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Policy Challenges for Infrastructure Development in Asian LICs: Lessons from the Region

Yasuo Fujita*

Abstract

This paper discusses policy issues pertaining to infrastructure development in low income countries (LICs) in Asia. Infrastructure challenges in Asian LICs have not been adequately highlighted to date mainly because the international focus has often been on African LICs and because large countries such as China, India, and Indonesia attracted more interest among the developing Asian countries. While Asian LICs have sought to improve their infrastructure over the years, the quality and quantity is generally insufficient although significant variations exist between countries and sectors. Since their fiscal space and governmental capacities are limited despite large investment needs, each possible infrastructure investment must be placed in order of priority. In Asian LICs, spatially connective infrastructure (including logistics, telecommunications, and electricity) should be given priority to generate benefits from economies of agglomeration, fragmentation of production activities, and better connectivity to fast-growing large markets, although the trade-off between economic efficiency and spatially balanced growth is a difficult issue. Particularly, some large Asian LICs have great potential to become part of sophisticated regional production networks through effective infrastructure. Climate change, both the adaptation of infrastructure and mitigation through green development, also needs to be sufficiently taken into account or mainstreamed. The fact that the investment in public private partnerships (PPP) projects in infrastructure has recently been increasing in Asian LICs is encouraging. To scale up PPP, Asian LIC governments should clarify the contributions of the private sector (in such aspects as capital investment and operational efficiency), continue to improve the investment climate, policies, and regulations, and prepare bankable projects in which the roles of the public and private sectors are defined. The public sector will continue to be the main provider and regulator of infrastructure in Asian LICs. Although public sector performance should improve, there has been no single blueprint for it, and therefore country-specific approaches are called for. Donors should continue to support Asian LICs in scaling up infrastructure investment through project-financing, technical assistance, and capacity development.

Keywords: Infrastructure, low income country, economic integration, public private partnership, climate change

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CONTENTS

TABLES

FIGURES

BOX

List of countries and terminology in this working paper

This paper looks at 28 developing countries in Asia, basically in accordance with the IMF 2011 definition (IMF website as of April 2011). This paper frequently uses the terms “Asian low income countries (LICs)”, “developing Asian countries”, and “other developing Asian countries”. “Developing Asian countries” include both the 17 Asian LICs and the 11 other developing Asian countries.

	Countries with populations of more than one million	Countries with populations of less than one million
Asian LICs (17 countries)	Afghanistan, Bangladesh, Cambodia, Lao PDR, Mongolia, Myanmar, Nepal, Papua New Guinea, Timor-Leste, Vietnam	Bhutan, Solomon Islands, Kiribati, Maldives, Samoa, Tonga, Vanuatu
Other developing Asian countries (11 countries)	China, India, Indonesia, Malaysia, Pakistan, Philippines, Sri Lanka, Thailand	Brunei Darussalam, Fiji, Tuvalu

1. Introduction

Infrastructure contributes to economic growth and poverty reduction by increasing the competitiveness as well as the international and domestic connectivity of economies. In a highly globalized economy with vertically and horizontally integrated production networks, regional integration and agglomeration offer significant growth and employment opportunities for developing countries. Infrastructure also improves rural access to earnings opportunities, raises rural productivity, and provides access to basic services, thereby achieving inclusive development (see ADB-JBIC-WB 2005, World Bank 2008, ADB-ADBI 2009, etc.).

Low income countries (LICs) in Asia generally lag behind other Asian countries in infrastructure development and service provision, because of limitations or weaknesses in the fiscal space, the capacity of governments and public operators, private sector interest, financial market, and other aspects. Emerging issues such as urbanization, regional integration, climate change, and natural disasters present additional challenges and opportunities to Asian LICs. The main objectives of this study are: a) to discuss policy issues focusing on (i) strategic choices in infrastructure investment, (ii) public private partnerships (PPP), and (iii) improvements in infrastructure service efficiency and regulation by the public sector; and b) to present recommendations based on lessons mainly drawn from the Asian region.

The seventeen (17) Asian LICs are diverse in terms of population, size of economy, economic growth, income level, and other aspects (Table 1). Eleven countries have geographical constraints to economic growth and poverty reduction, either because they are landlocked - Afghanistan, Lao PDR, Nepal, Mongolia, and Bhutan - or because they are small, isolated island states - Solomon Islands, Kiribati, Maldives, Samoa, Tonga, and Vanuatu. Small, isolated economies face particularly constrained options in relation to infrastructure development given high unit costs as a result of their size and distance from international production networks and markets. In should be noted, however, that Mongolia, Papua New Guinea (PNG), and Timor-Leste are rich in natural resources, while Bhutan and Lao PDR have sizable electricity export revenues from hydropower plants.

This paper mainly investigates the following eight countries, out of the ten with a total population exceeding one million: Bangladesh, Cambodia, Lao PDR, Mongolia, Nepal, PNG, Timor-Leste, and Vietnam. Analyses of Afghanistan, Myanmar, and the small LICs are very limited due to data constraints.[1] The

1. In general, statistics and data on infrastructure are scarce (Estache and Fay 2010). Some Asian LICs often lack even limited data.

infrastructure mainly investigated in this paper includes: transportation (roads, railways, ports, and airports); electricity and energy (excluding upstream exploitation); and water supply and sanitation. The information and communication technology (ICT) sector is touched on briefly since it is well known that competition, PPP, and regulatory reforms have rapidly expanded service. "Connective infrastructure" in this paper refers to national infrastructure connecting different locations within an area (e.g., urban railways); national infrastructure connecting different territories within a country (e.g., national highways); national infrastructure improve connections with other countries (e.g., ports and airports); and cross-border infrastructure (e.g., transnational highways).[2]

The paper has potential value in two ways: (i) providing an overview of infrastructure development and related issues in Asian LICs; and (ii) providing a analytical basis for prioritizing investments and designing policy interventions that assist in mobilizing funds and applying them effectively for infrastructure development in the LICs surveyed. To date, the policy issues associated with infrastructure development in Asian LICs have not been adequately highlighted because among the world's LICs, those in Africa have received more attention, and because larger countries such as China, India, and Indonesia have attracted greater interest among the developing Asian countries. In this paper, Asian LICs are always at the center of discussion.

The limitations of this paper are as follows: First, it does not deal with financing mechanisms and risks for infrastructure[3] because these were partly dealt with by the other two session papers of IMF at the conference where a draft of this paper was presented. Second, the paper is based on a review of recent literature and an analysis of available statistics infrastructure; and no new case studies or data collection were conducted for this paper. Third, only 8 out of 17 Asian LICs are studied due to data limitations and their diverse nature. These limitations are covered by the available literature, or will be addressed by future studies, encompassing data collection.

The paper is structured as follows: Section 2 overviews the current situation of infrastructure development and services of Asian LICs. Section 3 briefly summarizes policy challenges for scaling-up infrastructure investment and service provision in Asian LICs. Sections 4 to 6 focus on three key topics: strategic choices in infrastructure investment to respond to emerging challenges, PPP in infrastructure, and public sector efficiency in infrastructure. Section 7 concludes.

