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Infrastructure Gap in South Asia

Infrastructure Needs, Prioritization, and Financing

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Abstract

If the South Asia region hopes to meet its development goals and not risk slowing down or even halting growth, poverty alleviation, and shared prosperity, it is essential to make closing its huge infrastructure gap a priority. Identifying and addressing gaps in the data on expenditure, access, and quality are crucial to ensuring that governments make efficient, practical, and effective infrastructure development choices. This study addresses this knowledge gap by focusing on the current status of infrastructure sectors and geographical disparities, real levels of investment and private sector participation, deficits and proper targets for the future, and bottlenecks to expansion. The findings show that the South Asia region needs to invest between US$1.7 trillion and US$2.5 trillion (at current prices) to close its infrastructure gap. If investments are spread evenly over the years until 2020, the region needs to invest between 6.6 and 9.9 percent of 2010 gross domestic product per year, an estimated increase of up to 3 percentage points from the 6.9 percent of gross domestic product invested in infrastructure by countries in the region in 2009. Given the enormous size of the region's infrastructure deficiencies, it will need a mix of investment in infrastructure stock and supportive reforms to close its infrastructure gap. One major challenge will be prioritizing investment needs. Another will be choosing optimal forms of service provision, including the private sector's role, and the decentralization of administrative functions and powers.

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Infrastructure Gap in South Asia: Infrastructure Needs, Prioritization, and Financing[1]

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1. Introduction

Despite recent rapid growth and poverty reduction, the South Asia region (SAR) continues to suffer from a combination of uneven economic growth, a population boom, slow urbanization, and huge infrastructure gaps that together could jeopardize future progress. SAR has the largest population below the poverty line of any region. Between 1990 and 2010, the number of people living on less than $1.25 a day decreased by only 18 percent,[2] while the population grew by 42 percent. At the same time, structural change has been slow, with urbanization (around 31 percent) lower than in any other developing region, despite economic growth rates that have exceeded most other regions over the past two decades. In effect, departing from similar points, South Asian countries are remarkably "under-urbanized" when compared to East Asian countries over the past half century (income and urban population as percentage of total population). The result of these trends has been a dramatic rise in demands for infrastructure—but access to infrastructure services is generally below other developing regions, the only exception being Sub-Saharan Africa. Yet, as urbanization continues, it is creating growing demand for infrastructure services that are already severely stretched. According to the United Nations, five South Asian cities (Mumbai, Delhi, Kolkata, Karachi, and Dhaka) are expected to surpass the 15 million-person mark by 2015. Furthermore, according to the livability index produced by the Economist Intelligence Unit, four South Asian cities (Dhaka, Karachi, Kathmandu, and Colombo) are in the bottom 10 cities of the 140 countries evaluated.

SAR needs to invest between US$ 1.7 trillion and US$ 2.5 trillion (at current prices) to close its infrastructure gap. Many people living in the SAR remain unconnected to a reliable electrical grid, a safe water supply, sanitary sewerage disposal, and adequate roads and transportation networks. Meanwhile, both the number of poor and the poverty rate are expected to increase in some of the more vulnerable and low-growth economies of the region. This region requires significant infrastructure investment (roads, rails, power, water supply, sanitation, and telecommunications) not only to ensure basic service delivery and enhance the quality of life of its growing population but also to avoid a possible binding constraint on economic growth owing to the substantial infrastructure gap. A mix of investment in infrastructure stock and the implementation of supportive reforms will allow SAR to close its infrastructure gap. A preliminary estimation of the cost of doing so by 2020 gives a lower bound of US$ 1.7 trillion and an upper bound of US$ 2.5 trillion at current prices. If investments are spread evenly over the years until 2020, SAR needs to invest between 6.6 and 9.9 percent of 2010 gross domestic product (GDP) per year. These estimates represent an increase of up to 3 percentage points from the 6.9 percent of GDP invested in infrastructure by SAR countries in 2009.

But faced with this enormous demand for infrastructure investment and only limited available financial resources, it is critical for SAR to prioritize infrastructure investment needs. The criteria used to accomplish this must be able to answers questions about short-term needs versus longer-term development needs, especially in developing countries. For example, should infrastructure investment in the electricity sector be given priority over the transport sector? Given substantial lock-ins associated with infrastructure investments, should a country continue attempting to fill current gaps or direct investments to infrastructures that are likely large bottlenecks in the medium term? How does one

[2] The proportion of people living on less than $1.25 a day decreased from 54 percent to 31 percent (a 42 percent decrease), between 1990 and 2010, mainly due to the increase in population.

account for the social and environmental issues of these trade-offs related to the directly impacted population?

Moreover, it is not feasible to expect South Asian governments alone to shoulder the entire financial burden. This means that SAR cannot continue on a business-as-usual trajectory. Rather, it should seize this opportunity to rethink and improve the infrastructure service provision paradigm currently in place. Two important elements of the service provision paradigm are (i) the service provision approach, which refers to the organizational form that defines and structures the roles of the public and private sectors; and (ii) the degree of decentralization in the provision of services.

There are many possible approaches for service provision – such as traditional (or public) provision, public-private partnerships (PPPs), and privatization (regulated or deregulated). Different organizational forms offer different incentive structures to internalize the efficiency gains from life-cycle cost reductions and to tackle the trade-off between life-cycle efficiency and quality considerations. At a conceptual level, economic characteristics (e.g., returns to scale, feasibility to charge user fees, quality contractibility), and planning and coordination aspects of a specific infrastructure service determine the best incentive structure to deal with this trade-off. However, once political economy realities are considered, the optimal organizational form might change.

The nexus between service provision and decentralization is diverse and complex. For example, connective infrastructure (such as interstate transport and telecommunication) may have a higher direct impact on economic growth by facilitating agglomerations, making it a good fit for central service provision/regulation. However, water and sanitation provision may have a higher impact on welfare—at least in the short term in countries where economic sectors are not highly dependent on water as an input—making it a good fit for local service provision/regulation. At a conceptual level, the economic dimension of individual infrastructure services, technologies available for service delivery, and political economy realities guide this nexus. For instance, the economic dimension of an infrastructure sub-sector in terms of service delivery could fall into five broad categories: economies of scale; network effects; cross jurisdiction externalities; market failures (e.g., public bads, club goods); and allocative efficiency. These categories may hint at the jurisdiction that should provide this service and thus where the gap should be addressed. However, available technologies may result in a diverse response to addressing service provision, and political realities may add an extra layer of complexity. Ultimately, pre-established formulas are difficult to come by, and policy makers are left primarily with guiding principles that will need to be adjusted to specific realities.

In this paper we identify and assess SAR's infrastructure needs, and we analyze how to address them efficiently and effectively. The paper is organized as follows. We begin with how to assess infrastructure needs, then present a framework for this effort, and then compare the status of infrastructure in SAR with other regions, as well as among and within SAR countries. This is followed by infrastructure investment trends in SAR countries, our estimate of the total cost of regional infrastructure needs, and a proposed framework for assessing priorities. Finally, we examine ways to rethink infrastructure service provision and the degree of decentralization.[3]

Our conclusion is that infrastructure deficiencies in South Asia are enormous and a mix of investment in infrastructure stock and supportive reforms will enable the region to close its infrastructure gap. One

[3] Additional information on methodology, models, background papers, stock taking reviews, and data used can be found in the Infrastructure Needs Regional Study webpage: http://go.worldbank.org/URIGW1E4W0.

major challenge will be prioritizing investment needs. Another is choosing optimal forms of service provision – including the private sector's role – and the decentralization of administrative functions and powers.

2. What is the 'Infrastructure Gap'?

Over time, societies inherit man-made infrastructure stock from previous generations. Yet different factors influence demand and supply and, as countries grow, these needs – both the type of infrastructure and the quality of service provision – are likely to evolve. In this report, we assess the infrastructure gap using a four-step process, as illustrated in Figure 1. It shows (1) where a country is today; (2) where a country would like to be in a given point in time – the difference between the two points being the infrastructure gap; (3) how far business-as-usual scenarios (shown by the dotted blue line) will take the country toward reaching its goal; (4) how far financial and policy options using existing resources (shown by the dotted red line) could take the country toward reaching its goal; and (5) the remaining financial gap that will need to be bridged. Keep in mind that the importance of the financial gap will vary among countries, depending on how well better use existing resources can close the infrastructure gap.

First, evaluate a country's level of infrastructure provision needs. This includes a diagnosis of coverage, quality, and efficiency of infrastructure services, and investments in infrastructure. It involves gathering existing data on access rates to the various infrastructure services; and, to the extent possible, appraising the quality of service provision. In its simplest form, the actual gap is the difference between targets (each one may be priced in a variety of ways) and baseline over a time period in which the gap is aimed to be filled.

Different sectors require different methodological approaches. *One approach is costing set targets*, which involves estimating physical needs as the difference between the baseline and targets. These targets may be defined as universal service access, the Millennium Development Goals (MDGs), or a goal determined by benchmarking—which compares normalized infrastructure performance indicators across countries or areas with similar characteristics (usually socio-economic variables), or predetermined standards defined as optimal. *Another approach is costing sector needs*, using micro-sectoral analysis to build estimates based on sector data and sector specialists' views; for water and sanitation, estimates will be based on approximations of the cost of achieving coverage targets under the MDGs. *Yet another approach is costing macroeconomic needs* using macro-econometric models or micro-engineering economic models.[4] For example, one could look at the infrastructure coverage needed to achieve a particular growth objective, assuming given levels of other inputs.

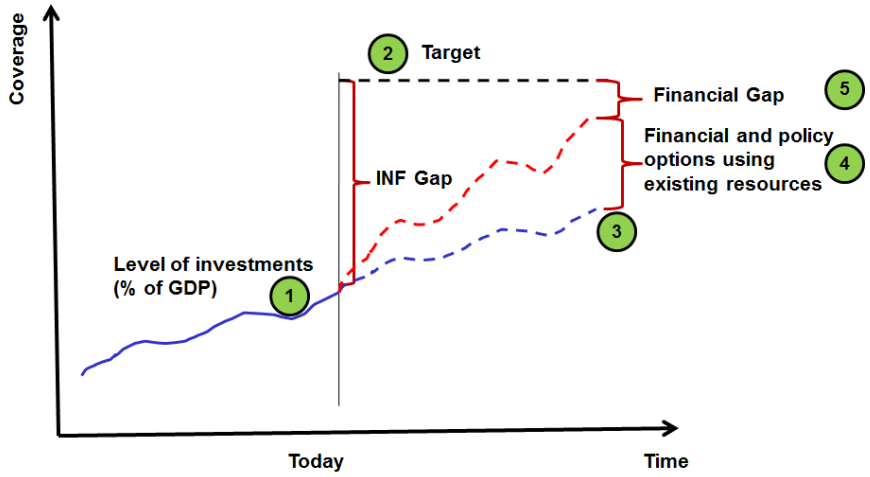
Second, assess long-term targets and goals for physical infrastructure. This component analyzes various sets of sector-specific targets and goals, and concludes with an estimation of investment needs. Different sectors inevitably require diverse approaches in terms of methodology.

[4] The relevant literature for costing macroeconomic needs includes: Fay and Yepes (2003); Estache and Yepes (2004); Chatterton and Puerto (2005), and Calderón and Servén (2004).

Third, develop a menu of financial and policy options using existing resources. This component focuses on key policy options for improving service delivery (including access, quality, and affordability), enhancing the quality and adequacy of public investment in the sector (including performance-based contracting, and prioritization of investments), and encouraging private investment (including PPPs). It emphasizes trade-offs of individual policy recommendations.

Fourth, develop a menu of financial and policy options for bridging the financial gap. This component explores possible new sources of finance and how the investment burden can be shared between current and future users and/or society through various financing schemes. It also examines investment climate issues that affect the region's ability to cost-effectively tap private resources. The reality is that even after improving service delivery, enhancing quality and adequacy of public investments, and encouraging private investments, it is likely that long-term targets and goals for physical infrastructure will remain out of reach. While any increase in investments has to be funded by direct users and/or society, there are options on how to apportion the burden—like higher public spending within a responsible macroeconomic framework, or higher user fees while remaining within accepted norms of affordability.

Figure 1: **A Framework for Assessing Infrastructure Needs**



3. Assessment of Coverage

The demand for infrastructure, whether from private or commercial users, is not static but evolves with country conditions. This is a notable feature of the relationship between infrastructure and economic growth. The relationship is not unidirectional as infrastructure investments create and perpetuate growth, which in turn changes the type of infrastructure demanded as society becomes more prosperous and the economic structure changes.

