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# *THE INFRASTRUCTURE GAP AND DECENTRALIZATION**

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-- Abstract --

This paper proposes an economic logic for underpinning decentralization in the infrastructure sectors. It starts by detailing the definition of the infrastructure gap and the methodologies to calculate it. It provides some global trends for developing countries in terms of the gap and briefly discusses financing possibilities for developing countries to address the gap. Then it turns to the discussion of the link between the infrastructure gap and decentralization, providing a typology infrastructure subsectors and possible jurisdiction of service provision. It briefly discusses the potential for raising local finances for provision and the relationship between poverty and provision. While it is very difficult to provide blanket recommendations on decentralizing the various sectors and respective subcomponents of infrastructure services, the paper offers a set of guidelines to direct policymakers in their decision to decentralize or not. First, decentralization is intrinsically neither good nor bad for infrastructure; its impact depends entirely on the incentives facing the various decision-makers in the decentralization process; second, decentralization is most fruitful when the decision-makers bear the financial and political cost with respect to design, finance, operation and maintenance; and, finally, political leaders are accountable to their constituents for the manner in which they spend tax revenues and how they use and allocate transfers from the central government.

*The World Bank, Washington DC, USA. Senior authorship is not assigned. The paper carries the names of the authors and should be cited accordingly. The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the views of the International Bank for Reconstruction and Development/World Bank and its affiliated organizations, or those of the Executive Directors of the World Bank or the governments they represent. Research assistance from Georgeta Dragoiu, Jared Haddon, Juan Agustin Echenique, and Ashma Basnyat is gratefully acknowledged.

# I. Introduction

1. The lack of infrastructure services often referred as the infrastructure gap is felt throughout the economy and society at large. The infrastructure gap acts as bottleneck to economic sectors, directly curtailing the growth potential. It also impacts negatively the opportunities to improve health, education and other social sectors that can be just as, or even more, important to current welfare improvement, poverty alleviation and future economic growth. The Infrastructure gap often disproportionally affects the poor more than the rich not only at the population level but also at different jurisdictions within a country. Even if the rich also suffers with the infrastructure gap, rich people, districts, and countries are also more able to implement coping mechanisms.

2. The policy discussion on filling the infrastructure gap takes several forms. One of them is the need to complement access to infrastructure with policies to incentivize the use of services, or make its potential benefits more obvious or attainable. In this sense, policy makers would focus on subsidizing (implicitly or explicitly and with sunset clauses) the infrastructures that provide the greatest public benefit (public good) in contrast to those that provide large private benefits. This should be true across infrastructure sectors as well as within sectors. However, evidence shows the need to think through the location of the infrastructure facilitites, their maintenance, and campaigns to promote their use. Another form is about who should be paying financing this gap. Given the magnitude of this funding requiremnent, it is not feasible to expect 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.

3. While the above statements are often true, the real story lies in the heterogeneity of infrastructure service provision. The nexus of the infrastructure gap and decentralization is both 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. They could thus be the focus of central service provision. At least in the short term and in countries where economic sectors are not highly dependent in water as an input, water and sanitation provision may have a higher impact on welfare; thereby being the focus of local service provision. At a higher conceptual level, the nexus of the infrastructure gap and decentralization is guided by the economic dimension of individual infrastructures, technologies available for service delivery, and political economy realities. For instance, the economic dimension of an infrastructure sub-sector in terms of service delivery could fall into four broad categories, namely economies of scale, network effects, cross jurisdiction externalities, and allocative efficiency. 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. Power distribution may serve as a good example. There are compelling economic reasons to have power distributed via a grid (e.g. economies of scale, less air pollution when compared with certain alternatives). Yet, technologies are available to supply single households with power at different need levels (e.g. generators) and adequately taking into account environmental considerations (e.g. solar panels). Political realities may however push for solutions that require central or regional power distribution. Ultimately, this array of factors influencing infrastructure service provision also generates a diverse response to

the infrastructure gap. Pre-established formulas are thus difficult to come by, and policy makers are left primarily with some guiding principles to be adjusted to specific realities.

4. This Paper provides this higher conceptual discussion of the nexus of the infrastructure gap and decentralization. It starts by detailing the definition of the infrastructure gap and the methodologies to calculate it. It provides some global trends for developing countries in terms of the gap and briefly discusses financing possibilities for developing countries to address the gap. The paper then turns to the discussion of the link between the infrastructure gap and decentralization, providing a typology infrastructure subsectors and possible jurisdiction of service provision. It briefly discusses the potential for raising local finances for provision and the relationship between poverty and provision. The paper concludes with some broad policy lessons.

## II. Infrastructure Gap: What is it? How to measure it?

5. In order to assess the infrastructure gap, a country's level of infrastructure provision needs first to be evaluated. 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. To the extent possible, the quality of service provision should also be appraised. In order to gage the realism of infrastructure service targets, a review of the historic level of investment in infrastructure through creation of a time-series on actual public and private investment is also essential. In its simplest form, the actual gap is thus the difference between targets and baseline over a time period in which the gap is aimed to be filled.

6. There are many ways of estimating the investment needed in physical infrastructure. The actual amount depends on targets, and each target may be priced in a variety of ways. Different sectors inevitably require different methodological approaches. These include:

- ***Costing set targets***—this approach estimate the physical needs as the difference between the baseline and the aimed targets. These targets may be defined as universal service access, the MDGs, or can be assessed using any type of benchmarking exercise. This compares normalized infrastructure performance indicators across countries or areas with similar characteristics (usually socio-economic variables). It can also be compared to predetermined standards defined as optimal. The choice of benchmark can affect the results significantly, and the targets do not usually have clear theoretical foundations. The benchmarking can be done through a simple comparison with peers. For example, what would it cost South Asia to reach the infrastructure density of a region deemed as an appropriate comparator or target? An even simpler approach is to benchmark countries in terms of how much the region spends on infrastructure with respect to historical investment levels. Once these values are estimated, the analysis should assess the unit cost per physical unit needed, and once aggregated these figures will result on the total investment needed for filling the gap.