2. See also ADB-ADBI 2009 for the definition of regional infrastructure.
3. For example, Bhattacharyay 2011 discusses these issues of developing Asian countries.

Table 1. Overview of Asian LIC economies

	Country	Total population, million (2010)	Population growth rate (%) per year (2005-2010)	Population density (people per sq. km of land area) (2010)	Urban population (% of total) (2009)	Land area (1000 sq. km) (2010)	GDP current price (current US$ million) (2009)	Anual GDP growth rate (constant LCU) (2004-2009)	GNI per capita, Atlas method (current US$) (2009)	Income Category (WDI 2011)	Doing Business Rank (2010)	GCI Overall Ranking (2010)	GCI Infrastructure Ranking (2010)
Large LICs	Afghanistan	30.61	2.69	46.9	24.4	652.23	14,483	12.9%	310 (2008)	Low	167	NA	NA
	Bangladesh	164.43	1.43	1,263.2	27.6	130.17	89,360	6.2%	580	Low	107	107	133
	Cambodia	14.14	1.14	80.1	22.2	176.52	10,447	7.7%	650	Low	147	109	114
	Lao PDR	6.44	1.82	27.9	32.0	230.80	5,939	7.4%	880	Low	171	NA	NA
	Mongolia	2.70	1.16	1.7	57.3	1,553.56	4,202	6.6%	1,630	Lower Middle	73	99	117
	Myanmar	50.50	0.87	77.3	33.2	653.52	35,226 (*)	13.2% (2001-06)	587 (**)	Low	NA	NA	NA
	Nepal	29.85	1.86	208.3	17.7	143.35	12,531	4.0%	440	Low	116	130	139
	Papua New Guinea	6.89	2.40	15.2	12.5	452.86	7,893	4.9%	1,180	Lower Middle	103	NA	NA
	Timor-Leste	1.12	2.16	75.6	27.7	14.87	558	4.5%	2,460 (2008)	Lower Middle	174	133	138
	Vietnam	88.36	1.23	285.0	28.3	310.07	97,180	7.3%	1,000	Lower Middle	78	59	83
Small LICs	Bhutan	0.71	1.74	18.5	35.6	38.39	1,277	9.0%	2,020	Lower Middle	142	NA	NA
	Kiribati	0.10	1.59	122.9	43.9	0.81	128	0.2%	1,830	Lower Middle	93	NA	NA
	Maldives	0.31	1.43	1,046.4	39.2	0.30	1,473	4.5%	3,970	Lower Middle	85	NA	NA
	Samoa	0.18	0.00	63.2	23.2	2.83	496	1.5%	2,840	Lower Middle	61	NA	NA
	Solomon Islands	0.54	2.49	19.1	18.3	27.99	657	5.5%	910	Low	96	NA	NA
	Tonga	0.10	0.46	144.8	25.0	0.72	311	0.0%	3,260	Lower Middle	71	NA	NA
	Vanuatu	0.24	2.56	19.7	25.2	12.19	648	5.9%	2,620	Lower Middle	60	NA	NA
Other developing Asia	Brunei Darussalam	0.41	1.92	77.2	75.3	5.27	11,471 (2006)	1.7% (2002-07)	31,180	High Income	112	28	52
	China	1,338.30	0.52	143.5	44.0	9,327.48	4,985,461	11.4%	3,650	Lower Middle	79	27	50
	Fiji	0.85	0.62	46.7	52.9	18.27	2,825	-0.2%	3,840	Lower Middle	62	NA	NA
	India	1,170.94	1.36	393.8	29.8	2,973.19	1,377,265	8.5%	1,220	Lower Middle	134	51	86
	Indonesia	232.52	1.19	128.4	52.6	1,811.57	540,274	5.6%	2,050	Lower Middle	121	44	82
	Malaysia	27.91	1.72	85.0	71.3	328.55	193,093	4.1%	7,350	Upper Middle	21	26	30
	Pakistan	173.38	2.17	224.9	36.6	770.88	161,990	4.9%	1,000	Lower Middle	83	123	110
	Philippines	93.62	1.83	314.0	65.7	298.17	161,196	4.4%	1,790	Lower Middle	148	85	104
	Sri Lanka	20.45	0.78	326.1	15.1	62.71	41,979	6.0%	1,990	Lower Middle	102	62	70
	Thailand	68.14	0.66	133.4	33.7	510.89	263,772	2.9%	3,760	Lower Middle	19	38	35
	Tuvalu	0.01	0.27	327.6	49.9	0.03	NA	NA	NA	Lower Middle	NA	NA	NA

Source: IMF 2011, WEF 2010 and World Bank 2011

Notes: (*) from IMF 2011(**)
GDP per capita (IMF staff estimates, IMF 2011)

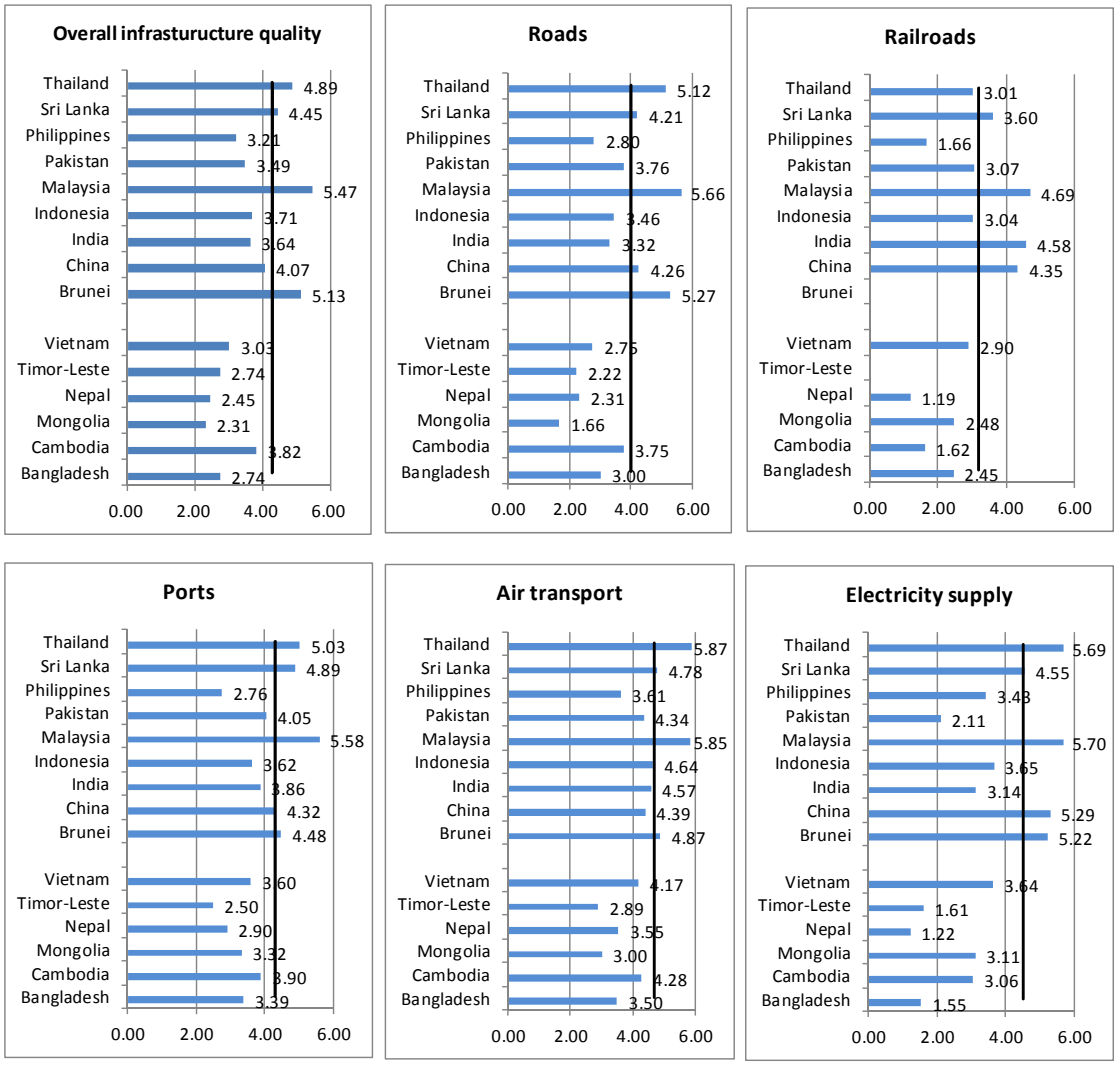
2. Infrastructure development and service provision in Asian LICs