3.1 Regional Benchmarking

The demand for infrastructure has been growing globally, especially in Asia. Two decades ago, SAR and EAP had similar urbanization rates, 25 percent and 28 percent respectively, and were close in terms of infrastructure service provision. Since 1990 SAR has enjoyed the second highest economic growth in the world behind only EAP. During the 1990s growth in SAR averaged over 5 percent, while between 2000 and 2012, it averaged 6.7 percent. But while economic growth has been accompanied by rapid urbanization in EAP (50 percent urbanization rate in 2012), SAR remains the least urbanized region in the world (31 percent), well below the world urbanization rate (53 percent) (Table 1).

SAR has a large infrastructure gap compared with other regions. Its access to infrastructure services closely resembles SSA, even though its economic growth is second only to EAP (Table 1).

- ***Electricity access.*** In SAR only 71 percent of the population enjoys the benefits of electricity access, ahead of SSA at 35 percent, but way behind the rest of the regions at above 90 percent. According to businesses in South Asia, infrastructure is a major or severe hindrance to their growth, and electricity is the largest problem.

- ***Improved sanitation access.*** In this category, SAR (39 percent) is at the bottom with SSA (30 percent) – rates that are close to half the world average of 64 percent population access. Open defecation seems to be one of the most salient issues facing SAR, with 680 million people (i.e., 41 percent of the population) relying on it in 2011.[5] This ranks South Asia as the region with the highest incidence of open defecation in the world.

- ***Improved water access.*** This is the only indicator where South Asia is about even with the rest of the world and EAP, averaging 90 percent population access. Yet the quality and quantity of improved water may be in question. Most of the access to water is through public stands; only 25 percent of the population has access to piped water and 24/7 water supply is a rare exception in South Asian cities.[6]

- ***Telecom access.*** Communication among people who are not in close proximity is inefficient. In terms of telecom access (measured as fixed and mobile lines per 100 people), SAR and SSA rank at the bottom (72 and 54) with less than half the access found in ECA and LAC (157 and 125).This situation becomes even more dramatic given SAR's low level of urbanization.

- ***Transport access.*** This other form of connectivity is also poor – a problem that troubles much of the developing world. Using total road network per 1,000 people, SAR has 2.9 km (Table 2)—which is close to EAP (2.5 km), SSA (2.5 km), and MNA (2.8 km), but well below the world average (4.7 km), ECA (8 km), and North America (24 km).[7] Furthermore, the transport infrastructure suffers from serious shortcomings (such as lack of intraregional connectivity between the national road networks, unrealized potential for rail and inland water freight transport, and inadequate road and rail connectivity of ports with hinterlands). These limitations turn transport infrastructure into a hindrance for regional and international trade, as investment climate surveys indicate.

[5] WHO / UNICEF Joint Monitoring Program for water supply and sanitation: http://www.wssinfo.org/data-estimates/table/
[6] Ibid.
[7] World Development Indicators.

Table 1: SAR Lagging Behind All but SSA in Access to Infrastructure Services

	Avg GDP Growth (2000-2012)	Urbanization Rate (2012)	Telecom Access (per 100 people) (2011)[1]	Electricity Access (% of pop.) (2010)[2]	Access to Improved Sanitation (% of pop.) (2011)[3]	Access to Improved Water (% of pop.) (2011)[4]
EAP	8.9	50	98	92	67	91
ECA	4.4	60	157	100	94	95
LAC	3.1	79	125	94	81	94
MNA	4.2	60	105	94	89	89
SAR	6.7	31	72	71	39	90
SSA	4.7	37	54	35	30	63
World	2.5	53	103	78	64	89

Source: World Development Indicators, except when noted otherwise.
Notes: 1. Telecom access is defined as the number of fixed and mobile lines; 2. World Energy Outlook 2010 by International Energy Association; 3. Improved sanitation is defined as connection to a public sewer, a septic system, pour-flush latrine, simple pit latrine, and ventilated improved pit latrine; 4. Improved water is defined as household connection, public standpipe, borehole, protected dug well, protected spring, rainwater collection.

3.2 Heterogeneity in Infrastructure Coverage among SAR Countries

Sri Lanka and Maldives have the best access rates in the region. More than 90 percent of their population has access to improved sanitation, which is better than in LAC at 81 percent. In terms of electrification, only Maldives (95 percent) and Sri Lanka (77 percent) are above the average rate for developing countries (76 percent).[8,9] On telecom, Sri Lanka and Maldives top the lists with 104 and 173 telephone lines per 100 people. This places Sri Lanka almost at the world average of 103 lines per 100 people and above EAP (98 lines per 100 people).

Afghanistan, Nepal, and Bangladesh have the worst access rates in the region. Nepal, with the lowest number of telephone lines per 100 people in SAR (47), is behind Afghanistan (54) – which matches SSA (54). For electrification, Afghanistan, not surprisingly, is the worst; a meager 30 percent of the population can rely on electricity powered lighting at night. Moreover, Afghanistan and Bangladesh (47 percent) are closer to the 35 percent found in SSA than to the 71 percent found in SAR. Total road network (km) per 1,000 people is also low in Nepal, Afghanistan, and Bangladesh—in Maldives it is also low, but it is explained by geographical reasons. And only 29 percent of Afghanistan's roads, and 10 percent of Bangladesh's roads, are paved.

The exception is high average access to improved water in SAR, and not just in a few countries. Five of the eight countries in SAR (i.e., Bhutan, India, Maldives, Pakistan and Sri Lanka) have access rates to improved water of at least 90 percent, similar to the 94 percent rate found in LAC.

[8] It should be noted that data sources are kept the same for consistency purposes when comparing countries. The Ceylon Electricity Board (CEB) estimates for example that over 90 percent of Sri Lankan households were electrified in 2011.
[9] World Energy Outlook, IEA:
http://www.worldenergyoutlook.org/resources/energydevelopment/globalstatusofmodernenergyaccess/

Table 2: *Big Range among SAR Countries in Access to Infrastructure Services*

	Avg. GDP growth (2000-2012)[1]	*Urbanization Rate (2012)*	*Telecom Access (per 100 people) (2011)*[2]	*Electricity Access (% of pop.) (2010)*[3]	*Access to Improved Sanitation (% of pop.) (2011)*[4]	*Access to Improved Water (% of pop.) (2011)*[5]	*Total Road Network (km per 1000 people)*[6]	*% Paved Roads*[7]
SAR	6.7	31	72	71	39	91	2.9	51
AFG	8.7	24	54	30	29	61	1.6	29
BGD	5.9	29	58	47	55	83	0.1	10
BTN	8.7	36	69	65	45	97	9.7	40
IND	7.1	32	75	75	35	92	3.5	50
MDV	7.0	42	173	95	98	99	0.3	100
NPL	4.0	17	47	76	35	88	0.8	54
PAK	4.4	37	65	67	47	91	1.5	72
LKA	5.5	15	104	77	91	93	5.5	81
Brazil	3.3	85	145	99	81	97	8.1	14
China	10.2	52	94	100	65	92	3.0	54

Source: World Development Indicators, except when noted otherwise.
Notes: 1. The average GDP growth for AFG is for the period 2002-2009; 2. Telecom access is defined as the number of fixed and mobile lines; 3. World Energy Outlook 2010 by International Energy Association, except BTN and MDV, which are based on authors' estimations; 4. Improved sanitation is defined as connection to a public sewer, a septic system, pour-flush latrine, simple pit latrine, and ventilated improved pit latrine; 5. Improved water is defined as household connection, public standpipe, borehole, protected dug well, protected spring, rainwater collection; 6. Varying data years: 2005 (MDV), 2006 (Afghanistan), 2008 (IND, NPL), 2010 (BGD, BTN, PAK, LKA, Brazil, China); 7. Varying data years: 2003 (LKA), 2005 (MDV), 2006 (Afghanistan), 2008 (IND, NPL, China), 2010 (BGD, BTN, PAK, Brazil).

3.3 Heterogeneity in Infrastructure Coverage within Each SAR Country

There is significant heterogeneity within countries and between sectors. Using district level data from the entire SAR region, districts were ranked by quintiles on access to electricity, gas, improved water, improved sanitation and telecoms respectively.[10] The heterogeneity on access to infrastructure services is not just among SAR countries but also among districts within the countries. For example, in India, some of the best performing districts on access to improved water sources are in the north and north west of the country, while some of the worst performing ones are in the north east and west as well as the southwest coast.

Within India, even bordering districts show big variations. An interesting example on access to improved sanitation is found on the north of India, where some of the worst performing districts in the country are in-between some of the best performing districts. In access to electricity, some of the districts in Gujarat, Haryana, Himachal Pradesh, and Punjab are among the best performing districts, while those in Bihar, Jharkhand, Orissa, and Uttar Pradesh are among the worst performing districts. Furthermore, districts that perform well on access to one infrastructure service do not necessarily perform well on others. For example, districts in Kerala are high performers in access to improved sanitation but among the worst on access to improved water sources.

[10] The fifth quintile on access to an infrastructure services represents the 20 percent of SAR districts with the highest access to that infrastructure service, while the first quintile represents the 20 percent of SAR districts with the lowest access to the same infrastructure service.

In India, there are districts in poor states that perform better than districts in rich states. The data show this contrast by highlighting bad districts in rich states and good districts in poor states. There are 10 districts ranked among the top 25 percent of districts on access to infrastructure services that are located in poor states (first quartile of GDP per capita). Similarly, there are 12 districts among the bottom 25 percent of the districts in terms of access that are in rich states (fourth quartile).

4. Investment Needs in South Asia

Consistent estimates of investment requirements across SAR are a pre-requisite for developing a sound menu of policy and financial options to close the infrastructure gap. Most governments in SAR have some estimates of the investments required to reach certain targets such as 24/7 electricity supply and the MDGs in water and sanitation. However, those estimates are not consistent across the region. For that reason we have developed different methodologies for different sectors to have consistent estimates of physical investment needs and their costs across the region. These models also allow us to calculate and compare the costs of different set of targets. Each model was applied to one country, which gives five sector-country combinations: (i) power for Nepal; (ii) transport for Sri Lanka; (iii) water and sanitation for India; (iv) solid waste management for Sri Lanka; and (v) irrigation for Afghanistan.[11] Having consistent estimates of investment requirements across the region gives us the much needed foundations to design a menu of policy and financial options to effectively and efficiently close the infrastructure gap in SAR.[12] These country-sector estimations were extrapolated to the rest of the region. Tables 3 and 4 present the estimations based on the technical models as well as the extrapolations for the other sectors where the models were not run.

Table 3: SAR's Total Investment Tab Could Reach Around $2 Trillion
(Investment Requirements 2011-2020 (total, in Billions of dollars 2010)

	India		Bangladesh		Pakistan		Nepal		Sri Lanka		SAR (5)		SAR (8)	
	Low	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Transport	340.0	595.0	36.0	45.0	17.2	21.5	3.7	5.5	10.8	18.0	408	685	411	691
Power	375.0	468.8	11.0	16.5	64.0	96.0	5.3	7.0	4.8	9.0	460	597	464	603
WSS	95.0	162.0	12.0	18.0	9.3	14.0	1.7	2.6	0.6	1.8	119	198	120	200
Solid Waste	32.5	65.0	2.1	4.2	3.3	6.7	0.4	0.5	0.2	1.3	39	78	39	78
Telecomm	150.0	225.0	5.0	5.0	12.4	12.4	0.4	0.6	2.0	2.5	170	246	171	248
Irrigation	140.0	210.0	7.7	11.6	9.7	14.6	1.6	2.3	2.5	3.1	161	242	163	244
Total	**1,133**	**1,726**	**74**	**100**	**116**	**165**	**13**	**18**	**21**	**36**	**1,356**	**2,045**	**1,369**	**2,064**

Source: Authors' calculations.
Note: Water Supply and Sanitation (WSS)

[11] No other study estimating investment requirements in SAR or in other regions of the world (e.g., LAC and SSA) have developed a methodology to estimate investment requirements in the irrigation sector, as it was done for this study.
[12] Additional information on these models can be found in the Infrastructure Needs Regional Study webpage: http://go.worldbank.org/URIGW1E4W0.