- ***Estimates based on sectoral analysis.*** The best approach may be to rely on micro-sectoral analysis. This effort should build estimates based on sector data and sector specialists' views. Although the approach varied across sectors, this may be summarized as follows. In the case of transport, the estimate would be based on planned expenditures by responsible agencies

and operators, adjustments based on experts' opinions of what could be postponed and what must be done within the next five years. In the case of water and sanitation, estimates will be based on various approximations of the cost of achieving coverage targets under the Millennium Development Goals (MDGs). Finally, in the case of the power sector, the figures would be largely based on experts' opinions about what is the minimum requirement to preserve the integrity of the systems (lower case scenario) or the investments needed to provide high-quality, reliability of service (higher case scenario). Sectoral estimates can, at times, be no more than "wish lists" and can benefit from benchmarking. It is useful, therefore, to pull them together and compare them with what peer countries are doing through various kinds of benchmarking exercises. It is also interesting to price socially desirable targets, such as universal coverage, and compare the estimated costs with the sectoral scheme. These various comparisons provide a "reality check" and allow for a more robust set of estimates.

- ***Macroeconomic models.*** More sophisticated approaches rely on either macro-econometric models, or micro-engineering economic models. For the macro-econometric models, there are several ways of looking at what might be needed. One could look at the infrastructure coverage needed to achieve a particular growth objective, assuming given levels of other inputs. An approximation can be obtained using econometric models based on cross-country panel data to estimate the relationship between infrastructure stocks, social and economic variables including GDP and population. Using GDP and population projections, the model allows estimating the future infrastructure investment needs. Maintenance costs are estimated as predetermined percentages of the total investments. The model predicts infrastructure needs at the aggregate (regional) level, but it is weak to estimate at the country level due to its high level of aggregation, limited explanatory factors and lack of location specific analysis.[1]

## III. Current Global Trends of the Infrastructure Gap

7. The demand for infrastructure, whether it is from private or commercial users, is not static but is dynamic evolving with country conditions. This is a notable feature of infrastructure is infrastructure's relationship with 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 as the economy's structure alters. The demand for infrastructure has been growing in the world in general and Asia in particular. Two decades ago, the South Asia region (SAR) and the East Asia and the Pacific region (EAP) had similar urbanization rates at 25 percent and 29 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 1990's decade, growth in SAR averaged over 5 percent, while between 2000 and 2011, it averaged almost 6.7 percent. While economic growth has been accompanied by rapid urbanization in EAP (49 percent

1. The relevant literature includes: World Bank (2001); Fay and Yepes (2003); Estache and Yepes (2004); Chatterton and Puerto (2005), Calderón and Servén (2004), and World Bank (2006).

urbanization rate in 2011), SAR remains the least urbanized region in the world (31 percent), well below the world urbanization rate (52 percent). The economic growth that the region has been experiencing is both influenced and influences the region's demand for infrastructure. For example, forecasts indicate that India will have more cars than the United States by 2050.

8. Access to infrastructure services significantly varies across regions. While SAR's economic growth is second only to EAP, SAR and Sub-Saharan Africa (SSA) have similar access to infrastructure services, ultimately translating in a large infrastructure gap when compared with other regions of the world:

a. Power: SSA, with 31 percent of its population having access to electricity, is followed by SAR where only 61 percent of the population enjoys the benefits of electricity access. This remarkably contrasts with the rest of the regions where more than 90 percent of the population has access to power services. According to businesses in South Asia, infrastructure is a major or severe hindrance to their growth, and electricity is the largest problem.

b. Improved sanitation: Access is quite low with only 31 and 38 percent of SSA and SAR's population having access, which is close to half the world average of 63 percent population access. Open defecation seems to be one of the most salient issues facing SAR, with 700 million people (i.e., 43 percent of the population) relying on it in 2010. This ranks South Asia as the region with the highest incidence of open defecation in the world.

c. Improved Water: This indicator 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 22 percent of the population has access to piped water and 24/7 water supply is a rare exception in South Asian cities.

d. Communications: SAR lags significantly behind both EAP and LAC when it comes to connectivity, being at times similar to SSA. 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 EAP and LAC (105 and 125). This situation becomes even more dramatic when we add urbanization to the picture, with only 31 and 36 percent of the population in SAR and SSA respectively, living in urban areas.

e. Transport: The transport infrastructure in SAR is not the exception when it comes to poor access, though this problem seems more pervasive throughout the developing world. Using total road network per 1000 people as an indicator, SAR has 2.7 km, which is close to EAP (2.5 km), SSA (2.5 km), and MNA (2.8 km), but is well below the World average (4.7 km), ECA (8 km), and North America (24 km). 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.