Asian LICs have improved infrastructure and service provision through investment and sector reform over the decades. In general, however, their progress has been slower and their present level is still lower among developing Asian countries with significant variations between countries and sectors. The progress and current status of the Asian LICs in comparison with non-LIC Asian developing countries are described below, using data from the World Development Indicators of the World Bank (World Bank 2011) and the Global Competitive Index (GCI) of the World Economic Forum (WEF 2010):

(i) Overall, Vietnam is doing better than most Asian LICs and is already comparable to some non-LIC Asian developing countries. In contrast, other Asian LICs are low among the developing Asian countries. The WEF 2010[4] infrastructure index ranking shows that Vietnam (83) is ranked near India (86) and Indonesia (82), and above the Philippines (104) and Pakistan (110) out of 139 surveyed countries (Table 1). The infrastructure index ranks of the other surveyed Asian LICs are quite low – Bangladesh 133, Cambodia 114, Mongolia 117, Nepal 139, and Timor-Leste 138. Regarding overall infrastructure "quality," Cambodia is assessed as superior to Vietnam, Philippines, Pakistan, Indonesia, and India (Figure 1), probably because most of its infrastructure has recently been constructed or rehabilitated. Well-developed infrastructure is one of the critical elements of a country's competitiveness, because it has significant implications for the efficiency of economic activities (WEF 2010). From Table 1, we see that poor infrastructure negatively affects their overall competitiveness. All Asian LICs need to increase the quantity of their infrastructure and improve its quality.[5]

4. WEF 2010 surveyed only Bangladesh, Cambodia, Mongolia, Nepal, Timor-Leste, and Vietnam among the 17 Asian LICs.
5. These data would suggest Vietnam could pay more attention to the quality aspect, and Cambodia to quantity, although the two countries need to make progress in both aspects.

Figure 1. Infrastructure quality of developing Asian countries



Source: WEF 2010

Notes: Scores are shown for the developing Asian countries whose data are available in WEF 2010.
The vertical line is the average of scores for all 139 surveyed countries for each item.
Scores given by respondents range from 1 (extremely underdeveloped) to 7 (extensive and efficient by international standards).
No railroads in Brunei and Timor-Leste.

(ii) Progress in the transport sector has been slow, with a mixed picture across countries and sub-sectors (Table 2 summarizes the transport sector statistics mentioned below.). Although there have been improvements over several decades (Bhattacharyay 2010), the quantity and quality of roads is generally inadequate in most Asian LICs. Road density and the ratio of paved roads in the large LICs are generally ranked in the lower tier of developing Asian countries. Railway network

expansion is generally limited in most developing Asian countries.[6] Regarding ports, the liner shipping connectivity index is low and has risen only marginally or actually declined in Bangladesh, Cambodia, Myanmar, PNG, and Pacific Island countries from 2005 to 2009. The performance of the air transport sector of Asian LICs is mixed in terms of the air freight and passengers carried from 2000 to 2009.

(iii) For electricity and energy, ICT, water, and sanitation, while significant gains have been made, the current levels are still low and further improvement is necessary. Electricity consumption per capita in Bangladesh, Nepal, Cambodia, and Myanmar is low among developing Asian countries (Figure 2), and is even lower than the world average for low-income countries (231 kWh in 2008). Mobile cellular subscriptions (per 100 people) increased rapidly from 2005 to 2009 in the Asian LICs, although on average the numbers are still low by the standards of developing Asian countries (Annex, Table 2 and Annex, Figure 1). For these electricity and ICT indicators, Vietnam and Mongolia belong to the upper group of developing Asia. While water access rates (total population) of the non-LIC Asian countries were almost 90% or higher in 2008, those of the Asian LICs vary. The rates of Vietnam, Nepal, and Bangladesh are more than 80%, while those of PNG and Afghanistan are less than 50%, reflecting their low access rates in rural areas (Figure 3). Regarding sanitation, access rates do not appear to differ much among the developing Asian countries expect Malaysia, Thailand, and Sri Lanka (Annex, Table 3 and Annex, Figure 2).

In summary, while the quality and quantity of infrastructure and services in Asian LICs have improved, more effort is needed if the LICs are to catch up with other Asian developing countries. Particularly, the two principal drivers of growth and productive employment in Asian LICS are international competitiveness for export-led growth and urbanization that facilitates economies of agglomeration and fragmentation. These two key drivers of investment and growth are highly dependent on efficient infrastructure services that shorten supply chains and generate agglomeration dividends.

6. Railways operate in Afghanistan, Bangladesh, Cambodia, Fiji, Lao PDR, Mongolia, Myanmar, Nepal, and Vietnam. Only data on Bangladesh, Cambodia, Mongolia, and Vietnam are available in World Bank 2011. Railway length data on Vietnam vary significantly year by year, probably because of statistical issues.