Table 4: Closing SAR's Infrastructure Gap Will Require Investing a Higher Share of GDP
Investment Requirements 2011-2020 (% of GDP, per year)

	India		Bangladesh		Pakistan		Nepal		Sri Lanka		SAR (5)	
	Low	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Transport	1.97	3.44	3.60	4.50	0.98	1.23	2.32	3.49	2.17	3.64	1.97	3.31
Power	2.17	2.71	1.10	1.65	3.66	5.49	3.34	4.46	0.97	1.82	2.22	2.89
WSS	0.55	0.94	1.20	1.80	0.53	0.80	1.08	1.62	0.12	0.37	0.57	0.96
Solid Waste	0.19	0.38	0.21	0.42	0.19	0.38	0.24	0.30	0.04	0.27	0.19	0.38
Telecomm	0.87	1.30	0.50	0.50	0.71	0.71	0.27	0.40	0.40	0.50	0.82	1.19
Irrigation	0.81	1.21	0.77	1.15	0.55	0.83	0.99	1.48	0.50	0.63	0.78	1.17
Total	**6.55**	**9.98**	**7.38**	**10.02**	**6.63**	**9.44**	**8.24**	**11.75**	**4.21**	**7.23**	**6.55**	**9.89**

Source: Authors' calculations.
Note: Water Supply and Sanitation (WSS)

The bottom line is that South Asia region needs to invest US$ 1.7 trillion to US$ 2.5 trillion (in current prices) in infrastructure until 2020 – equivalent to US$ 1.4 trillion to US$ 2.1 trillion at 2010 prices (Table 3)**.** Going forward, a mix of investing in infrastructure stock and implementing supportive reforms will allow SAR to close its infrastructure gap. In GDP terms, if investments are spread evenly over the years until 2020, SAR needs to invest between 6.6 and 9.9 percent of 2010 GDP per year – an increase of up to 3 percentage points compared with the 6.9 percent of GDP invested in infrastructure by SAR countries in 2009 (Table 4).[13]

5. Infrastructure Investment Trends

What are the odds that SAR can put together enough funds to meet these investment targets? A look at past infrastructure investment trends should shed some light on this question.

5.1 Total Sector Investment[14]

[13] These percentages are based on the investment requirements at 2010 prices.
[14] While the main source of the data for this sub-section are multi-year development plans prepared by the National Planning Commissions, annual reports from ministries, state banks, and other related government agencies have also been used in order to form as much as a complete picture as possible. The data used is a mixture of estimated and actual expenditure, as not all plans state actual expenditure from the previous plan or fiscal year. Furthermore, these plans do not distinguish between Capital and Operational Expenditures (CAPEX and OPEX). For public sector investment, South Asia is defined as: Bangladesh, Bhutan, India, Nepal, and Pakistan. Afghanistan, the Maldives and Sri Lanka are not included in this definition due to data limitations.

Total infrastructure investment in South Asia increased from 4.7 percent of GDP in 1973 to 6.9 percent in 2009, but fluctuated considerably around this trend. It rose from a low of 4.7 percent in 1973 to peak at 7.1 percent in 1985, before dropping down to only 5.0 percent in 1997 and then rising again to 6.9 percent in 2009 (Figure 2a). Nonetheless, despite these fluctuations, the total change in annual infrastructure in South Asia during 1973-2009 was sizeable, increasing by more than 47 percent.

The main driver of these fluctuations was the large infrastructure investment in electricity generation in the region during the 1980s. Infrastructure investment in the electricity sector on average constituted more than a third of the total portfolio (Figure 2b), but fluctuated considerably during the 1973-2009 period. Infrastructure investment in electricity was only 1.9 percent of GDP in 1973. It then increased dramatically to almost 3 percent GDP in the mid-1980s, as India, Pakistan, and Nepal invested heavily in the sector. Subsequently, investment dropped to merely 1.5 percent of GDP at the turn of the century before rising again to 2.4 percent in 2009.

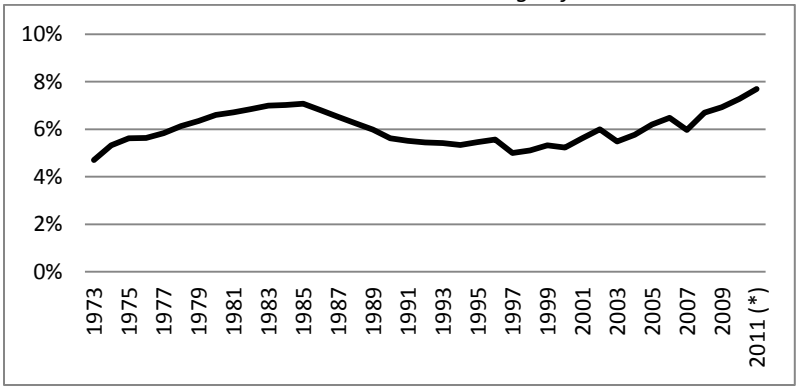
In contrast, investment in transport, water supply and sanitation, and irrigation was much more stable. Infrastructure investment in transport remained stable throughout most of the period averaging 1.8 percent of GDP per year and 31 percent of total investment. After an initial upsurge from 1.3 percent in 1973 to about 2 percent in the 1980s, it largely fluctuated around this trend. Similarly, infrastructure investment in water supply and sanitation, as well as irrigation, remained fairly constant at the average of 0.9 percent and 0.1 percent of GDP respectively. However, the figures for irrigation mask a continual decline in the sector's contribution to total investment. In fact, the share of irrigation declined from 20 percent in the early 1970s to merely 13 percent in 2009.

Over the past four decades an increasing amount of resources were devoted to the emerging telecom sector, although its overall contribution remains small. In 1973, investment in this sector stood at only 0.3 percent of GDP, but rose to an impressive 1.1 percent in 2009. As a result, its share of total investment doubled, from 6 percent in 1973 to 16 percent in 2009.

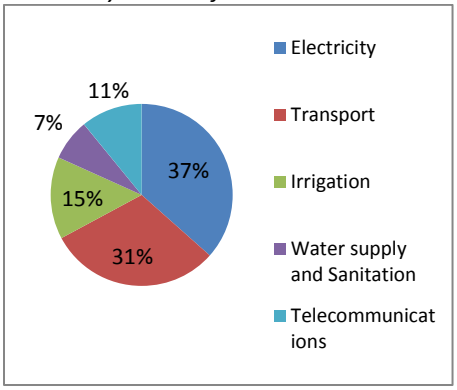
Figure 2: Electricity is Driving the Rise in Infrastructure Investment

Investment in Infrastructure in South Asia, 1973-2011 (Percentage of GDP)

a. Total Investment as Percentage of GDP



b. Share by Sector of the Total Investment



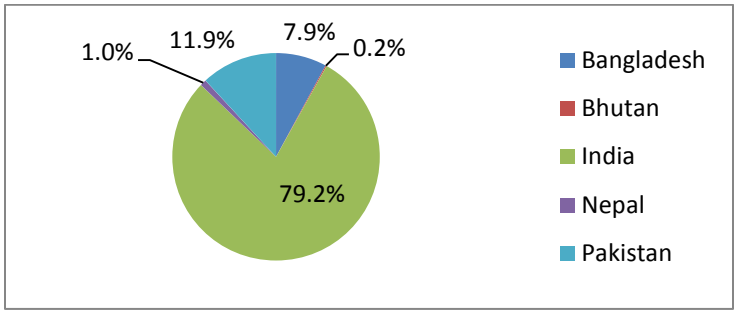
Sources: Data has been collected from the public investment plans for each country. The Investments for the region were computed as a weighted average by GDP level across the countries in SAR.

Note: Missing data is linearly interpolated. Extrapolation is based on the average growth rate of the other countries, weighting by their share in regional GDP. Figures for 2010 and 2011 are estimate projections based on India's public investment trends.

As expected, these overall patterns have been largely driven by India, which contributes the biggest share of total infrastructure investment in South Asia during the 1973-2009 period. In fact, infrastructure investment in India makes up on average 79 percent of total investment in the region (Figure 3). The second largest contributor – Pakistan – merely has an average share of 12 percent, and is followed by Bangladesh with 7.9 percent, Nepal with 1.0 percent, and Bhutan with 0.2 percent. These differences in the shares of total infrastructure investments in the region are roughly in line with the relative size of each economy. The average infrastructure investment as a percentage of GDP for the period 1973-2009 hovers around 6 percent for India, Pakistan, and Bangladesh, and 5 percent for Nepal. Bhutan with infrastructure investments representing 14.6 percent of its GDP has given significantly higher importance to infrastructure development.

Figure 3: India Leads the SAR Pack in Infrastructure Investment

(*Share in Total Infrastructure Investment by Country, 1973-2009)*



Sources: Data has been collected from the public investment plans for each country.

5.2 Private Sector Investment[15,16]

India clearly has the largest presence in terms of private sector participation in infrastructure development at 85 percent of regional investment commitments. While India dominates each sub-sector, it is interesting to note: i) there is a large investment in energy compared to the other sub-sectors, and ii) India is the only country where the private sector has invested in water and sanitation (Table 5). Pakistan and Bangladesh rank second and third in terms of private sector investments, followed by Sri Lanka and Afghanistan (primarily telecom). Furthermore, India is the country that, after Bhutan and Maldives, has the highest proportion of investment commitments with respect to GDP.

The energy sector received the highest private sector investments not just in India but also in SAR. From 1990-2012, the energy sector received US$155 billion in private investments. In 2012, 67 energy projects alone reached financial closure and a total of US$11.4 billion was invested – although this amounted to about half the investment in the previous year.[17]

[15] The core source for private sector investment is the World Bank Private Participation in Infrastructure Database (for a detailed explanation on the PPI methodology, refer to: http://ppi.worldbank.org/resources/ppi_methodology.aspx). In this section, Private Participation in Infrastructure (PPI) investment consists of all eight countries in the region - Afghanistan, Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan and Sri Lanka.

[16] Irrigation is not included in the definition of infrastructure for this section. This is primarily because there is not enough data available but also because irrigation is primarily a public sector domain.

[17] Source: http://ppi.worldbank.org/explore/ppi_exploreRegion.aspx?regionID=6

Table 5: *Private Investors Favor Energy and Telecom*

(Total Private Sector Investment Commitments in current US$ Mil (1990-2012)

Country	*Water & Sewerage*	*Transport*	*Energy*	*Telecom*	*Total*	*% of total PPI*	*% of GDP (2007-12)*
India	470	81,098	135,703	89,054	306,325	85.49	2.57
Pakistan	0	2,555	13,416	17,090	33,061	9.23	1.59
Sri Lanka	0	740	1,438	3,003	5,181	1.45	1.04
Nepal	0	0	997	135	1,132	0.32	0.66
Maldives	0	478	0	84	562	0.16	4.09
Bhutan	0	0	201	18	219	0.06	2.65
Bangladesh	0	0	3,285	6,855	10,140	2.83	1.14
Afghanistan	0	0	2	1,683	1,685	0.47	0.01
SAR	470	84,871	155,042	117,922	358,305	100	2.34

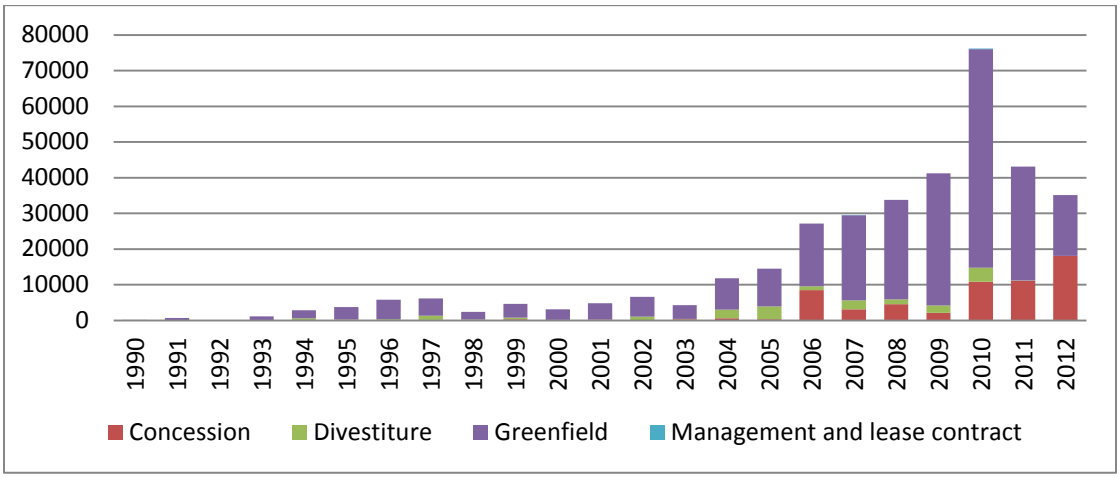
Source: World Bank Private Participation in Infrastructure Database.