**Table 1 Access to Infrastructure Services by Region**

| | Avg GDP Growth (2000-2011)[1§] | Urbanization Rate (2011) | Telecom Access (per 100 people) (2011)[2] | Electricity Access (% of pop.) (2009)[§] | Access to Improved Sanitation (% of pop.) (2010)[*] | Access to Improved Water (% of pop.) (2010)[§] |
|---|---|---|---|---|---|---|
| EAP | 8.9 | 49 | 105 | 91 | 66 | 90 |
| ECA | 5.1 | 65 | 157 | 100 | 84 | 96 |
| LAC | 3.6 | 79 | 125 | 93 | 79 | 94 |
| MNA | 4.3 | 59 | 105 | 90 | 88 | 89 |
| SAR | 6.7 | 31 | 72 | 62 | 38 | 90 |
| SSA | 4.6 | 36 | 54 | 31 | 31 | 61 |
| World | 2.7 | 52 | 103 | 79 | 63 | 88 |

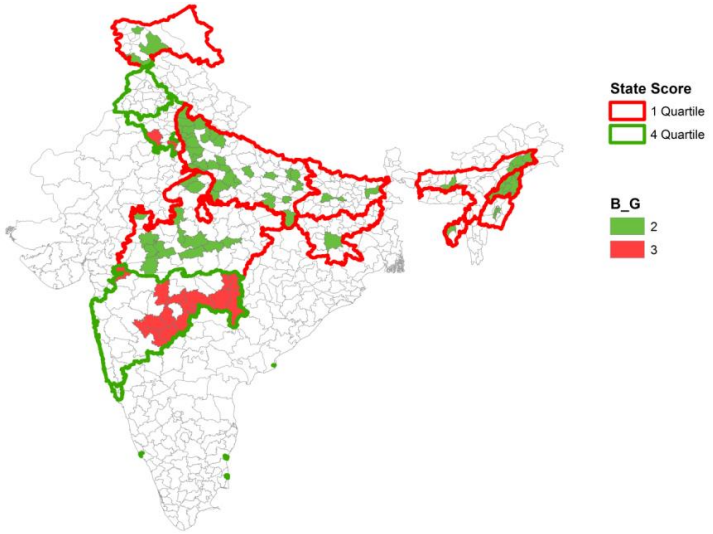
*Source:* Andres, Biller, and Herrera Dappe (2013a).
*Notes*: 1. Telecom access is defined as the number of fixed and mobile lines; 2. World Energy Outlook 2010 by International Energy Association; 3. Improved sanitation is defined as connection to a public sewer, a septic system, pour-flush latrine, 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.

9. The fight to alleviate absolute poverty in the last twenty years has had a marked effect on increasing access to basic infrastructure services; however outcomes have neither been uniform across countries nor across infrastructure sectors. Nearly 2 billion people have gained access to improved water supplies over the last two decades, largely due to the MDGs (UN, 2011). However, networked electricity remains well below demand especially in Africa where an additional 7000 MW of new power generation capacity is required yearly, but less than twenty percent of this figure is currently being installed (Foster and Briceño-Garmendia, 2011).

10. The heterogeneity on access to infrastructure services is not just among countries, but also among districts within countries. For instance, 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. In India, some of the best performing districts in terms of access to improved water sources are in the north and north west of the country, while some of the worst performing districts are in the north east and west as well as in the south west coast (see box 1). An interesting example of the heterogeneity on access to improved sanitation is found on the Indian side of the border with Pakistan, where some of the best performing districts in the country are next to some of the worst performing districts. Furthermore, districts that perform well on access to one infrastructure service don't necessarily perform well on access to another infrastructure service. For example, districts in Kerala are high performers in access to improved sanitation, but are among the worst performers on access to improved water sources (Andres, Biller, and Herrera Dappe, 2013a).

**Box 1: Districts in poor states that perform better than districts in rich states in India.**

Bihar is the poorest state in India while Maharashtra is one of the richest. Yet, several districts in Bihar are performing better than several districts in Maharashtra. It is not surprising that Maharashtra has significant more coverage in tap water and access to electricity than Bihar; but Bihar has higher access to improved water services (95% vs. 79%) than Maharashtra. Moreover, the top 25% of the districts in Bihar, in terms of overall access to infrastructure services, over perform half of the districts in Maharashtra in access to improved sanitation, gas, and telecom; sectors that are more capital than natural resource intensive. The map below presents bad districts in rich states and good districts in poor states, and shows that the case of Bihar and Maharashtra is not isolated. In the map, districts in the bottom quartile of the GDP per capita distribution have their boundaries drawn in red, while those in the top quartile have their boundaries drawn in green. The districts among the top performers (i.e., top two quartiles) on infrastructure access, but located on states in the bottom quartile of the GDP per capita distribution, are shaded in green. Similarly, those districts among the bottom performers (i.e., bottom two quartiles) on infrastructure access, but located on states in the top quartile of the GDP per capita distribution are shaded in red. As it can be seen from the map, there are 67 districts ranked among the top 50% of districts in terms of access to infrastructure services, which are located in poor states (those on the first quartile of GDP per capita distribution). Similarly, there are 16 districts among the bottom 25% of the districts in terms of access, which are in rich states (those on the fourth quartile of the GDP per capita distribution).



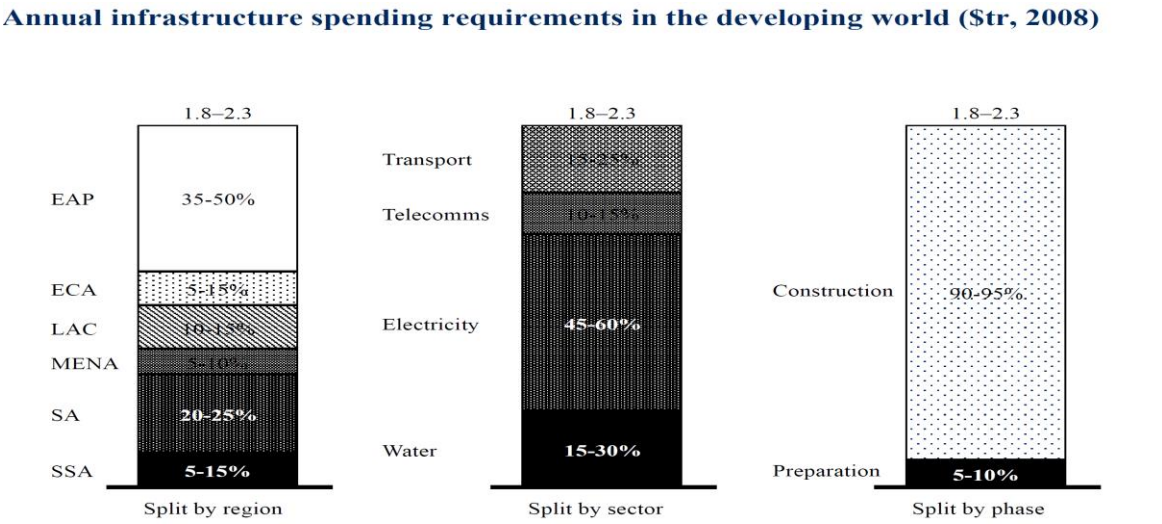

Source: Andres, Biller, and Herrera Dappe (2013a).