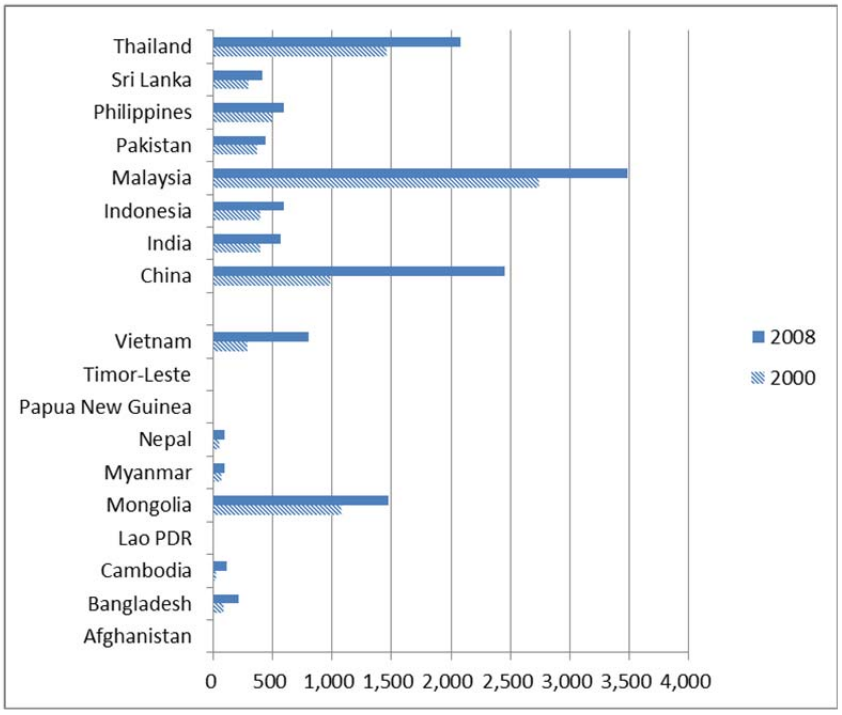
Table 2. Transport infrastructure in Asian LICs

	Country Name	Road density (km of road per 100 sq. km of land area) 2001-2008		Roads, paved (% of total roads) 2001-2008		Rail lines (total route-km) 2000	2009	-	Annual change	Liner shipping connectivity index (max value in 2004=100) 2005	2010	Air transport, freight (million ton-km) 2000	2009	Annual change	Air transport, passengers carried (1,000 people) 2000	2009	Annual change
Large LICs	Afghanistan	6.0	(2006)	29.3	(2006)	-	-			-	-	7.8	-	-	150	-	-
	Bangladesh	166.0	(2003)	9.5	(2003)	2,768	2,835		0.3%	5.1	7.5	193.9	0.0	-65.6%	1,331	1,409	0.6%
	Cambodia	21.0	(2004)	6.3	(2004)	601	650	(2005)	1.6%	3.3	4.5	4.1	1.0	-18.4%	125	184	5.7%
	Lao PDR	15.0	(2008)	13.5	(2008)	-	-	-	-	-	-	1.7	2.4	3.9%	211	303	4.1%
	Mongolia	3.0	(2002)	3.5	(2002)	1,810	1,814		0.0%	-	-	8.4	2.6	-12.4%	254	257	0.1%
	Myanmar	4.0	(2005)	11.9	(2005)	-	-	-	-	2.5	3.7	0.8	2.6	14.5%	438	1,527	14.9%
	Nepal	12.0	(2006)	55.9	(2006)	-	-	-	-	-	-	17.0	6.3	-10.5%	643	484	-3.1%
	Papua New Guinea	4.0	(2001)	3.5	(2001)	-	-	-	-	6.4	6.4	22.3	19.3	-1.6%	1,100	847	-2.9%
	Timor-Leste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Vietnam	48.0	(2007)	47.6	(2007)	3,142	2,347	-	-3.2%	14.3	31.4	117.3	311.5	11.5%	2,878	11,074	16.2%
Small LICs	Bhutan	20.0	(2003)	62	(2003)	-	-	-	-	-	-	0.0	0.4	-	34	49	4.0%
	Kiribati	92.0	(2001)	-	-	-	-	-	-	3.3	2.9	-	-	-	-	-	-
	Maldives	29.0	(2005)	100	(2005)	-	-	-	-	4.1	1.7	13.2	0.0	-53.7%	315	85	-13.5%
	Samoa	82.0	(2001)	14.2	(2001)	-	-	-	-	5.3	5.2	2.2	1.6	-3.3%	164	271	5.7%
	Solomon Islands	5.0	(2001)	2.4	(2001)	-	-	-	-	4.3	5.6	1.0	0.7	-4.0%	75	94	2.5%
	Tonga	91.0	(2001)	27	(2001)	-	-	-	-	4.8	3.7	0.0	-	-	52	-	-
	Vanuatu	9.0	(2001)	23.9	(2001)	-	-	-	-	4.5	3.7	1.8	1.6	-1.4%	102	112	1.1%
Other developing Asia	Brunei Darussalam	63.0	(2005)	77.2	(2005)	-	-	-	-	3.5	5.1	140.2	90.4	-4.8%	864	999	1.6%
	China	39.0	(2008)	53.5	(2008)	58,656	65,491		1.2%	108.3	143.6	3,900.1	11,976.4	13.3%	61,892	229,062	15.7%
	Fiji	19.0	(2001)	49.2	(2001)	-	-			8.3	9.4	90.8	65.6	-3.6%	586	1,147	7.7%
	India	129.0	(2008)	49.3	(2008)	62,759	63,273		0.1%	36.9	41.4	547.7	1,235.2	9.5%	17,299	54,446	13.6%
	Indonesia	23.0	(2008)	59.1	(2008)	5,324	3,370	(98-08)	-4.5%	28.8	25.6	408.5	276.9	-4.2%	9,916	27,421	12.0%
	Malaysia	30.0	(2004)	82.8	(2006)	1,622	1,665		0.3%	65.0	88.1	1,863.8	2,853.3	4.8%	16,561	23,766	4.1%
	Pakistan	33.0	(2006)	65.4	(2006)	7,791	7,791		0.0%	21.5	29.5	340.3	303.9	-1.2%	5,294	5,303	0.0%
	Philippines	67.0	(2003)	9.9	(2003)	491	479	(2008)	-0.3%	15.9	15.2	289.9	227.5	-2.7%	5,756	10,481	6.9%
	Sri Lanka	148.0	(2003)	81	(2003)	1,447	1,463	(99-08)	0.1%	33.4	40.2	255.7	279.0	1.0%	1,756	2,418	3.6%
	Thailand	35.0	(2006)	98.5	(2000)	4,103	4,429		0.9%	31.9	43.8	1,712.9	2,132.6	2.5%	17,392	19,619	1.3%
	Tuvalu	-	-	-	-	-	-			-	-	-	-	-	-	-	-