Note: % of GDP was computed as a simple average across the specified period. Afghanistan % of GDP is from 2001-2011 due to a lack of data.

The telecom sector comes in second. From 1990-2012, telecom received US$118 billion in private investments. In 2012, service providers invested a total of US$4.7 billion. The transport sector comes in third with a total investment commitment of US$85 billion for 1990-2012. In 2012, it received US$20 billion in private investments.

The greatest interest from the private sector is in greenfield investments. These investments have taken off since the mid-2000s, reaching about US$61 billion in 2010 before dropping off somewhat (Figure 4). For most South Asian countries these investments oscillate between energy and telecommunications projects. Concession projects have also drawn some private sector interest, almost all in transport. For the period 1990-2012, concessions account for 100 percent of transport investments in Maldives, 72 percent in India, and 32-33 percent in Sri Lanka and Pakistan. In addition, 4 out of India's 14 total water and sanitation projects are concessions.

Figure 4: Greenfield Investments Hold the Biggest Lure for the Private Sector in SAR
(*Investment in Projects (US$ mil)*



Sources: World Bank Private Participation in Infrastructure Database
Notes: Concessions: When a private entity takes over the management of a SOE for a given period during which it also assumes significant investment risk. Divestiture: When a private entity acquires a stake in a SOE. When the private entities completely acquire a SOE it is considered to be a full divestiture. A partial divestiture is when the government transfers part of the equity of a SOE to private entities. This does not guarantee private management. Greenfield Projects: When a private entity or a public-private joint venture builds and operates a new facility for the period specified in the project contract. The facility may return to the public sector at the end of the concession period. Management and lease contract: Under a management contract, government hires private entities to manage facilities while still bearing the operational risk. However under a lease contract, the government leases assets to private entities while the private operator bears the operational risk.

6. Prioritizing Infrastructure Investments in South Asia

The demand for infrastructure investment is enormous but the available financial resources are limited; therefore, prioritizing infrastructure investment needs is crucial. Criteria used to prioritize infrastructure investment needs play a major role in mitigating the infrastructure gap. A few existing studies attempted to address this question (see e.g., Berechman and Paaswell, 2005; Karydas and Gifun, 2006), but the methodological framework they developed is narrow and can be applied only to rank infrastructure investment projects. This section aims to develop a methodology that would be helpful in prioritizing infrastructure needs in developing countries, particularly in South Asia.

6.1 Methodological Framework for Prioritization of Infrastructure Projects/Portfolios

How to prioritize investment projects or portfolios is a common question a government at any jurisdictional level asks. This question is especially critical in developing countries, particularly in South Asia and Sub-Saharan Africa where demand for investment is huge and financial resources are limited. Without an appropriate methodological framework to assess investment projects, it is difficult to allocate funding across various investment projects. The methodological framework consists of three main steps: (i) identifying factors that affect infrastructure investment decisions, (ii) quantifying identified factors, and (iii) ranking the infrastructure projects.

6.1.1 Identifying and Quantifying Factors Affecting Infrastructure Investment Decisions

A large number of factors could influence investment decisions. The list of specific factors might change depending upon the nature of infrastructure projects and country's development plans and priorities. In general, these factors, which are captured by different methodologies, can be classified into four categories: (i) project level factors, (ii) economy-wide impacts, (iii) project related market failures, and (iv) rent capture.

Direct costs and benefits play an important role in determining infrastructure investment priorities. In fact, cost/benefit analysis (CBA) is the first step in any investment decision process. While problems of underestimation are not uncommon, assessing the costs of a given project is generally the simplest part of the CBA. Estimation of benefits in many infrastructure projects is significantly more complex as actual benefits are either uncertain or not tangible. Even in projects where CBAs are routinely done (e.g. transport, power, water and sanitation), accounting for external benefits (like improved health, pollution abatement) is rarely undertaken. Another important project level factor affecting investment decisions is financing. The public sector in developing countries is not always capable of undertaking infrastructure projects alone. Participation of the private sector via firms or communities in financing, building, and operating infrastructure investments is often sought. However, the first step should be to determine whether a specific project or portfolio is economically sensible, and then determine the optimal financial structure that makes it feasible.

Indirect project costs and benefits (also known as economy-wide impacts) –those that spill over to an economy from a project – must also be identified. They can be further divided into two sub-categories: (i) impacts on economic growth and employment generation, and (ii) distributional impacts (e.g., welfare impacts, poverty alleviation) across different income level and geographical jurisdiction. In some cases, the size of indirect costs and benefits of an infrastructure portfolio might be as high as the corresponding direct costs and benefits. Typically a variety of approaches are used to assess economy-wide impacts of investment portfolios (including input-output approach, macroeconomic approach, and CGE approach), with the focus often on GDP and employment. If it is feasible to measure economic impacts,[18] this is a powerful factor in prioritizing infrastructure projects or portfolios—most recently, for renewable and clean energy technologies and green growth agendas.

External costs and benefits – those that are not captured in direct or indirect costs and benefits – also matter but they are not easily quantifiable. One example is a better quality of life thanks to the access to electricity, telephone lines, clean water and adequate sanitation, or a road network. Another is the loss of forest or biodiversity while constructing a highway or electricity transmission lines. Although a social appraisal of an investment project attempts to assess external costs and benefits of an infrastructure project, such an assessment is qualitative in nature. Alternatively, valuation techniques can be used to appraise where markets fail—notably revealed and stated preference approaches. While different approaches are available to attempt to monetize at least part of the values associated with nonmarket goods and services, these are seldom used in project economic analyses, input-output, macroeconomic, or CGE approaches. Basing decisions solely on any of these approaches can thus skew infrastructure investments toward projects easily valued, while one could argue that public funds should go to those projects that yield the most public goods (e.g. power distribution versus flood protection).

[18] In many circumstances, measuring economy-wide impacts of a project would not be feasible as necessary data (such as input-output table and social accounting matrix of an economy) are not available.

A final factor that needs to be accounted for is the strength or weakness of a country's institutional system. In the best case scenario, politicians and policy makers account for the aforementioned factors and the information coming out from the respective methods when negotiating the prioritization of particular interventions. Independent or quasi-independent regulatory institutions (including the judicial and civil society) may also weigh in with checks and balances, blocking questionable infrastructure projects. However, the result of such a decision process is unlikely to be optimal when there is rent-seeking behavior – which refers to situations where individuals organized in special interest groups (or acting alone) are motivated by their particular interests rather than by the general interest of the society. Examples are industrialists wanting infrastructure investments that only (or mainly) benefit them and farmers seeking cheap or free power for irrigation. Rent-seeking behavior leads some groups to attempt to capture key state institutions (such as public contracts agencies) where they can extract rents. Infrastructure projects are by nature highly politicized and a significant source of rents. Political economy analysis focuses on distributing power and wealth between different groups and individuals, and the processes that create, sustain, and transform these relationships. This type of analysis helps to identify potential winners and losers of particular infrastructure interventions. For example, Sanchez et al. (2013) investigates the winners and losers in the rural and urban spaces of an increase in total factor productivity (TFP) in Pakistan's transport sector. Understanding the political, economic, and social processes that promote or block pro-poor investments – and understanding the role of institutions, power, and the underlying context in countries – allow more effective and politically feasible investments.[19]

6.1.2 Factor-based Ranking of infrastructure Investments

Taking into account all the aforementioned caveats, some stylized rankings can be designed to facilitate prioritization of infrastructure investments. Table 6 relates infrastructure services with some of the factors discussed above. Specifically, it ranks infrastructure services according to input intensity of use, degree of spatial manifestation, typical development outputs, and commonly debated market failures. The infrastructure services listed often fall under the public sector, but in some cases may be a combination of public and private provision. For example, sanitation via off-site systems is typically provided by public utilities, but on-site sanitation such as septic tanks are generally private investments. The list is not meant to be exhaustive and provides ranks from 1 to 3, with 1 being the lowest relative weight, based on the existing literature on infrastructure services and its impacts discussed in the previous sections.

Different infrastructure services rank better depending on the specific factor of interest. Take the case of solid waste. This service (both collection and processing) is primarily labor intensive, dominates urban agendas, has an important impact on welfare improvement but less of a generalized impact on economic growth, and while it generates important market failures it is not a major contributor to agglomeration effects. In contrast, connective infrastructure (such as transport infrastructure) yields higher agglomeration effects and a higher impact on economic growth than solid waste infrastructure, but a lower impact on welfare. Similarly, connective infrastructure has a higher impact on economic growth than water and sanitation infrastructure, while the ranking is reversed when talking about welfare. When it comes to negative externalities such as local/global pollution, these are higher in the case of fossil fuels based power generation than water and solid waste infrastructure.

[19] OECD - www.oecd.org/dac/governance/politicaleconomy

Table 6: *Ranking of Prioritization of Infrastructure Investments* (Scale: 1 to 3)

	Infrastructure Services[1]		Inputs Intensity[2]				Spatial Manifestation		Development Challenges					
									Outputs		Externalities			
			Capital	*Labor*	*Land*	*Natural Resources*	*Urban*	*Rural*	*Economic Growth*	*Welfare*	*Agglomeration*	*Local Pollution*	*Global Pollution (Climate Change)*	*Green Growth*
Power	Grid-connected Generation	Fossil Fuels (Gas, Coal, etc)	2	1	1	3	2	2	2	2	3	3	3	1
		Hydro	3	1	2	3	1	3	2	2	3	1	1	3
		Wind	3	1	2	3	1	3	2	2	3	1	1	3
		Geothermal	2	1	1	3	1	3	2	2	3	1	1	3
		Biofuels	2	1	1	2	1	3	2	2	3	1	1	3
	Off-grid Generation	Diesel	2	2	1	3	2	3	2	2	1	3	3	1
		Small Hydro	2	2	1	3	1	3	2	2	1	1	1	3
		Wind	3	2	1	3	1	3	2	2	1	1	1	3
		Solar	3	2	1	3	2	2	2	2	1	1	1	3
		Biofuels	2	2	1	2	1	3	2	2	1	1	1	3
	Transmission Grid		2	1	2	1	3	1	2	2	3	1	2	2
	Distribution Grid		2	1	1	1	3	1	2	2	3	1	2	2
Water	Piped water into dwelling		2	2	1	3	3	1	1	3	3	1	1	3
	Water well		1	3	1	3	1	2	1	3	1	1	1	2
	Protected spring		1	3	1	3	1	3	1	3	2	1	1	2
Sanitation	Piped sewer system		2	2	1	1	3	1	1	3	3	2	1	2
	Septic tank		1	3	2	1	2	2	1	3	1	3	1	2
Solid Waste	Collection and processing		1	3	2	1	3	1	2	3	1	2	2	2
Transport	Roads	Rural	2	2	2	1	1	3	3	2	3	2	2	2
		Urban	2	2	2	1	3	1	3	2	3	3	3	1
		Highway	2	2	2	1	2	2	3	2	3	2	2	2
	Railways		3	2	2	1	2	2	3	2	3	1	1	2
	Ports		3	1	1	1	3	1	3	1	3	1	1	2
	Airports		3	2	1	1	3	1	3	1	3	3	3	1

Notes: 1. The provision modalities considered for each infrastructure service are the best available technologies (BAT) to provide the specific infrastructure service. The BAT for a specific infrastructure service is the best ranked technology according to a cost-benefit analysis. In the case of power generation, the BAT varies by location; hence the different options; 2. Inputs intensity is based on BAT to provide the specific infrastructure service and the BAT for building the infrastructure needed to provide the infrastructure service.

6.1.3 Valuing or Weighting the Factors[20]

The biggest challenge in prioritizing infrastructure projects is how to value or weigh different factors that influence investment decisions. Decisions require understanding a goal or a set of goals and alternative paths to achieving these goals. In the case of infrastructure investments, these goals usually fall under welfare improvements ("a principle of inclusion"), including those that come from public goods like a cleaner environment) or fostering economic growth ("a principle of connectivity") or both (Biller and Nabi 2013). If one considers that costs also imply forgone goals due to trade-offs that need to be equated, minimizing costs may be viewed as a goal or as a constraint to achieve other goals. A simple decision making matrix would thus bring together different goals with different paths to achieving these goals, and each cell would be filled by indicators (e.g. increase economic growth by 0.5% in year 1). One of the goals may act as a numeraire and weights may be assigned to the other goals with respect to this numeraire. From such a matrix, a weighted score of benefits can be derived. Once divided by the costs of each alternative path, a cost-effective indicator would be derived, indicating a preferred option. Both indicators and weights may have a high degree of subjectivity given the measurement issues. Weights may differ spatially (e.g. local versus global, across countries, rural versus urban), across economic sectors, across stakeholders, and across time (outcomes now versus future outcomes).[21]

A number of non-economic theories/techniques exist in the decision science literature to weight these factors. While desirable, not all factors affecting priority setting can be measured in monetized or quasi-monetized forms. In these cases, non-economic methods need to be used – including multi-attribute and multi-criteria decision theory, Delphi approach, and analytical hierarchy process (AHP).