11. Table 1, therefore, provides a snap-shot of the access deficit in 2011, but this deficit has risen and will continue to rise in the coming years. To meet the current demand for infrastructure approximately US$0.8-0.9 trillion worth of annual infrastructure investments are required in the developing world. By 2020 this figure inflates to US$1.8-2.3 trillion per year. This equates to roughly an increase in annual infrastructure investment from 3 percent of developing world GDP to 6-8 percent of GDP[2]. Climate change has created an additional financial burden on the public provision of infrastructure as US$200-300 billion of the aggregate US$1.8 – 2.3 trillion figure cited above is needed to retrofit existing infrastructure assets. These estimates are more closely related to the costing the targets approach.

2. Bhattacharya, Romani, and Stern ( 2012). Other Fay et al. (2011); Estache (2010); Macquarie Bank (2009); and the MDB Working Group on Infrastructure (2011).

12. Bearing this in mind Figure 1, below, quantifies investment needs by sector, by region and by phase of project development (preparation or construction) highlighting that bridging the gap between estimated needs and the current level of investments in infrastructure is a significant challenge in all regions. Reinvigorating the supply of infrastructure requires supplementing traditional sources of finance with new sources of equity and debt finance, pairing existing instruments with innovative techniques to lower the cost of sovereign borrowing and promoting institutional performance to improve market and project environments.

**Figure 1: Annual Infrastructure Spending Requirements in the Developing World (by 2020)**




NOTES: $ trillion per year, (2008 real prices), capital investments only (excl. operation and maintenance costs)
SOURCE: Estimated annual infrastructure spending need for 2020 calculated by taking the Fay et al (2010) estimate of $1.25-1.5 trillion annually in 2013 and assuming a 4% annual growth rate from 2013-20, and an additional $200-300 billion annual requirement to make the infrastructure sustainable (both mitigation and adaptation); the split by region, sector, and phase are authors' own calculations taking ranges from Yepes (2008), MDB G20 working group on infrastructure (2011), and Foster and Briceño-Garmendia (2010); note the $200-300 billion annual requirement for sustainability is assumed split in the same ratio as the other investments across regions, sectors and phases

## IV. Decentralization and the Infrastructure Gap

13. 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): "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."

14. Ultimately, decentralization is a tool for improving service delivery to the smallest units of society – households and individuals. If it would work well, decentralization would mean diminishing the infrastructure gap. Yet, as stated above it cannot be viewed as a silver bullet. There are several conditions and characteristics of infrastructure services that need to be considered when analyzing the nexus of decentralization and the infrastructure gap.

15. The degree of decision making at the local level determines the type of administrative decentralization. For example, deconcentration 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.

16. Each type of infrastructure investment has its own specific characteristics that directly or indirectly impact the desirability and type of decentralization at all stages of the process including design, finance, construction, operation, and maintenance. Two roads with the same physical characteristics, built in very different environments will result in different growth impacts, amongst others. Given that variations of decentralization differ in response to a multitude of factors, it is challenging to generalize and recommend 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 is located.

17. In this vein, the table 2 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 variations existent by sector, geographic location, and country. 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; however in some sectors, it is not always easy to differentiate. There are two important strategies or institutional arrangements which can render the assignment of responsibilities more complex: i) horizontal cooperation, when two or more subnational governments cooperate in joint delivery of infrastructure services so there are higher economies of scale); and ii) vertical cooperation, when this assistance occurs between a regional and local government, for instance.

**Table 2: 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<br>*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* |
| **Sewage 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**<br>**Urban** | Central or Regional<br>Local * | cross-jurisdiction externalities and addressing local public bads | *national / regional water agencies*<br>*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 | 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 |

| **Infrastructure Sector** | | **Level of Jurisdiction** | **Economic Determinants** | **Institutional Arrangements** |
|---|---|---|---|---|
| | **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 |

*Note:* * While operation and implementation should be local, the central and regional governments could play an important role in regulation

18. Frequently, when infrastructure services are unbundled as in the table above, at least two aspects become apparent: i) the diversity of potentially adequate provision in a given subsector; and ii) those subsectors that require special attention at a given level of jurisdiction. 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 (via for example air pollution). The quality of generation (e.g. individual solar panels, diesel generators etc.) and usage (lighting, appliances etc.) varies greatly. Yet, there are some noticeable advantages in having a central or regional generation due to economies of scale, mitigating public bads like air pollution, among others, which doesn't necessarily mean that all households in a country should be connected to the power grid. 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.

19. The experience on decentralization and infrastructure service delivery is mixed. The varying impacts of decentralization point to its underlying essence which is highly contingent on the type of infrastructure and the existing institutional, political and economic environment in a given country. It is also a dynamic process, which takes time to be fully integrated in any given society. There are however, several features that characterize successful decentralization: i) the local decision process is fully democratic, transparent and inclusive of the beneficiaries; ii) the cost of local decisions are fully borne by the local government; and iii) the benefits don't spill over jurisdictional boundaries. When these criteria are met, decentralization is promising.