Source: World Bank 2011

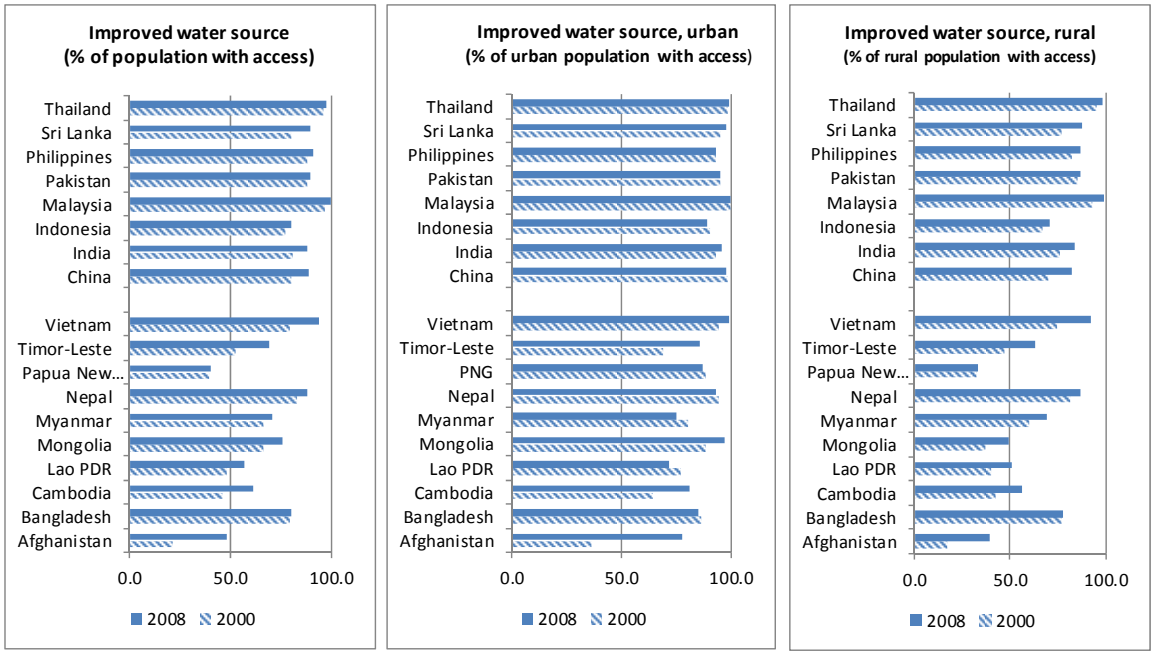
Note: Air transport data on Cambodia for 2002, instead of 2000

Figure 2. Electricity power consumption (kWh per capita)



Source: World Bank 2011
Note: Data on Afghanistan, Leo PDR, PNG and Timor-Leste are not available in World Bank 2011.

Figure 3. Improved access to water sources (% of population with access)



Source: World Bank 2011

3. Policy challenges for scaling up infrastructure in Asian LICs

This section reviews important policy challenges for scaling up infrastructure development and services in Asian LICs. We discuss only selected issues for scaling up infrastructure in Asian LICs, exclusive of issues of financing mechanisms and financial sector development.

3.1 Government fiscal space[7]

Bhattacharyay 2010 estimates the investment needs for domestic infrastructure (2010-2020) - energy, transport, telecommunications, water and sanitation - for the 32 ADB developing member countries, including 16 Asian LICs, excluding only Maldives. The total investment needs of the 16 Asian LICs is estimated at US$358 billion (in 2008 US dollars), and total investment per year at US$33 billion (columns (i) to (iv), Table 3).[8] Bangladesh has the largest investment needs (US$145 billion), representing 11.56% of its estimated GDP (2010-2020). Vietnam ranks second in total investment needs, at US$110 billion, or 8.12% of its estimated GDP.

Since private sector investment in infrastructure will be limited (as discussed below), most Asian LIC governments need to increase infrastructure investment during the next decade to meet these requirements. The share of total investment relative to estimated GDP exceeds the share of government capital expenditure relative to GDP in most large Asian LICs except PNG, Timor-Leste, and Vietnam (columns (v) and (viii)). When only "new" investment is considered, the share of estimated new investment relative to estimated GDP exceeds the share of government capital expenditure relative to GDP in Bangladesh.[9] The importance of maintenance should also be underscored as the stock of infrastructure increases, as indicated in Table 3. In the context of constrained

7. Heller 2005b defines "fiscal space" as budgetary room in a government's budget that allows it to provide resources for a desired purpose without jeopardizing the sustainability of its financial position or the stability of the economy.
8. The estimate has some methodological constraints, so the figures should be regarded as a reference point (Bhattacharyay 2010). In addition to this amount for domestic infrastructure, Asian LICs need to shoulder the costs of regional infrastructure. However, actual investment in regional projects is usually a small fraction of total infrastructure investment (ADB-ADBI 2009). Also, it is not possible to know how much should be paid by the LICs. The present paper does not take into account the cost of regional infrastructure.
9. In general, data on the amount of infrastructure investment by the public and private sectors are not available. Investment in PPP projects (Subsection 3.3) includes investment by both sectors; it is not private investment alone (World Bank and PPIAF, PPI Project database 2011). Caution is needed when comparing the data because government capital expenditure includes expenditure for other infrastructure (say, school buildings), and may not include maintenance expenses.

fiscal space, sufficient priority needs be attached to maintaining the stock of existing infrastructure. Increasing infrastructure investment for new capacity and maintenance is a challenge for Asian LICs because most have an overall budgetary deficit (Annex, Table 4).

The main reason for infrastructure deficits is insufficient spending. Ultimately, there are only two sources from which these needs can be funded: consumers via user charges, and taxpayers[10] (ADB-JBIC-WB 2005). Financiers, whether public or private, can change the requisite time profile of taxes or user charges; however, eventually their contributions have to be repaid or remunerated (ADB-JBIC-WB 2005). Since user charges are often set lower than the cost-reflective level for political and social considerations - for instance, the present electricity tariff in Bangladesh and Vietnam - service providers cannot afford new investment and maintenance expenses. Governments provide subsidies to cover the deficits of public utilities, resulting in a further decline of government resources. In LICs, raising user charges to a cost-reflective level has a negative impact on the lives of low-income groups, and is therefore difficult to do. Infrastructure helps boost domestic tax revenues through economic growth, but this usually takes time to materialize. In the long run, it is essential for LIC governments to enhance the two ultimate sources of infrastructure investment with due consideration to a balance between efficiency and equity. Subsidies that effectively target low-income groups need to be designed and implemented. Nevertheless, both approaches face significant policy challenges.

In general, broad options[11] for creating fiscal space for infrastructure in LICs include: (i) mobilization of domestic revenue including the above two sources; (ii) mobilization of external grants; (iii) expenditure reprioritization and efficiency; (iv) concessional financing; (v) PPP including direct private investment; and (vi) sovereign borrowing from domestic or international credit markets. The latter three options, which have to be repaid or remunerated, are necessary for upfront disbursement during the construction stage. While natural resource-rich and electricity-exporting LICs may have more fiscal space for infrastructure, caution is needed regarding sound macroeconomic/fiscal management and the negative impact on export industries when they scale up infrastructure investment. Asian LICs need to explore all options with due attention to debt sustainability, contingent liabilities, and overdependence on external aid.

