proxy of sanitation service quality;

World Bank's *World Development Indicators* (1997-2001, depending on the country): technical quality of electricy services, access to water services, sanitation services, to telecom services, and technical quality of transport services;

World Economic Forum (2003): perceived quality of water services, perceived quality of electricity services, of sanitation services, of ICT services, and of transport services.

International Telecommunication Union: technical quality of telecoms services, access to telecom services;

Angel (2000): quality of housing;

Roberts (2003): access to transport services.

[ix] Urban housing alone is worth more than twice that, but problems of double counting make it difficult to estimate the value of infrastructure stock, including housing (Angel, 2000, p. 288).

[x] The project is one of the components of the World Bank's Infrastructure Action Plan launched in July 2003.

[xi] DFID, Making Connections: Infrastructure for Poverty Reduction, January 2002.

[xii] The World Bank has launched an Infrastructure Action Plan (available at http://www.worldbank.org/infrastructure/files/iaPPublic.pdf) to respond to country demand for infrastructure with a broad range of options for public and private provision and a scaling up of the project pipeline, with better integration of infrastructure into Country Assistance Strategies and Poverty Reduction Strategy Papers. The plan also aims to rebuild the knowledge base for infrastructure, strengthening analytical work to support policy reforms and improving poverty impact through greater attention to affordability and targeted subsidies, and expand the range of instruments used to support the sector.

[xiii] Hesselarth (2004).

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[xv] Hesselarth (2004).

[xvi] The data discussed covers commitments because statistics on actual disbursements is not available.

[xvii] These figures are estimated with an econometric model of the demand for infrastructure based on a GDP forecast for each country for a sample of over 100 countries and an adjustment for investment in electricity distribution and transmission. They are not based on a detailed analysis of investment need.

[xviii] These estimates have to be used with caution since they have been compiled using different methodologies from various sources (the World Bank -- Private Participation in Infrastructure database and report various--, DFID, International Monetary Funds –published databases and reports various, among other sources). The general order of magnitude for these estimates is, however, reasonable and on the specifics.

[xix] Arthur Andersen and Enterprise LSE (2000).