20. A key issue that often occurs is a mismatch between responsibilities in terms of infrastructure service delivery and the ability to execute the 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; iii) transferring tax revenues from the central government to local governments, amongst others.

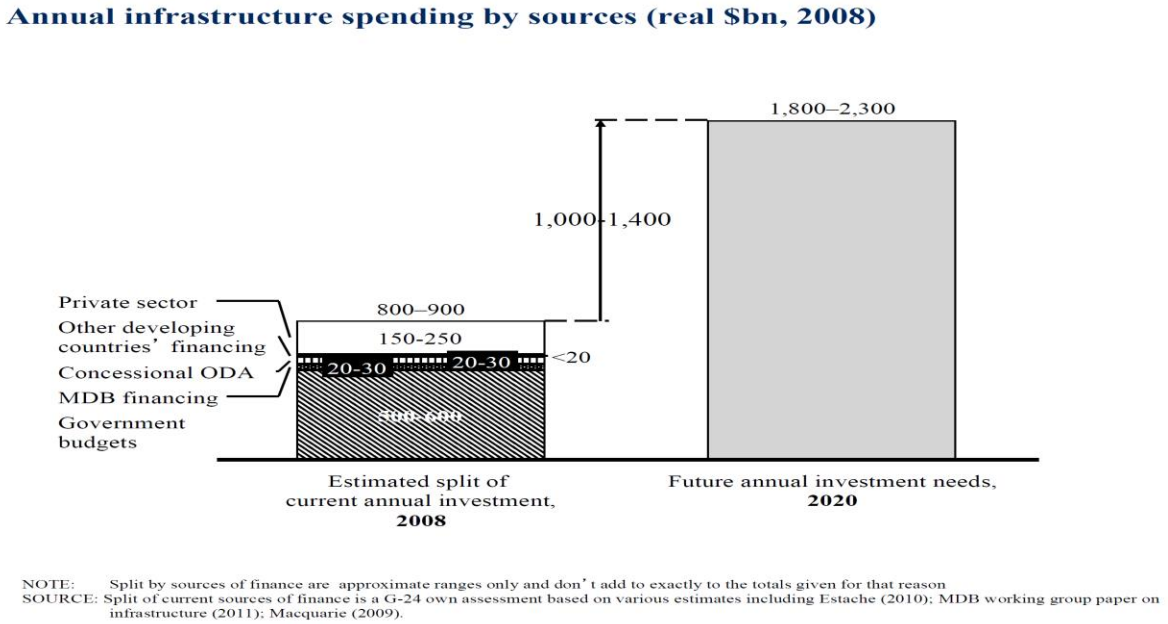
21. Even if funding were available, capacity for implementation at lower tiers of government or communities is often lacking. While with adequate funding this issue could be surpassed over time, a lag between decentralization and filling the infrastructure gap should be expected. In addition, while decentralization 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. Finally, there are infrastructure services where unregulated decentralization may not be desirable. This is true especially to 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? Yet, piped water distribution is often though not always considered a local service.

22. The key to decentralization is flexibility in accommodating a wide range of local conditions. Sometimes this is achieved through decentralized public, or centralized public means, but what really determines the right fit is accounting for the heterogeneity of local needs, potential for quality, efficient and cheap 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. In the end assigning responsibility is always also a political decision, and driven by political economy factors.

## V. Decentralization and Filling the Infrastructure Gap: What policy tools, where does the money come from, how are investments made?

23. A detailed discussion on decentralization policy tools, financing to fill the infrastructure gap, and the consequences of infrastructure expenditures (e.g. impact on economic growth, poverty alleviation, etc.) is beyond the scope of this paper. It includes traditional public finance instruments such as central/local taxes and subsidies, central to local cash transfer schemes, local to local payments (e.g. payments for ecological services), pooling resources in metro or user association arrangements, privatization and public-private partnerships (PPPs) at all jurisdiction levels, community driven development schemes and household private investments, among others. There are several financing possibilities and the impacts of infrastructure investments in the economy are far and wide. Nonetheless, this paper wouldn't be complete without at least a brief analysis of some main current issues in addition to those covered above.

**Figure 4: Annual Infrastructure spending by sources (real US$bn, 2008)**



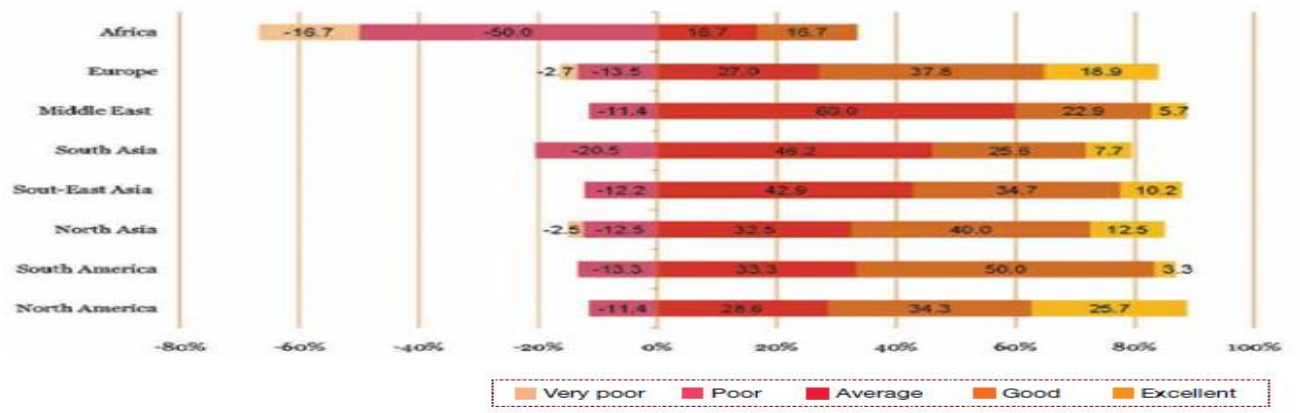

NOTE: Split by sources of finance are approximate ranges only and don't add to exactly to the totals given for that reason
SOURCE: Split of current sources of finance is a G-24 own assessment based on various estimates including Estache (2010); MDB working group paper on infrastructure (2011); Macquarie (2009).