10. Taxpayers include both domestic and foreign taxpayers. The latter provides grant assistance to developing countries.
11. These options are rearranged from Ter-Minassian, Hughes and Hajdenberg 2008.

Table 3. Infrastructure investment needs (US$ 2008 price) in Asian LICs (2010-2020)

	Estimated investment needs (US$ million)	Investments as % of total		Total investment per year (US$ million)	Investment as % of estimated GDP 2010-2020	New capacity investment, % of GDP 2010-2020 (=(ii)*(v))	Total investment per year, % of GDP 2008	Government capital expenditure, % of GDP (2006-2010 average)
		New capacity (%)	Maintenance (%)					
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
Afghanistan	26,142	57	43	2,377	11.92	6.8	20.2	11.2
Bangladesh	144,903	54	46	13,173	11.56	6.2	16.6	5.6
Cambodia	13,364	51	49	1,215	8.71	4.4	11.7	7.5
Lao PDR	11,375	56	44	1,034	13.61	7.6	18.9	8.8
Mongolia	10,069	37	63	915	13.45	5.0	17.4	6.8
Myanmar	21,698	56	44	1,973	6.04	3.4	6.3	3.6
Nepal	14,330	50	50	1,303	8.48	4.2	10.3	6.1
PNG	4,214	34	66	383	4.35	1.5	4.8	15.3
Timor-Leste	71	35	65	6	0.86	0.3	1.2	25.3
Vietnam	109,761	53	47	9,978	8.12	4.3	11.1	9.2
Large LICs, subtotal	355,927	-	-	32,357	-	-	-	-
Bhutan	886	30	70	81	4.07	1.2	6.5	16.9
Kiribati	82	10	90	7	5.65	0.6	5.3	24.4
Maldives	NA	NA	NA	NA	NA	NA	NA	10.5
Samoa	242	13	87	22	4.70	0.6	3.8	10.6
Solomon Islands	336	33	67	31	4.13	1.4	4.8	6.1
Tonga	106	13	87	10	3.71	0.5	2.9	1.2
Vanuatu	306	40	60	28	4.13	1.7	4.5	2.5
Small LICs, subtotal	1,958	-	-	179	-	-	-	-
Asian LICs, total	357,885	-	-	32,536	-	-	-	-
Brunei Darussalam	NA	NA	NA	NA	NA	NA	NA	-
China	4,367,642	72	28	397,058	5.39	3.9	8.8	-
Fiji	667	15	85	61	1.68	0.3	1.7	-
India	2,172,469	64	36	197,497	11.12	7.1	16.2	-
Indonesia	450,304	70	30	40,937	6.18	4.3	8.0	-
Malaysia	188,084	79	21	17,099	6.68	5.3	7.7	-
Pakistan	178,558	53	47	16,233	8.27	4.4	9.9	-
Philippines	127,122	53	47	11,557	6.04	3.2	6.9	-
Sri Lanka	37,908	52	48	3,446	6.85	3.6	8.5	-
Thailand	172,907	72	28	15,719	4.91	3.5	5.8	-
Tuvalu	NA	NA	NA	NA	NA	NA	NA	-
Other developing Asia, total	7,695,661	-	-	699,607	-	-	-	-

Source: Bhattacharyay 2010, ADB 2011, IMF 2011, World Bank 2011 and author's calculation

Note 1: (i) to (v) from Bhattacharyay 2010; (vi) calculated by author from (ii) and (v);
(vii) calculated by author from (iv), World Bank 2011 and IMF 2011; and
(viii) calculated by author from ADB 2011.

Note 2: Regarding (viii), the figures for Afghanistan, Bhutan and Vanuatu are the averages for 2005-2009; and Myanmar's figure is that for 1996-2000.

3.2 Government capacity for infrastructure and service provision

Planning and coordination

Infrastructure is politically, economically, and technically complex, and has long-term implications; therefore, institutions that can develop long-term strategies and coordinate the policies of different agencies to implement them are essential for effective infrastructure services (ADB-JBIC-WB 2005). National development and poverty reduction strategies usually include a long-term national development vision accompanied by infrastructure investment and sector reform programs. Asian LICs depend on donor technical assistance in strategy formulation, project identification, master planning, and feasibility studies. Limodio 2011, having reviewed infrastructure projects funded by the World Bank, concludes that governance and the selection of well-designed projects are essential for success, and that donors should support governments in these aspects.

In addition to coordination at the central level, infrastructure requires extensive coordination. In countries where the devolution of power to local governments has taken place, both vertical (central-local) and horizontal (local-local) coordination is necessary. For regional (cross-border) infrastructure, coordination among sovereign states is required.[12] Because infrastructure is a "club good" and often has externalities to neighboring areas, coordination among the governments involved is indispensable for efficient infrastructure supply (ADB-ADBI 2009).

Implementation, and operation and maintenance

Weak implementation, operation, and maintenance capacity of governments and public operators is also a problem. JICA ex-post project evaluation (JICA 2011) finds that inefficient project implementation is often caused by delays in construction progress and procurement procedures, and delays in the licensing procedure of recipient governments and implementing agencies, apart from external factors such as inclement weather. In projects whose sustainability was questioned, the main reason was attributed to insufficient budgets for operation and maintenance. This was caused by insufficient

12. Existing and prospective regional cooperation and integration initiatives involving Asian LICs are: Master Plan on ASEAN Connectivity, Greater Mekong Subregion (GMS), South Asia Subregional Economic Cooperation (SASEC), Central Asia Regional Economic Cooperation (CAREC), and the proposed Pan-Asian Infrastructure Forum.

budget allocations from the central government, as well as the collection of insufficient user charges to cover the necessary operation and maintenance expenses.[13]

Social and environmental safeguard

The environmental impact of infrastructure is frequently negative. While project-level interventions have an important role to play, it is essential to mainstream efforts to mitigate and limit negative environmental outcomes through, for example, environmental legislation, capacity building in environmental agencies and at the community level, improved information and transparency, and systematic use of strategic environmental assessments at the national and sector levels. But mainstreaming environmental issues in these ways is related to broader governance and policy/agency coordination challenges.[14]

According to the Country Policy and Institutional Assessments (CPIA) of the World Bank, 10 of the 16 Asian LICs (excluding Myanmar due to a lack of data) are below the average score (3.11) of the 77 IDA eligible countries in the criteria "policies and institutions for environmental sustainability" (Annex, Table 6). It is suggested that these Asian LICs need to strengthen efforts for mainstreaming social and environmental issues.