All methods and techniques for priority setting in decision making come with caveats. Monetizing across the board has the advantage of converting factors in a common unit of measurement, but often generates important moral dilemmas. Alternatively, solely using expert opinion to direct decision making may result in skewed investments, as experts usually have their own bias toward their expertise. Given the long-term nature of most infrastructure investments and their lock-in characteristic, the time dimension and how to discount the future play a particularly important role. Yet, this further complicates decision making since decisions made today generate political pressures and future rent-seeking. For example, implicit and explicit subsidies to urban sprawl in the United States generated a pattern of private vehicle dependency and expectations of a "rural" living combined with an urban experience and income generation. This in turn has tremendous external consequences that are difficult to address often because of political reasons. The process advanced mostly in the 1950s but continues today given vested interests. It is also well known that the way in which the future is discounted in decision making economic methods like CBA penalize the future with respect to the present. The economic logic of the currently used discount factor remains and enables comparisons of "apples and apples." Yet, if long-term discrete or continuous phenomena that may potentially cause severe harm to societies – like pandemics, and climate change – are to be effectively addressed by decision makers, better methodologies need to be designed to enable comparisons for prioritizing investments across long time horizons under scarce resources.

6.2 Infrastructure Gap and Prioritization

[20] It should be noted that the discussion here is not exclusive to infrastructure investments but encompasses decision making processes. Much of this discussion comes from OECD (2002).
[21] This last factor becomes particularly important under uncertainty and over a long term as argued in Hallegatte et al. (2012).

Assessing the gap is fundamental to understand overall needs and potential financing requirements. Yet, it should be noted that infrastructure gap assessment (IGA) does not necessarily determine which investments are priorities. IGA is usually based on a baseline of where a country, state, or municipality is in terms of infrastructure provision and where it would like to be in x years. The fact that IGA may be substantially larger in one infrastructure sector versus another does not infer that the large gap sector should be given all resources in a priority setting exercise. The size of the gap after all is also dependent on investment costs, existing technologies etc. The departure for priority setting exercises is the goals decision makers are attempting to reach. For example, if a goal is to generate employment, decision makers may place a large weight in labor-intensive infrastructure investments, while the IGA may indicate that the largest gap is in capital-intensive infrastructures.[22]

6.2.1 Infrastructure, Economic Growth, and Welfare Debate

One of the burning questions any developing country often faces is how much financial resources should be allocated to infrastructure development, within infrastructure sectors, and other sectors (such as health, education, public safety, and national defense). But there is no rule to determine the investment allocations.[23] It depends on a country's priority, economic growth, and welfare objectives. Considering that infrastructure is both a means to facilitate economic growth and development and a measure of the former, at least for developing countries – where there is greater scarcity of man-made and human capital related to infrastructure – one could expect that a higher share of GDP would need to be allocated for infrastructure investment. Funds received from bilateral and multilateral donor agencies may also be allocated for that purpose.

That said, there is a false dichotomy between prioritizing large-scale infrastructure versus addressing the needs of the poor. At a very basic level, this dichotomy is false because many large-scale infrastructure investments may concurrently facilitate economic growth and increase the welfare of poorer populations. For example, a large transport project may primarily target facilitating trade of raw materials, but at the same time it may also connect isolated poorer populations to better services. A more interesting debate is at which stage of development a particular infrastructure investment has a higher impact on economic growth versus on welfare. For instance, a power distribution project may have large welfare impacts given that it enables education and health outcomes, which may in turn translate into future economic growth as a more educated, healthier labor force join the labor market in the medium to long run. Yet, it may also facilitate growth in manufacture today, which in turn may promote short-term economic growth. Given that most power sources are limited, there is a clear policy choice related to power allocation for different usages. Instruments such as tariffs and other incentives play a vital role in allocating this scarce resource. Moreover, policy makers should be cognizant that attempting to apply the same standards across the board regardless of income may translate into no provision to the poor. For example, strict standards of offsite sewage collection may translate into no collection in slums, generating negative externalities to the rest of the city that the strict standards were

[22] Methodologies presented here are mainly ex-ante. They support decision making before the decision is taken. Yet, equally important for learning and adjustment in future decision making is to understand the impact of the interventions. For this purpose, one would need to design robust impact evaluations (IEs) such as randomized control trials, which are particularly challenging in infrastructure or infrastructure related investments. This is also an area that remains a major gap in the literature of decision making and priority setting.

[23] Some existing literature attempted to address this question. Based on information from a previous study (Fay and Yepes, 2003), Estache and Fay (2010) estimate that developing countries might need 6.5% of their GDP, in average, during 2005-2015 period. Of which 2.3% would be needed to maintain the existing infrastructure and 3.2% for new infrastructure projects.

trying to avoid. Ultimately, both types of investments are needed – those that clearly target economic growth in the short run and those that attempt to reduce poverty in the short run. The right combination as well as the level at which design and implementation take place is highly dependent on country level institutions, the policy makers' objectives, and the economic characteristics of the infrastructures under consideration.

6.2.2 Infrastructure and Economic Growth

Investment in infrastructure is accumulated in man-made capital formation and thus contributes to GDP growth.[24] A significant number of micro and macro studies find a positive link between infrastructure investments and growth (see Straub, 2008), which holds for both long-run economic growth and specific factor outputs. For example, looking mostly at U.S. public capital stocks, the macro-level literature finds very large estimates for the elasticity of infrastructure—between 0.20 and 0.40.

Connective infrastructure, such as roads, is likely to have the greatest impact on economic growth. Improved connectivity within a country and within a region increases firms' access to markets for their goods and for cheaper inputs; assists businesses in developing competitive advantages; and provides workers, particularly those in lagging areas, with greater job and income opportunities. Transport typically facilitates agglomerations, which in turn promotes economic growth. For example, Njoh (2009) finds a strong positive relationship between transportation infrastructure and growth based on evidence from 24 West African countries. As countries develop, economic growth becomes more closely linked to a "principle of connectivity" (Biller and Nabi 2013).

Other capital intensive infrastructures such as power are also closely related to economic growth via connectivity. While not directly linked to connectivity (in terms of moving people, goods, and services), power facilitates information flows, thereby enabling agglomerations. More importantly, power is a key input in the production process, and power constraints have been identified as a major bottleneck for growth and job creation in SAR (World Bank 2011, and several business climate surveys). A good example can be found in Nepal. Over the past two years, Nepal has faced up to 16 hours of electricity load shedding in dry months – stalling the manufacturing sector and severely curtailing basic services (like health care), other services, and commerce. The economic loss of such a huge power outage must be tremendous. In transport, Nepal has similar constraints, being a mountainous landlocked country. Yet while geography may be more benign in other South Asian countries like Pakistan and India, connective infrastructure is also severely lacking and the existing ones are poorly used.[25]

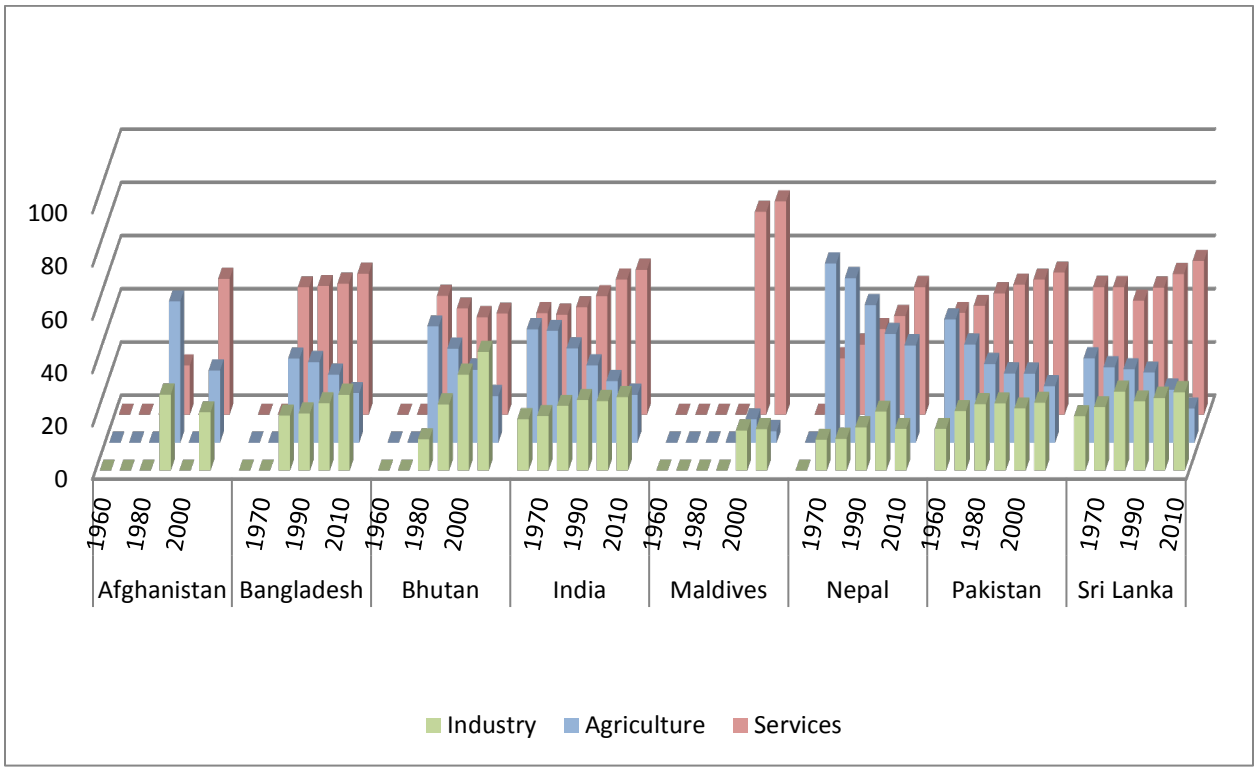
Substantial lock-ins exist in infrastructure investments, which in turn may constrain or incentivize future economic growth. Much of the existing connective infrastructure in SAR has been built or initiated by former colonial powers, whose main goal may have been different from the current or future reality of the region's output. Even after independence the region's economy has changed significantly as indicated by Figure 5. For example, at independence, Sri Lanka had a reasonably well-developed road and rail network. At the time, priority was given to connecting the tea, rubber, and coconut plantations with the Colombo Port – the gateway to Great Britain. Electricity was available only in a few areas. Over time, the economy's reliance on agricultural commodities diminished significantly

[24] See for example Yoshino (2008), Calderón and Servén (2004), Estache and Fay (2010).

[25] See Sanchez-Triana et al. 2013 for a detailed analysis on the potential of transport investment on economic growth in Pakistan.

not only in Sri Lanka but also in SAR as a whole. Agriculture's loss has been primarily service's gain. Yet, the region remains with large numbers of infrastructure assets like irrigation canals targeting agriculture production. How much of these assets should be maintained if a country's output is less reliant on agriculture? To what extent does their sole existence pressure governments to allocate funds to their maintenance because of the rent-seeking behavior of a few? The same situation could be found in transport (e.g. connecting isolated communities, which is costly, or providing quality services for a few) and in other infrastructure sectors as well. They are aggravated by the substantial lock-ins that are common to many infrastructure investments because of their long-term nature. This in turn also partly pre-determines future economic growth and is an integral part of the tension existing in a country's path to structural change such as rural–urban transformation and a corresponding change in shares of a country's output.

Figure 5: Industry and Services are Replacing Agriculture
(*The Evolution of GDP Composition in South Asia (1960 – 2010)*



Source: World Development Indicators 2013 Online Database, The World Bank.

6.2.3 Infrastructure and Welfare

Infrastructure investments help improve welfare through three mechanisms. They are based on either a direct or indirect relationship between infrastructure investments and welfare, and they center on alleviating poverty, enhancing prosperity, and boosting economic growth.