24. The 2008 global economic crisis heightened a reality that existed for much of the past 30 years in most developing countries perhaps with the exception of China, Vietnam and a few others. Access to easy sources of financing either from government budgets or access to capital markets is limited across the developing world. This translates both into a lack of new infrastructure investments as well as accentuated depreciation of existing infrastructure stocks. As figure 4 indicates, government budgets remain the lion share of infrastructure investments. Even if 2008 numbers may have been spurred by Keynesian policies to counteract the economic downfall, and even if fiscal space is becoming a severe issue in several countries, governments are likely to remain the main source of infrastructure spending. The increasing constraints in government spending around the world highlight the importance of policy instruments to improve the efficiency of infrastructure service delivery. Yet, it also indicates the importance of private sector participation in filling the infrastructure gap at different jurisdictions in the future. Only twenty MICs have the ability to access capital markets at the national level, while an additional 20 have limited access to volatile and costly short-maturity loans. MDB instruments, such as the suite of guarantee instruments, can be used to lower borrowing costs for those MICs able to access international debt markets and to mitigate country level risk that might otherwise dissuade international investors. The rest of the MICs, as well as most provincial and local governments in all MICs, have little or no market access severely constraining the provision of sub-national, publically funded infrastructure unless funding is sought from official development assistance (PPIAF, 2012).

25. Private sector investments, both debt and equity, have the potential to reduce the financing shortfall, but substantial barriers remain. Recent experience with private investment shows that investments pool within sectors that can be readily commercialized and in countries

that offer minimal risk[3]. The reasoning for this is intuitive: projects must generate an adequate and reliable financial return that can be ring-fenced by the investor and risks must be carefully defined, allocated and as far as possible mitigated. According to PwC (2011)'s latest survey on infrastructure poor capacity including urban infrastructure planning, transaction capacity, lack of political and public support, poorly defined and unstructured procurement processes have contributed to the slow development of private sector financing. Figure 5 illustrates the ability to attract private investment around the world.

**Figure 5: Ability to attract private investment, by region**



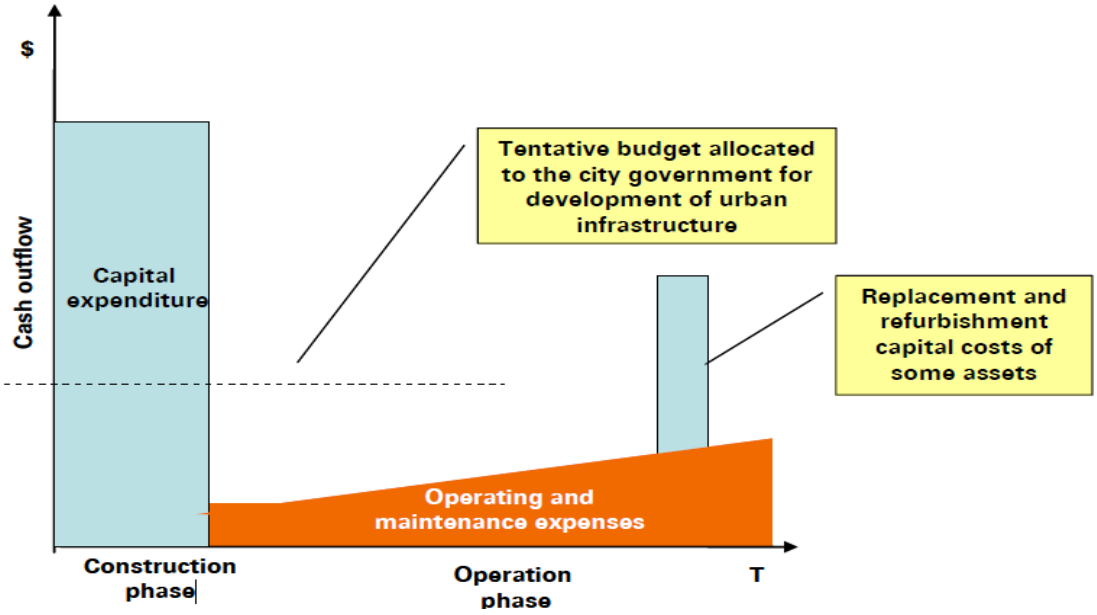

Source: PWC Infrastructure Survey (2011).

## VI. Decentralization and Infrastructure: can finances be raised locally?

26. 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. Therefore, matching the financial requirements of a given infrastructure project with the political mandate to deliver the service is a complicated matter for many local authorities. Figure 6 illustrates this mismatch schematically.

3. Foster and Briceno-Garmeñdia (2011) estimated the following shares of financial contribution by the private sector in Africa: ICT (81%); Power (10%); Transport (13%) Water, Sanitation, and Sewerage (45%). For MICs, the share of power in that mix is much higher whereas only a tiny share of water investments have been financed by the private sector. Between 2007 and 2009, 49.6 of all PPI in developing countries was in the power sector. Bhattacharya et all (2012) estimates that about 20-30% of total current annual infrastructure spending in developing countries is financed by the private sector.

**Figure 6: Gap between municipal budgets and infrastructure investment needs.**




*Source:* KPMG (2010).

27. As urbanization and fiscal decentralization shift more responsibilities to local authorities, the importance of inter-governmental fiscal transfers increases. However, recent experience shows that fiscal subsidies have not grown together with the increased responsibility vested in local authorities and 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.