Regulatory framework, transparency, and accountability mechanism

When the regulatory framework as well as the transparency and accountability mechanism are weak, infrastructure can cause inefficiencies and be a frequent target for corruption. The monopoly structure of supply can provide a significant opportunity for rent-seeking. The political protection and intervention given to infrastructure blurs financial accountability. Active community participation, competition, and regulation have important roles to play in avoiding these kinds of outcomes.[15]

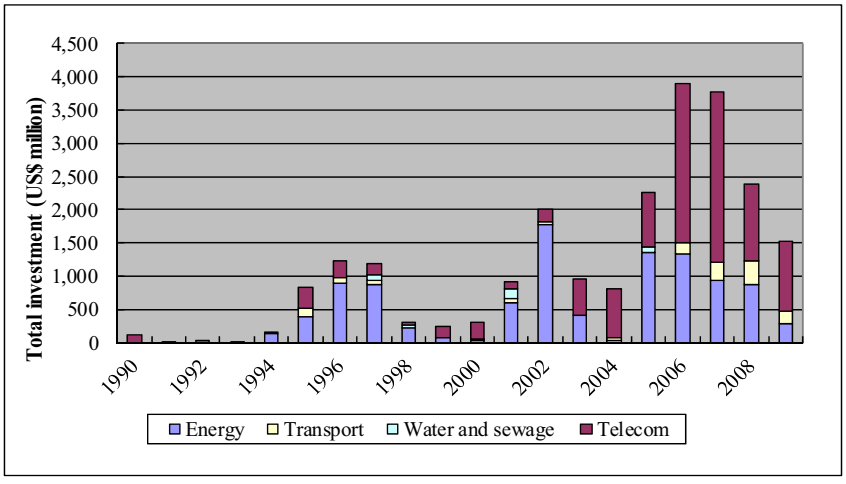
In Asian LICs, there is room for improving these modalities, as shown in the Annex, Figure 3. The "voice and accountability" indicator of some of the large Asian LICs is quite low by the standards of developing Asian countries. The "regulatory quality," "government effectiveness" and "corruption control" indicators of the large Asian LICs are also low, on average, compared to other developing Asian countries.

13. This paragraph is taken from JICA (2011, 18-22). This paragraph is on projects in developing countries in general, including Asian LICs.
14. This paragraph is taken from ADB-JBIC-WB 2005.
15. This paragraph is mostly taken from ADB-JBIC-WB 2005.

3.3 Limited private sector participation in infrastructure

The Asian LICs attracted a small amount of private sector investment in infrastructure: US$22,928 million for 133 projects from 1990 to 2009. This is 4.4% of total investment and 6.8% in terms of the number of projects in Developing Asia. Since the Asian LICs' share of GDP in Developing Asia was 3.5% in 2009, the total investment (1990-2009) appears to correspond to the size of the economy. The investment is concentrated in a limited number of countries, and in the telecommunications and energy sectors, as consistent with global patterns. The share of the five largest recipients accounts for approximately 90%; Bangladesh (30.0%), Vietnam (29.1%), Lao PDR (15.4%), Cambodia (8.3%), and Afghanistan (6.6%) (Annex, Figure 4). The telecommunications sector is 47.5% and the energy sector is 44.7% (Annex, Table 7), with a slightly higher concentration in these two sectors than is seen in developing Asian countries in general. Starting in 2005, Asian LICs began attracting more private sector investment than ever before (Figure 4),[16] which is encouraging for Asian LIC governments. Also, regional and domestic private investors are becoming active in Asian LICs.[17] We will look at what Asian LICs can do to encourage more PPP in their infrastructure in Section 5.

Figure 4. Private sector investment in infrastructure (Asian LICs)



Source: World Bank and PPIAF, PPI Project database 2011

16. Private infrastructure investment fluctuates probably due to influence of a small number of large projects (such as large hydropower projects in Lao PDR and Bhutan). Annex, Table 7 shows the recent rapid increase. The share of number of projects and investment from 2005-2009 are 39% (52 projects) and 60**%**(US$ 13,849 million), against 133 projects amounting to US$ 22,928 million for 1990 to 2009. Even though the recent increase is due to a few large projects, it is a new phenomenon.

17. For example, in 2010 there are five power sector PPP projects in Bangladesh. Bangladeshi nationals invested in three projects (World Bank and PPIAF, PPI Project database 2011).

3.4 Emerging opportunities and challenges: urbanization, regional integration, and climate change

This subsection identifies emerging opportunities and challenges for infrastructure development in Asian LICs, and their current situation. Given space constraints, they are not comprehensive. The present paper looks only at urbanization and regional integration as well as climate change.

Urbanization and regional integration

In a highly competitive globalized economy with vertically and horizontally integrated production networks, regional integration provides significant growth and employment opportunities for LICs. Asian LICS can leverage the advantages of economic geography through their proximity to the fastest-growing production networks in the world economy. Modernizing urban infrastructure will be key to realizing this potential.

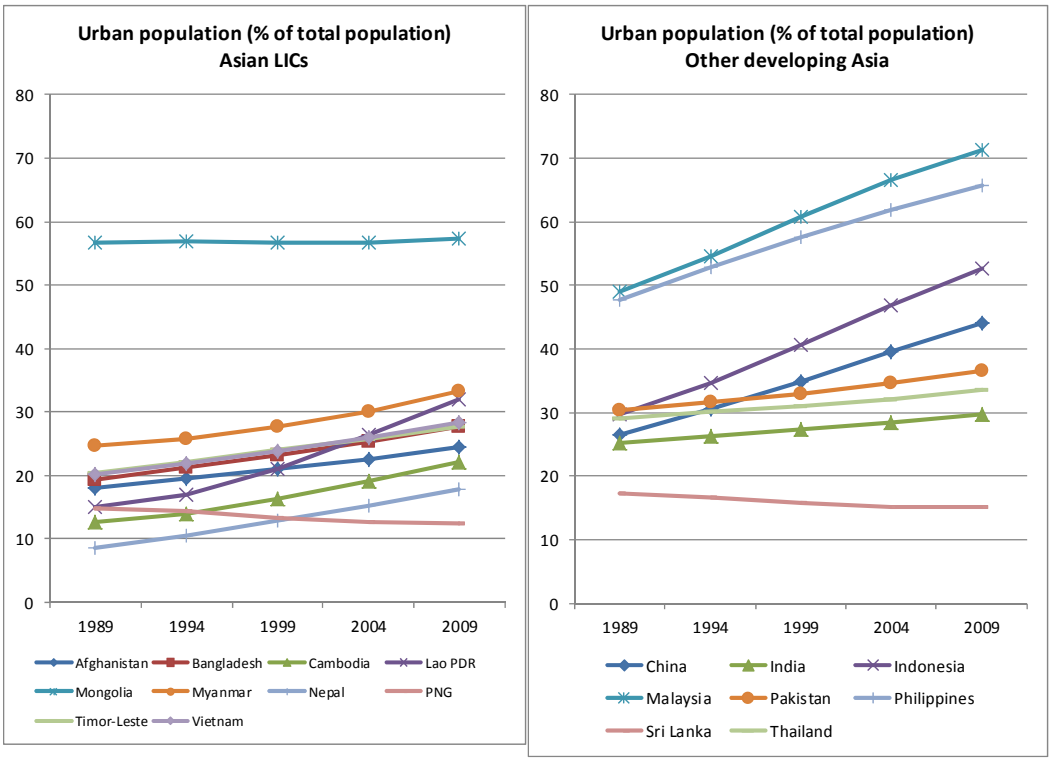
World Bank 2008 argues that some places are doing well because they have pursued their transformations along the three dimensions of economic geography: higher densities, as seen in the growth of cities; shorter distances, as workers and business migrate closer to density; and fewer divisions, as countries thin their economic borders and enter world markets to take advantage of scale and specialization. East Asia's recent economic growth and poverty reduction is characterized by the rapid expansion of regional trade through a sophisticated production network and efficient production in industrial agglomerations (in most cases, urban agglomerations) (ADB-ADBI 2009 and ERIA 2010).