First, physical infrastructure – such as roads, electricity, and water supply and sanitation systems – provide services that directly contribute to improving the quality of life; and hence, increase household welfare. On the education front, a better transportation system and a safer road network

help raise school attendance (Brenneman and Kerf, 2002). Access to electricity improves school performance by allowing kids to spend more time studying and use computers (Leipziger et al., 2003). On the health front, several studies show that access to clean water has significantly helped reduce child mortality (Behrman and Wolfe, 1987; Lee et al. 1997; Jalan and Ravallion, 2003). In Argentina, expanded access to water and sanitation has reduced child mortality by 8 percent, with most of the reduction taking place in low-income areas where the expansion in the water network was the largest (Galiani et al., 2002). Transport also makes a difference. Lokshin and Yemtsov (2005) show that road and bridge rehabilitation projects generate clear economic benefits at the community level – not only by increasing the number of small and medium-size enterprises but also by improving access to emergency medical assistance. Infrastructure raises an economy's ability to produce health services, which, in turn, enhances labor productivity (Aegnor, 2010). Similarly, Ganelli and Tervala (2010) shows that a higher domestic stock of public capital financed by lower public consumption increases domestic welfare if the productivity of public capital is not too low and the importance of public consumption (relative to private consumption) in private utility is not too high.[26]

Second, infrastructure services help increase household income and therefore welfare (e.g., market access to household products, job created by the construction and operation of the infrastructure projects). Infrastructure projects, such as construction of road, irrigation canal, and power plants, provide jobs to low-income households, which are the main source of unskilled labor in the short-run. In South Asia, a key source of cash income to unskilled labor is construction work in infrastructure projects. Using a sample survey of cities from 20 developing countries over the period 1980-2005, Seetanah et al. (2009) finds that transport and communication infrastructure helps reduce urban poverty in developing countries. Using a large panel data set encompassing over 100 countries and spanning the years 1960-2000, Calderon and Serven (2004) finds that increased infrastructure quantity and quality reduces income inequality. Another strain of the literature argues that connective infrastructure services, such as roads, do not necessarily help reduce poverty in rural and remote areas as poor households cannot afford them. Using survey data from Ethiopia, Zambia, and Vietnam, Bryceson et al. (2008) find that, in extremely remote areas, enhancing the mobility of the rural poor does not necessarily reduce poverty given the poor's lack of access to motor vehicles and ability to pay for public transport. This finding shows that infrastructure investments are not a silver bullet for reducing poverty.

Third, infrastructure investment boosts economic growth, which spills over to household welfare. Economic growth and welfare are positively correlated. This reflects the fact that when a country achieves higher economic growth and development, the welfare of its population would also increase. Gupta and Barman (2010) support this hypothesis developing an endogenous growth model with special focus on the role of health capital, public infrastructure, and environmental pollution. They find no conflict between the social welfare maximizing solution and the growth rate maximizing solution in the balanced growth equilibrium in an economy.

7. Infrastructure Services Provision: Financing, Construction, and Operation

[26] On the empirical side, there is a vast literature on valuating the welfare impacts of some infrastructure services, particularly those with strong externalities associated with them (see Andres, Iimi, Orfei, and Samad (2013) for a survey of this literature).

Given the macroeconomic situation in South Asia and the sheer size of the funding requirements, it is not feasible to expect South Asian governments to fund the gap only with public resources. However, this situation can be seen as an opportunity to rethink and improve the infrastructure service provision approach currently in place, which refers to the organizational form that defines and structures the roles of the public and private sectors. Moreover, once infrastructure projects or portfolios have been ranked based on their overall benefit-cost ratios, then the optimal service provision approach needs to be determined.

There are different approaches for providing infrastructure services: (i) traditional (or public) provision; (ii) public-private partnerships (PPPs); and (iii) privatization (either regulated or deregulated). Each approach includes a number of different contractual arrangements. Guasch (2004) identifies twelve contractual arrangements, which organized by increasing order of private participation are: public supply and operation; outsourcing; corporatization and performance agreement; management contract; leasing; franchise; concession; build-operate-transfer (BOT); build-own-operate; divestiture by license; divestiture by sale; and private supply and operation. In this list, traditional provision includes public supply and operation, outsourcing, corporatization and performance agreement, and management contract; PPPs include leasing,[27] franchise, concession, and BOT; and the remaining arrangements fall under privatization.

PPPs are the most complex approach of all. Under the traditional approach the government contracts a private firm to build the project, and in some cases, contracts another firm to operate and maintain it. Under this approach, the private firm that builds the project has no responsibility over the projects' performance once the construction warranty has expired. Under privatization, the government transfers the ownership rights over the infrastructure assets indefinitely to the private firm. Hence, the latter has full responsibility over the performance of the assets. Following Grimsey and Lewis (2007), "A PPP fairly obviously involves two (or more) parties, and at least one of them has to be a public body [and one a private body…] Partnerships need to be enduring and relational […] Each of the participants must bring something of value to the partnership. PPPs seek to draw on the best available skills, knowledge and resources, whether they are in the public or the private sector, and deliver value for money in the provision of public infrastructure services […] PPPs involve sharing of responsibility and risk for outcomes (whether financial, economic, environment or social) in a collaborative framework […] There has to be a mutual interest and unified commitment." According to Engel et al (2009), another defining characteristic of PPPs is that they bundle investment and service provision into a single long-term contract.[28] Furthermore, the firm has control rights during the contract and the infrastructure return to the government when the contract term expires.

7.1 Which Service Provision Approach?

There is no single service provision approach that is better than the alternatives for all infrastructure services and under all degrees of institutional development. Following Engel et al. (2009) who study the conditions for each organizational form to be the optimal service provision approach, we consider

[27] For some authors, such as Grimsey and Lewis (2007), a lease (also known as an affermage) is a PPP, while for others, such as Yescombe (2007), it is not.

[28] Engel et al (2009) definition restricts PPPs to those contracts that involve an upfront investment by the firm either building new infrastructure or rehabilitating existing infrastructure. A maintenance and operations contract does not quality as a PPP according to this definition.

traditional provision, PPP, regulated privatization, and liberalization (i.e., deregulated privatization) as possible organizational forms (Table 7). It is assumed that private firms build, operate, and maintain the infrastructure under all forms. Hence, the benefits of each organizational form stem from the incentive structure and not from the degree of private participation.

The three main features that define each organizational form are: *(i) bundling of finance, construction, operation, and maintenance; (ii) ownership (such as type and duration); and (iii) whether prices are regulated or determined by the market*. In many infrastructure projects, operation and maintenance costs depend on investments made during construction. Thus, a firm delivering finance, construction, operation, and maintenance internalizes the long-term nature of an infrastructure project, which gives the firm the incentive to invest in life-cycle cost reductions. Ownership rights grant the firm, either permanent or temporary, control and autonomy in managing assets and the right to retain the gains stemming from its decisions. Thus, a firm holding ownership rights on a project has strong incentives to make innovative and cost reducing investments. The longer the tenure of ownership rights, the stronger the incentive to make optimal cost cutting investments. For example, when ownership is temporary the firm does not care about the assets the day after its rights expire; hence, it might invest in low cost assets that deteriorate fast. Some cost cutting investments might have unwanted effects – such as lowering service quality, which reduces consumer welfare. Hence, there is a trade-off between productive efficiency and quality considerations.

Table 7: *Possible Organizational Forms*

	Characteristics		
	Bundling	Ownership	Regulated prices
Traditional	no	public	yes
PPP	yes	private, temporary	yes/no
Regulated privatization	yes	private, permanent	yes
Liberalization	yes	private, permanent	no

Source: Engel et al. (2009) and authors
Note: For Engel et al. (2009) regulated prices is a characteristic of PPPs, however, we believe that is not the case.

7.1.1 Benchmark

Depending on the features of each infrastructure service, one of the four organizational forms brings the highest social welfare. Applying the framework developed by Engel et al. (2009), we select the optimal organizational form for different infrastructure services (see Table 8). This framework is based on the idea of a benevolent and efficient government that does not suffer any of the normal failures of real governments and aims to maximize social welfare.

When market liberalization is optimal. Power generation is an example of an infrastructure service that is produced under constant or decreasing returns to scale, and for which user fees can be charged. In cases like this, the optimal organizational form is market liberalization (that is, privatization plus price deregulation). Competition together with private ownership induces firms to select optimal life-cycle cost saving investments and provide the optimal service quality, thereby solving the trade-off between productive efficiency and quality considerations.

Table 8: *Optimal Organizational Form for Service Provision*

Infrastructure Sector		Determinants	Optimal organizational form
Water	**Catchment (often the case for groundwater as well)**	User fees possible; Quality contractible; Global planning and coordination*	*PPP*
	Distribution	Increasing returns to scale; User fees possible; Quality contractible; Project-level planning	*Regulated Privatization*
Sanitation	**Collection and treatment**	Increasing returns to scale; User fees possible; Quality contractible; Project-level planning	*Regulated Privatization*
Flood control	**Catchment urban**	User fees not possible; Quality not contractible; Quality considerations dominate productive efficiency	*Traditional provision*
Power	**Generation**	Constant/decreasing returns to scale; User fees possible	*Liberalization*
	Transmission	Increasing returns to scale; User fees possible; Quality contractible; Global planning and coordination*	*PPP*
	Distribution	Increasing returns to scale; User fees possible; Quality contractible; Project-level planning	*Regulated Privatization*
Transport	**Roads/highways**	Increasing returns to scale; User fees possible; Quality contractible; Global planning and coordination*	*PPP*
	Railways	Increasing returns to scale; User fees possible; Quality contractible; Global planning and coordination*	*PPP*
	Airports	Increasing returns to scale; User fees possible; Quality contractible; Global planning and coordination*	*PPP*
	Ports	Increasing returns to scale; User fees possible; Quality contractible; Global planning and coordination*	*PPP*
Solid Waste	**Collection**	Constant/decreasing returns to scale; User fees possible	*Liberalization*
	Disposal	Increasing returns to scale; User fees possible; Quality contractible; Project-level planning	*Regulated Privatization*
ICT	**Fixed**	Network externalities; User fees possible Quality contractible; Project-level planning	*Regulated Privatization*
	Mobile	Entry barrier (i.e., limited spectrum); Network externalities; User fees possible; Quality contractible; Project-level planning	*Regulated Privatization*

*Note: * Global planning and coordination means beyond project*

When traditional provision is optimal. In the case of flood control, which is a non-excludable service, it is not possible for the government to set service standards that are enforceable. Furthermore, quality considerations dominate productive efficiency, making traditional provision the optimal organizational form. If the costs of quality reduction were not as important as the benefits of reducing life-cycle cost, then a PPP would be preferred over traditional provision. Similarly, if it were not possible to charge fees for the use of a service, but service standards could be designed and enforced, then a PPP would be the optimal organizational form.

When PPPs are optimal. In addition to the cases discussed in the previous paragraph, this occurs when the service is produced under increasing returns to scale (i.e., natural monopoly) or there are technical aspects that create barriers to entry (e.g., the scarcity of radio spectrum for wireless communications), conditions that would rule out market liberalization. So in a case like power transmission – which is a natural monopoly, and where expansion requires significant network planning – PPPs would dominate

over regulated privatization. PPPs have the advantage of leaving the government with the authority to decide on future expansions. The same applies for most transport services. An interesting and slightly different case is that of container ports. In this case, the optimal organization is to have a state-owned port authority responsible for the long-term planning of the whole port and for managing the infrastructure connecting the port with the sea (e.g., channels, sea locks) and the hinterland (e.g., roads, rails), and firms operating terminals under PPPs. Temporary transfer of ownership rights is preferred to permanent transfer to avoid planning and coordination (if there are several terminal operators) problems when expansion or reconfigurations are required. In addition, in large ports it is optimal to have different firms operating terminals. This creates competition among them, and allow for either light-handed price regulation or even price deregulation.

When regulated privatization is optimal. This occurs when competition is not feasible (e.g., because of increasing returns to scale or technical and/or legal entry barriers), user fees can be collected, the government can design and enforce service standards, and planning is best done at the firm level. Hence, regulated privatization is optimal for power distribution, and ICT services (fixed and mobile). In the latter case, network externalities are important, creating the need to regulate interconnection charges. Regulated privatization is also optimal for sanitation and water services, particularly at the distribution level in the latter case. An issue of planning and coordination in the use of a natural resource that is beyond the project level arises in water production or catchment, which makes PPPs the optimal organizational form in water production.