28. Similar to cost recovery, the mobilization of tax revenues faces political and economic challenges. On one hand the tax base may be insufficient to mobilize the financing necessary, or, 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 due to lack of capacity to collect, corruption and political will to curb the lack of compliance. 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 price 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.

29. 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; it also extends to their utility companies. For instance, in Kenya the Water Services Regulatory Board calculated and published utility shadow credit ratings for 43 water service providers in 2011 and found only 13 providers to have investment grade ratings. In addition, lack of policy and regulatory support from the central government, lack of capacity of the local government to handle the borrowing in a responsible way further constraints credit to local governments in many developing countries.

30. 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.

## VII. Decentralization and Infrastructure: Who benefits from infrastructure investments?

31. It is often said that infrastructure investments are regressive in income and that the poor are disproportionately affected by the lack of infrastructure services and the infrastructure gap. This intuitively makes sense. On the governance side, elite capture is a common problem from community driven development interventions all the way to lobbying for public funding at the highest levels of government. Moreover, the rich are more equipped to find private solutions to the infrastructure gap due to better education, greater disposable income and access to information and better technology.

32. Yet, as the discussion above indicates, there are nuances that can be found at district levels. Decentralization also allows us to delve into the question of infrastructure service availability relative to poverty in some detail. While the above intuition is likely correct, even in a region with one of the largest infrastructure gap such as South Asia the picture that emerges is also heterogeneous[4]. For instance, in Sri Lanka access to key infrastructures like power, and water and sanitation (W&S) seems quite inclusive. District level analysis (where data is available) yields very low access Gini coefficients adjusted by the household distribution Gini coefficients[5] for Power, and W&S services (0.04, 0.01, and 0.01 respectively).[6] Access is widely spread, and quality of these services in the country is generally good. At least for some basic infrastructure, Sri Lankan services are generally not regressive in income.[7] Map 1 provides an illustration for the country as a whole.[8]

4. This is based on Biller (2012), Biller and Nabi (2013), and Andres, Biller, and Herrera Dappe (2013).

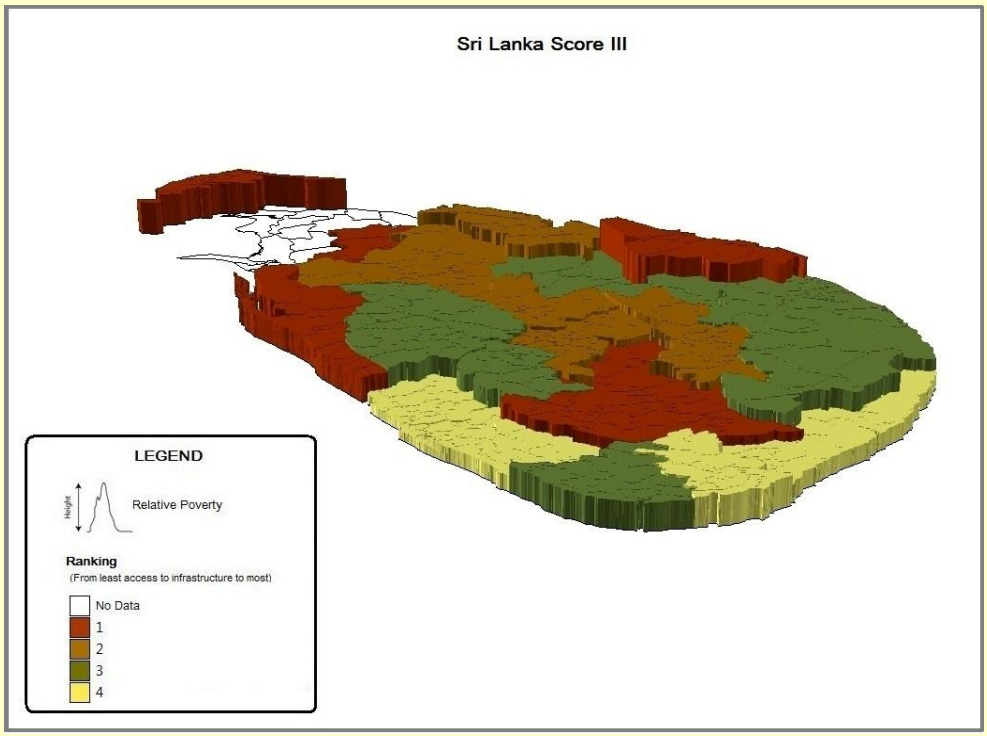
5. See and Andres, Biller, and Herrera Dappe (2013b) for more description on this methodology.

6. Gini coefficient for gas is 0.33 and for Phone access is 0.03. The former reflects the wide use of firewood for cooking in the country, which may have severe health consequences in terms of indoor air pollution (not analyzed in this study but a possible topic for future work). The latter is less troublesome given the wide use of mobile phones as in other developing countries.

7. For the basic infrastructure, there is little correlation between services and poverty rate.

8. Height represents relative poverty (number of poor individuals in each district /total headcount of each district). For the colors, three scores were constructed. Score I: Simple average (sum of the points for each indicator divided by the number of indicators); Score II: Weighted average using predetermined weights to capture that WATSAN and Power are important direct benefits to households; and Score III: Weighted average using weights obtained from a Principal Component Analysis – a statistical procedure. They all yield similar results. Each district is then ranked between 1 and 4. This ranking is dependent on the quartile the aggregate scores fall into. If a district falls in the bottom quartile it ranks 1 (red in the map) which indicates poor accessibility to infrastructure while a district that scores in the top quartile ranks 4 (gold in the map) and indicates highest accessibility.

Map 1: Relative Poverty and Access to Selected Infrastructure Services in Sri Lanka

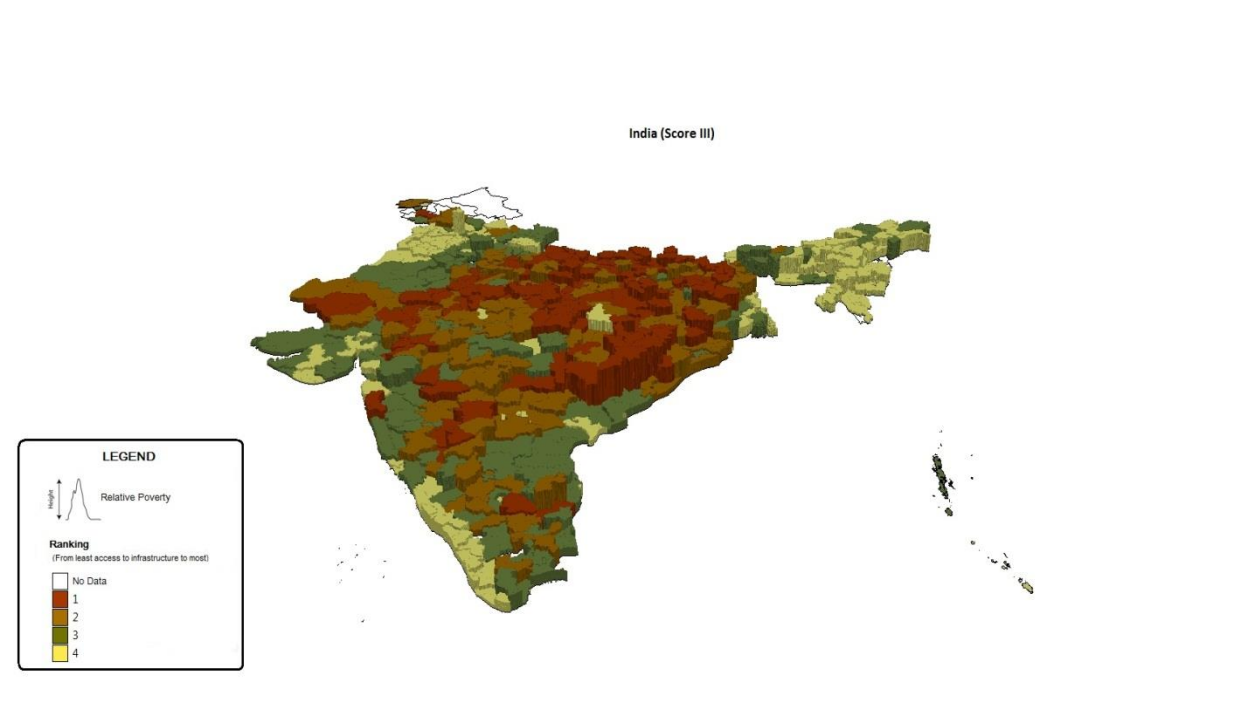



*Source: Andres, Biller, and Herrera Dappe (2013b)*

33. The same however could not be stated for India. District level analysis yields much higher Gini coefficients for Power, and W&S services (0.15, 0.06, and 0.29 respectively) than in Sri Lanka. There is also evidence that the quality of these services in the country is generally poor. Even with LPG subsidies in India, the Gini coefficient is similar to Sri Lanka (0.35 versus 0.33 respectively), implying that richer households capture a large share of the subsidy, while poorer household largely rely on fuel wood and animal waste for cooking. Yet, access to phone is wide spread given the popularity of mobiles (Gini of 0.20). As Map 2 below illustrates, the leading regions of India have lower relative poverty and are better served in terms of infrastructure than the rest of the country, which is intuitively expected[9].

9. With the exception of water, there is a strong negative correlation between access to basic infrastructure services (power and sanitation) and poverty rates. In map 2 this is depicted by the lagging states located mainly in the northeast portion of the country. The exception is the area northeast of Bangladesh, bordering Bhutan, China and Myanmar. The high score on infrastructure services is driven by power (the area has a high hydropower potential) and sanitation.

Map 2: Relative Poverty and Access to Selected Infrastructure Services in India




*Source: Andres, Biller, and Herrera Dappe (2013b)*

## VIII. Decentralization and Infrastructure: Policy lessons

34. Investment in infrastructure has proven to be indispensable in triggering and sustaining economic growth. But often times, infrastructure investments have also proven to be ineffective to the intended beneficiaries, when designed, allocated or managed poorly. Some countries provide expensive infrastructure for the few and inadequate infrastructure for the poor, who also pay a disproportionate amount of their income for lower quality service. The overarching reason for this is explained by wrong incentives at various decision-making levels prompted by rent seeking behavior, policy failures and complexities associated with addressing market failures. What type of infrastructure gets built, where, how, when and how it is maintained directly depends on the level of government responsible for these decisions and whether or not they contribute to economic development and poverty reduction goals.

35. The previous sections offer a glimpse of the global trends in infrastructure gaps, the need for new and innovative financing mechanisms and the role that decentralization plays in improving allocative efficiency and local participation the solving local problems. Unfortunately, there is no straightforward answer to which level is responsible for the gap; but this paper attempted to propose an economic logic for underpinning decentralization in the infrastructure sectors.

36. While it is very difficult to provide blanket recommendations on decentralizing the various sectors and respective subcomponents of infrastructure services, we do offer a modest set of guidelines to direct policymakers in their decision to decentralize or not:

1. Decentralization is intrinsically neither good nor bad for infrastructure; its impact depends entirely on the incentives facing the various decision-makers in the decentralization process;
2. Decentralization is most fruitful when the decision-makers bear the financial and political cost with respect to design, finance, operation and maintenance; and
3. Political leaders are accountable to their constituents for the manner in which they spend tax revenues and how they use and allocate transfers from the central government.

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