7.1.2 Departure from Benchmark

The reality, however, is that governments suffer from inefficiencies and in some cases their project decisions are based more on political considerations than on social welfare considerations. When this occurs, wasteful projects or 'white elephants' (i.e., projects with social costs higher than social benefits), which are prevalent throughout the world, arise. Obviously the first best is to strengthen the project selection process. However, the organizational form for service provision can also help avoid 'white elephants'. An organizational form that transfers ownership to a private firm, bundles construction, operation, and maintenance, and finances it through user fees, has the potential to filter out some of these wasteful projects. A private firm will not bid for a project that is not financially viable. So, those projects that are neither financially viable nor economically sound will not materialize. However, projects that are financially viable but lack sufficient overall public benefit (low social rate of return) would escape the market test. Hence, privatization and PPPs financed by user fees are two possible options to limit 'white elephants.' But if the project financing is based on shadow tolls or availability payments, and if the government provides guarantees, then PPPs would not filter out wasteful projects. Also, if the government gives in to opportunistic renegotiations on the terms of PPPs or privatizations, then firms might have the incentive to bid for 'white elephants,' which are not financially viable under the original project design, as long as they can obtain better conditions later on (e.g., subsidies, tax breaks).

When using traditional provision, governments tend to underspend on maintenance of infrastructure projects – a common problem in the developing world. According to the World Bank (2005), "[m]any countries spend just 20-50 percent of what they should be spending on maintenance of their road network." Similarly, Foster and Briceño-Garmendia (2010) find that, on average, 30 percent of African infrastructure assets need rehabilitation because of under maintenance. In India, the Working Group on Roads for the National Transport Development Policy Committee reports a 40-50 percent shortfall in the maintenance allocation for state highways and major district roads. Governments prefer to build rather

than to maintain, because building new projects gives them more visibility, and hence, political benefits. But this is an inefficient path. Under-spending on maintenance of infrastructure has direct and indirect costs. Without regular maintenance, physical infrastructure can rapidly fall into disrepair, requiring expensive reconstruction to bring it back to adequate standards. For example, the cost of full reconstruction of roads that have been poorly maintained is, on average, at least three times the cost of maintenance (World Bank, 2005). But while funds for new construction may be easier to obtain and implement, those for maintenance are more difficult as they need to be sustained on a regular basis.

Fortunately, policy makers can use a variety of mechanisms to improve maintenance in different infrastructure sectors. In the road sector, some governments have adopted or considered adopting a "road fund" type of arrangement for supporting maintenance. Under such arrangements, maintenance funds are assured from a mandated tax on gasoline and diesel and are deposited into an assured and independently operated fund, possibly overseen by a Board that includes the public sector, or the private sector, or both. In addition, policy makers may consider altering organizational forms, given that incentives to undertake appropriate maintenance are stronger under private ownership than under traditional provision, thanks to bundling of construction, operation, and maintenance, and funding by user fees. On the one hand, paying users exert more pressure on the provider than when the government provides the service through traditional provision. On the other hand, the government has higher incentives to enforce the private firm's obligation to maintain the quality of the service, because the government does not benefit from under spending on maintenance. Hence, PPPs or regulated privatization provide strong incentives for adequate maintenance.

That said, private participation in infrastructure is not a panacea, and weaknesses in its implementation can create fiscal risks. The sale of state-owned enterprises provides a temporary increase in fiscal resources for the current administration. In some cases, the choice of privatization is based more on the government's resource needs than on organizational merits – but selling assets to cover fiscal holes caused by problems unrelated to the specific asset is a policy bound to fail. PPPs also reduce pressure on the immediate budget deficit, but impose important future costs on the government through explicit and implicit obligations, some of which are kept off the balance sheet. Governments typically do not concentrate on the risk that comes from such obligations, particularly from contingent liabilities when assessing their overall risk profile. Adequate measures to capture the long-term nature of infrastructure projects in the budgetary process and proper accounting of liabilities stemming from PPPs are essential for their selection to be based on social welfare considerations and not on short-term fiscal benefits.

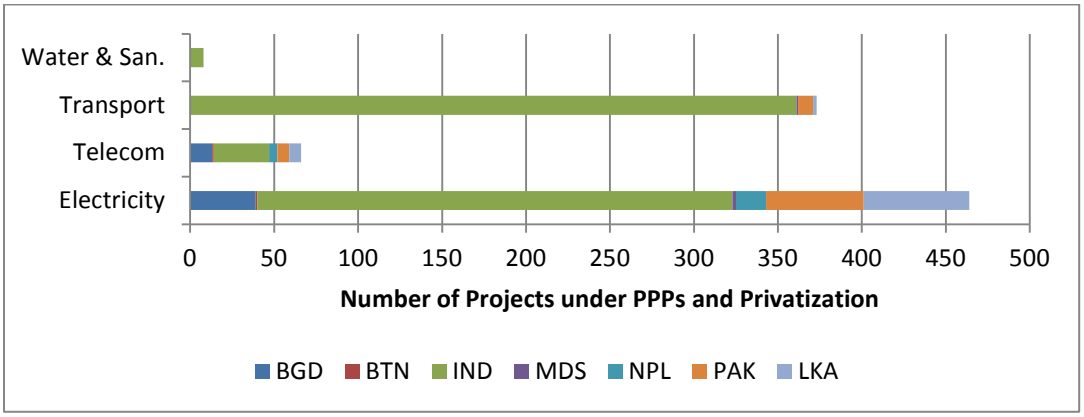
At this point, a traditional or public provision approach is still the norm in South Asia, even though private participation in infrastructure has been increasing, mainly in the past decade. According to the World Bank Private Participation in Infrastructure Database,[29] there are fewer than 1,000 active projects in the energy, telecom, transport, and water and sanitation sectors under PPPs or fully owned by the private sector.[30] This is quite low compared with the more than 400 power plants in the region, the extension of the electricity transmission network, the large number of cities where electricity distribution, water, and sanitation networks exist or are needed (in India only there are more than 5,000 towns and urban agglomerations), the more than 400 seaports and airports, and the extension of the road network.

[29] http://ppi.worldbank.org

[30] The database considers 7 possible statuses for a project (i.e., cancelled, concluded, construction, distressed, merged, operational, under development). We consider a project is active, if it is not cancelled or concluded.

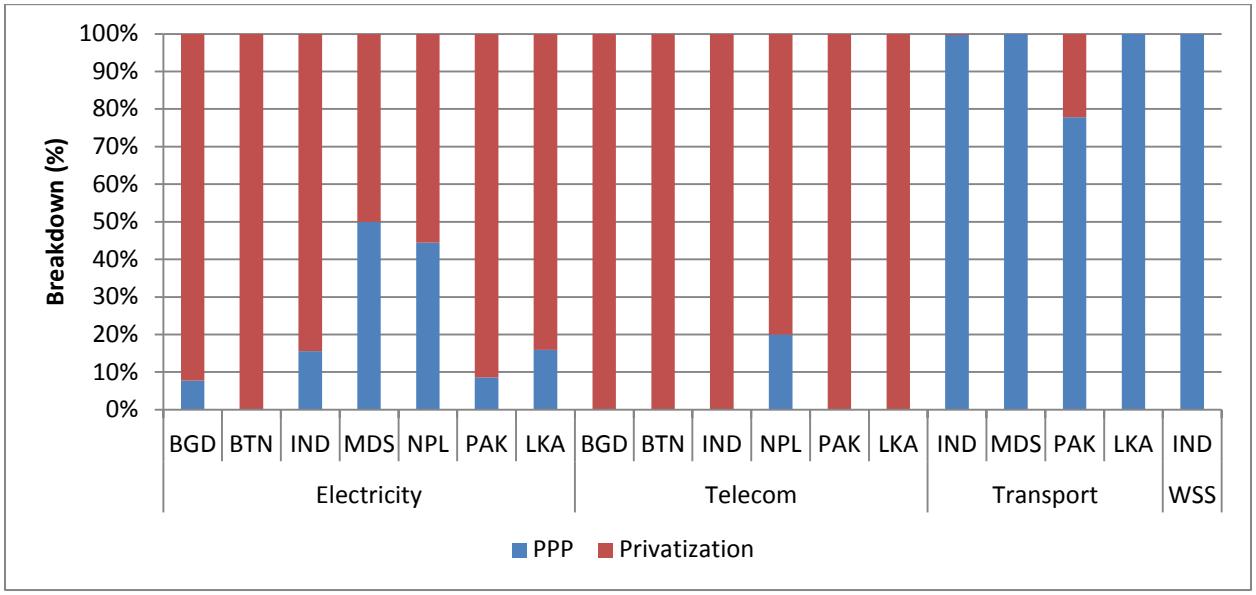
When the private sector invests in infrastructure, it tends to choose the optimal organizational forms. As Figure 6 shows, electricity and transport are leading the way in private sector participation in South Asia. As Figure 7 shows, in transport, the private sector tends to partner with the public sector through PPPs; while in telecoms, it tends to invest by itself (i.e., regulated privatization). When it comes to energy, the private sector chooses to invest mainly by itself, but also through partnerships with the public sector. Many of the PPPs in the power sector in South Asia happen in generation (60),[31] mainly through BOT arrangements – even though PPPs are the optimal organizational structure in transmission, not in generation or distribution.

Figure 6: There are more Projects under PPPs and Privatization in Electricity and Transport



Source: World Bank Private Participation in Infrastructure Database.

Figure 7: Electricity and Telecom Favor Privatization while Transport and WSS Favor PPPs



[31] As of August 2013, according to the World Bank Private Participation in Infrastructure Database there are 69 active projects in the power sector under lease contract, concession, or BOT.

Source: World Bank Private Participation in Infrastructure Database.

Optimal service provision approaches require an enabling environment to materialize. It is a good sign that the private sector is playing a bigger role in power generation. But governments across the region need to set the conditions for an even bigger role of the private sector in a service such as power generation, which is better suited for liberalization, and shift the public resources and efforts toward other services where the public sector has the comparative advantage. In that sense, South Asian governments should aim for a transparent, well designed, and implemented regulatory framework for both public and private operators of infrastructure services to attract private investment in line with the best organizational form for each service.

8. Decentralization of Infrastructure[32]

Decentralization means to distribute the administrative powers or functions of a central authority over a less concentrated area. As stated by the World Development Report (2004):[33] "Decentralization can be a powerful tool for moving decision making closer to those affected by it. Doing so can strengthen the links and accountability between policymakers and citizens—local governments are potentially more accountable to local demands. It can also strengthen them between policymakers and providers—local governments are potentially more able to monitor providers. But local governments should not be romanticized. Like national governments they are vulnerable to capture—and this might be easier for local elites on a local scale." Ultimately, decentralization is a tool for improving service delivery to the smallest units of society—households and individuals.

The degree of decision making at the local level determines the type of administrative decentralization. For example, de-concentration refers to the process of dispersing responsibility of the central government to its regional offices—often a mere shift of responsibilities from the capital offices to the regional ones. Delegation however, enables local governments to perform on behalf of the central government, sharing decision-making and administration responsibilities. However, the most complete form of decentralization is devolution, which transfers authority for decision-making, finance, and management to local government. Local governments elect their own mayors, raise their own revenues, and have independent investment powers.

8.1 Conditions for Successful Decentralization

The experience on decentralization and infrastructure service delivery is mixed. The varying results of different decentralization attempts point to its underlying essence. The outcome of decentralization is highly contingent on the type of infrastructure and the existing institutional, political, and economic environment in a given country. Decentralization is also a dynamic process that takes time to be fully integrated in any given society. That said, there are several features that characterize successful

[32] This section is based on Andres, Biller, and Schwartz (2013).
[33] World Bank (2004).

decentralization: (i) fully democratic, transparent, and inclusive (of the beneficiaries) local decision process; (ii) cost of local decisions fully borne by local government; and (iii) no spillover of benefits to other jurisdictions. When these criteria are met, decentralization is promising.

A key issue that often arises is a mismatch between responsibilities in infrastructure service delivery and the ability to execute such responsibilities. This mismatch is often financial/fiscal in nature – namely local authorities are not financially capable of delivering or at least regulating the delivery of a particular infrastructure service. Financial/fiscal decentralization is multifaceted, including: (i) self-financing or cost recovery through user charges; (ii) co-financing arrangements in which respective users contribute to infrastructure services through monetary or labor contributions; (iii) raising local revenues through property or sales taxes; and (iii) transferring tax revenues from the central government to local governments, among others.

Even if funding is available, capacity for implementation at lower tiers of government or communities is often lacking. While with adequate funding this issue could be surpassed over time, a lag between decentralization and expanding service provision should be expected. In addition, while decentralization often follows a constitutional legal process, the actual application of laws varies widely. Equally important is the lack of clarity in the laws. Some infrastructure services could be tagged to local jurisdictions, but status-quo or even different legal interpretations may prevent or slow decentralization. Decisions from courts, at times to the highest levels, are needed to provide the necessary clarity.

8.2 When Decentralization of Infrastructure Services Is a Good Idea

There are several conditions and characteristics of infrastructure services that need to be considered when analyzing the nexus of decentralization and infrastructure provision. Each type of infrastructure investment has its own characteristics that directly or indirectly impact the desirability and type of decentralization at all stages of the process (i.e., from design to operation, and maintenance). For example, two roads with the same physical characteristics, built in very different environments might result in different growth impacts. Given that different types of decentralization differ on an array of factors, it is challenging to pinpoint the best fit without taking a country and sector specific approach. Decentralization for infrastructure depends on the nature of the investment, the reason it is being provided, how it is being financed, and where it is located.

In this vein, we have constructed a matrix (table 9) that outlines which sectors would benefit from decentralization and the challenges they face. It serves only as a general guide for considering decentralization phases and highlights the myriad of available options by sector, geographic location, and country. At a conceptual level, the economic dimension of individual infrastructure services, technologies available for service delivery, and political economy realities guide the nexus of the infrastructure provision and decentralization.

Table 9: ***Economic Logic Underpinning Decentralization in the Infrastructure Sectors***

Infrastructure Sector		Level of Jurisdiction	Economic Determinants	Institutional Arrangements
WATER	**Catchment (often the case for groundwater as well)**	Central or Regional	cross-jurisdiction externalities or open access issues *Central and regional governments or water user associations should regulate (i.e. catchment, groundwater and water shed management to ensure equitable distribution across jurisdictional boundaries).*	*State or Regional Water utility; responsible line ministry; national / regional water agencies, user associations*
	Distribution	Local *	allocative efficiency, economies of scale	*Local sector entities*
SANITATION	**on-site and off-site**	Local *	cross-jurisdiction externalities; allocative efficiency	*Local sector entities, private household level solutions*
SEWERAGE TREATMENT	**On-site and off-site (depends on collection)**	Local *	cross-jurisdiction externalities and addressing local public bads	*Local sector entities, private household level solutions*
FLOOD CONTROL	**Catchment** **Urban**	Central or Regional Local *	cross-jurisdiction externalities and addressing local public bads	*national / regional water agencies* *Local authorities*
POWER	**Generation**	Central, Regional, Local *	Economies of scale and cross-jurisdiction externalities	Para-statal, State Company, National Agency, Local communities; individual user
	Transmission	Central or Regional	Economies of scale and cross-jurisdiction externalities	Para-statal, State Company or National Agency
	Distribution	Local	Economies of scale; allocative efficiency	Private or public entity
ROADS	**Highways**	Central, Regional, Local**	Economies of scale; club good issues (i.e. congestion)	National Highway Administrators
	Rural Roads	Local *	Club good issues; Allocative Efficiency	State or local government / communities
SOLID WASTE	**Collection**	Local	Allocative efficiency	Local government
	Disposal	Regional	cross-jurisdiction externalities; economics of scale	Metro agencies, Local government associations
ICT	**Landlines**	Central, Regional	Economies of scale; network externalities	Regulated Private Sector
	Mobile	Central, Regional	Economies of scale; network externalities	Regulated Private Sector

Source: Andres, Biller, Schwartz (2013).

Note: * While operation and implementation should be local, the central and regional governments could play an important role in regulation. ** The jurisdiction for urban highways could be local.

The economic dimension of an infrastructure sub-sector in terms of service delivery fall into five broad categories, namely economies of scale, network externalities, cross jurisdiction externalities, market failures (e.g., public bads and club goods), and allocative efficiency. Power generation offers an interesting example. All jurisdictions are potentially involved in power generation – from central authorities (private or public) to households. Technology is readily available at different private and public costs (e.g., via air pollution). The type of generation (e.g. individual solar panels, diesel generators) and usage (e.g., lighting, appliances) varies greatly. Yet, there are some noticeable advantages in having central or regional generation due to economies of scale and mitigating public bads like air pollution. However, this does not necessarily mean that all households in a country should be connected to the power grid. On the contrary, providing electricity from stand-alone generating units (e.g., rooftop solar panels) to those households in isolated and sparsely populated areas does maximize welfare reached (i.e., allocative efficiency).

In theory, local residents should finance the cost of infrastructure projects (through user fees and taxation) but regional and national governments should assume financial responsibility for the spillover benefits (i.e., positive cross-jurisdiction externality). However, in some sectors, it is not always easy to differentiate. There are infrastructure services where unregulated decentralization may not be desirable. This is true especially for those services with large cross-jurisdiction externalities. For example, what would be the incentives for a municipality in upper watersheds to avoid contaminating waters (e.g. via sewage treatment) for the use of a municipality downstream? Another type of positive externality that plays an important role on the choice of decentralization is network externality. For example, the more people with telephones (fixed or mobile) the higher the benefit of having one. Furthermore, telecommunication infrastructure facilitates agglomeration. Hence, ICT could be the focus of central service provision.

These categories may hint at the jurisdiction in which the service should be provided thus indicating where the infrastructure gap should be addressed. However, available technologies may result in a diverse response to addressing service provision, and political realities may add an extra layer of complexity. The power sector alone sheds light on the heterogeneous nature of decentralization and the importance of collaboration between the central and local governments in identifying and serving the interest of their constituents.

The key to decentralization is flexibility in accommodating a wide range of local conditions. Sometimes this is achieved through decentralized or centralized public means, but what really determines the right fit is accounting for the heterogeneity of local needs, potential for quality, efficient service provision, and the existence of market failures (e.g. public bads, externalities) associated with the provision. Through this decentralization lens, the results then depend on three primary factors: (i) the weight ascribed to various criteria; (ii) the nature of infrastructure; and (iii) the economic, political, and environmental characteristics of the respective country, region, and infrastructure via available technologies.

8.3 Decentralization and Infrastructure: Can Finances Be Raised Locally?

Infrastructure investments are illiquid and require substantial upfront capital contributions. Local governments often lack the user base and, therefore, revenue streams to finance large-scale urban

infrastructure. This makes matching the financial requirements of a given infrastructure project with the political mandate to deliver the service a complicated matter for many local authorities.

As urbanization and fiscal decentralization shift more responsibilities to local authorities, the importance of inter-governmental fiscal transfer increases. However, recent experience shows that fiscal subsidies have not grown together with the increased responsibility vested in local authorities. In addition, for many cities in the developing world, revenues from basic service provision fail to recover costs, because the payment capacities of consumers are severely constrained. For example, of 20 large cities in India, only 8 recovered their operation and management costs for water supply and sanitation through fees.[34] And none recovered capital expenditure and depreciation. As a result, the urban water sector in India can survive only on large operating subsidies and capital grants from the states.

The mobilization of tax revenues faces political and economic challenges. The tax base may be insufficient to mobilize the necessary financing. But even if it is sufficient, political opposition to the proposed increase may prevent local governments from pursuing the initiative. In addition, non-payment of traditional local taxes (such as property tax) is usually high owing to a lack of capacity to collect, and insufficient political will to curb the lack of compliance and fight corruption. As a result city governments have attempted to shift to market borrowing. However, the ability of local governments in the developing world to borrow directly on national or international capital markets at an attractive cost is limited. In many low-income countries, local capital markets tend to be illiquid and shallow, with limited secondary market activity and a limited range of short-term instruments, which are generally not suitable for infrastructure investment. As a consequence, domestic funding is limited and very costly.

Without domestic credit markets, and often lacking the transparency needed in municipal bond markets, many city governments in developing countries cannot access long term credit. Creditworthiness is not only limited to local governments but it also extends to utility companies. In Kenya, the Water Services Regulatory Board calculated and published utility shadow credit ratings for 43 water service providers in 2011, showing that only 13 providers have investment grade ratings. In addition, lack of policy and regulatory support from the central government, and lack of capacity at the local government to handle the borrowing in a responsible way further constraints credit to local governments in many developing countries.

Local governments need to navigate a challenging financial landscape to secure the resources needed to provide their beneficiaries with basic infrastructure services. Decentralization has vested many sub-national authorities in the developing world with increased fiscal, political, and administrative autonomy allowing regional and local authorities to respond directly and independently to the infrastructure services provision. However, the assumption that input costs can be recovered from user fees, or some form of beneficiary taxation, does not hold for many cities in the developing world as the payment capacities of consumers are severely constrained.

9. Conclusion

If South Asia hopes to meet its development goals and not risk slowing down – or even halting – growth, poverty alleviation, and shared prosperity – it is essential to make closing its huge

[34] See Andres, Biller, and Schwartz (2013).

infrastructure gap a priority. Even though SAR's economic growth follows that of EAP, its access to infrastructure rates (sanitation, electricity, telecom, and transport) are closer to that of SSA – the one exception being water, where SAR is comparable to EAP and LAC. According to businesses in South Asia, infrastructure is a major or severe hindrance to their growth, and electricity is the largest problem, with transport also an obstacle for regional and international trade. The good news is that policy makers do not have to choose between growth and welfare, as there is enormous potential for them to be mutually supportive.

The cost to close this gap by 2020 will be an estimated US$ 1.7 trillion to US$ 2.5 trillion (in current dollars). If investments are spread evenly over these years, SAR needs to invest between 6.6 and 9.9 percent of 2010 GDP per year – an increase of 3 percentage points over the current 6.9 percent invested by SAR countries in 2009, up from 4.7 percent in 1973. This increase was driven mainly by the region's large investment in electricity generation.

Given the size of the gap and limited fiscal and financial resources, it is essential for SAR to prioritize the possible infrastructure investments. We propose a generic methodological framework for doing just that, building on the existing literature. It is not desirable to have a single methodology, providing a single ranking of infrastructure investments, because of the complexities of infrastructure investments. Rather, a multidisciplinary approach should be taken. Decision makers will also need to account for factors that are often not easily measured. While having techniques that enable logical frameworks in the decision making process of establishing priorities is highly desirable, they are no substitute for consensus building and political negotiations.

It is not feasible to expect South Asian governments to fund the gap only with public resources. The sheer size of the gap and the macroeconomic situation in South Asia dictate that the region taps other funding sources. However, this situation should also be seen as an opportunity to rethink and improve its current infrastructure service provision paradigm. Ultimately, closing the gap will require a mix of investing in infrastructure stock and adopting supportive reforms.

One way to do this is by broadening service provision to give the private sector a bigger role. This can take many forms, ranging from PPPs to regulated privatization and market liberalization. There is no single service provision approach that is better than the alternatives for all infrastructure services and under all degrees of institutional development. The key will be weighing which organizational form offers the highest welfare for a given sector, keeping in mind current investment patterns. For example, being aware that one-third of private sector infrastructure investments are dominated by energy and telecom projects – especially Greenfield investments – will enable countries to guide some PPP or public investments to other sectors (if needed). Thus, a mixture of investment in infrastructure stock and supportive reforms such as allowing for PPP involvement (given the nature of the sector) is imperative to setting SAR in the path to close its infrastructure gap.

Another way is by decentralizing administrative powers and functions. The degree to which this is desirable will depend on the nature of the investment, the reason it is being provided, how it is being financed, and where it is located. Local governments need to navigate a challenging financial landscape to secure the resources needed to provide their beneficiaries with basic infrastructure services. Decentralization has vested many sub-national authorities in the developing world with increased fiscal, political, and administrative autonomy allowing regional and local authorities to respond directly and independently to the infrastructure services provision. However, the assumption that input costs can be

recovered from user fees, or some form of beneficiary taxation, does not hold for many cities in the developing world as the payment capacities of consumers are severely constrained.

A new service provision paradigm will have to reflect the enormous heterogeneity in infrastructure coverage and access to infrastructure services among countries, within countries, and among infrastructure sectors. Within India, for example, we illustrate that some of the best performing districts on access to improved water are in the north and northwest, while the worst ones are in the northeast and southwest coast. We also show that districts that perform well on access to one type of infrastructure service do not necessarily perform well on access to a different type. For example, Balochistan, southwestern Afghanistan, northeastern Sri Lanka, and some parts of Bihar have poor rates of access to improved water, improved sanitation, and electricity. However, the Gangetic Plains and surrounding areas have higher rates of improved water sources (and low rates in the other two). Similarly, Kerala, Himachal Pradesh, Punjab and areas surrounding capital cities have better access to improved sanitation, and Gujurat and northern Delhi have high access to electricity.

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