The combination of agglomeration and urbanization can have a significant impact not only on the need for infrastructure services, but also on the pattern of natural resource use and the environment. This, in turn, can influence migration and agglomeration. These feedback loops ultimately influence the prospects for economic growth and high productivity jobs. Agglomeration and migration also have an impact on the four forms of capital (man-made capital, natural capital, social capital, and human capital) that are the basis for sustained development. Asian LICs should manage their urbanization to maximize the public benefits of agglomeration while minimizing the public costs, such as congestion, pollution, and crime.

At present, Asian LICs do not appear to be taking full advantage of the benefits of higher densities, shorter distance, and fewer divisions. Although urbanization has been progressing, their overall urbanization level is still in the lower tier of

developing Asian countries, with the exception of Mongolia with its sparse population and vast rural area (Figure 5). In the capital cities of Asian LICs, rapid urbanization causes congestion and a shortage of infrastructure, thereby dispersing economic activities. Infrastructure in urban agglomerations should be provided before it is too late. While Vietnam is already part of the production network and a few countries including Cambodia are becoming part of it (ERIA 2010), most Asian LICs are outside the network because of their weak connectivity. Strengthening connectivity should be a priority with reference to the recent growth pattern of Asian nations.

Figure 5. Urban population (% of total population), 1989-2009



Source: World Bank 2011

Climate change and natural disasters

Climate change represents additional challenges and opportunities for infrastructure in Asian LICs. Historically, the frequency of natural disasters is increasing around the world (Figure 6). The number of natural disasters has increased more rapidly in Asia than in other parts of the world; and more than 90% of natural disaster damage is due to earthquakes, floods, and storms in Asia (EM-DAT database). Climate change is

expected to increase the number of natural disasters of all kinds (meteorological, hydrological and biological).

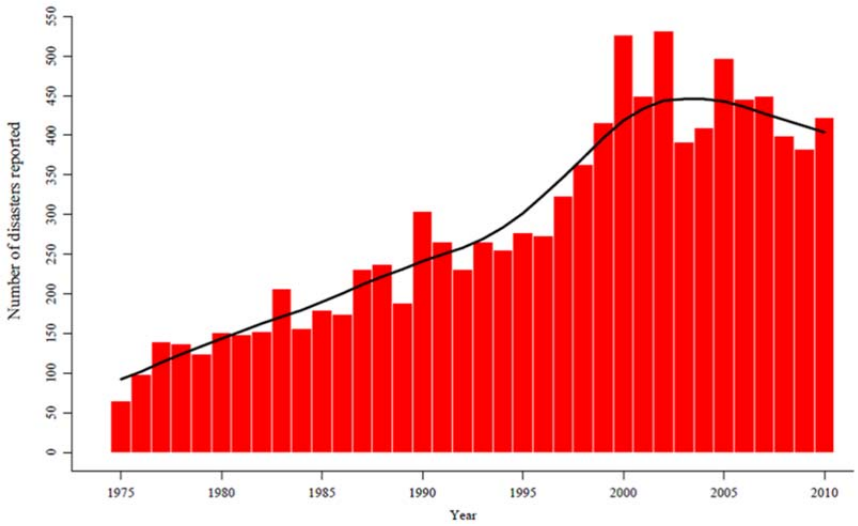
For Asian LICs, adaptation to climate change is inevitable. By the 2070s, for instance, the top 10 port cities with high exposure and vulnerability (size of population) to climate change extremes will include Dhaka (Bangladesh), Ho Chi Minh City (Vietnam), Yangon (Myanmar), and Hai Phong (Vietnam)[17] (Nicholls et al., 2008)[18]. This adaptation will make infrastructure planning more complicated and will raise the cost of infrastructure.

Mitigating climate change will create challenges and opportunities. The share of Asian LICs in greenhouse gases is minor because of their small economic size, but they do need to expand their infrastructure, such as power generation capacity and transportation, which will have adverse effects, especially in rising greenhouse gas emissions, if they are constructed and operated with traditional technologies. Mitigation may be more costly for infrastructure developers, but mitigation opportunities are linked to more sustainable land and forest management, to cleaner energy (such as geothermal or hydropower), and to the creation of sustainable urban transport systems in Africa and Latin America (World Bank 2009).

Making infrastructure resistant to natural disasters has benefits and costs to users and taxpayers. The experience of the Great East Japan Earthquake clearly shows that infrastructure plays an important role in obtaining information about damage, and also had significant meaning for people's lives, relief operations, and recovery from the damage. However, the more disaster-resistant the infrastructure, the more costly it is. Low income countries face a difficult trade-off given their limited financial capacity. The number of victims of natural disasters can be reduced by information systems and disaster mitigation structures (for example, in Bangladesh), and insurance mechanisms are also available for economic losses (Sawada 2011). Some infrastructure damage may be covered by insurance mechanisms as well. But it is not clear how disaster-resistant infrastructure should be, and how the risks of natural disasters can be reduced.

18. Nicholls et al., 2008 focuses on 136 port cities in the world, including ports located inland but still with high exposure and vulnerability to climate extremes, such as Dhaka (Bangladesh).

Figure 6. Natural disasters reported during 1975-2009



Source: EM-DAT: The OFDA/CRED International Disaster Database – www.emdat.net – Université catholique de Louvain – Brussels – Belgium

A number of recent studies have already provided evidence that infrastructure can contribute to economic growth and poverty reduction (for instance, Calderón and Servén 2008, 2010). Hence, the issue is related to the prioritization among infrastructure projects given limited resources and capacity. In the following sections, we will see what suggestions are possible regarding the choice of infrastructure from the recent literature on two emerging issues. In Section 5, we look at what should be done by Asian LICs to attract more PPP in view of its upward trend. Section 6 argues the public sector efficiency because it continues to be the main provider and regulator of infrastructure in Asian LICs, even with increased PPP.

4. Strategic choices in infrastructure investment

Given the financial and capacity constraints of LIC governments, each possible infrastructure investment must be placed in order of priority. Basically, infrastructure has a long life, and thus it determines land use, the structure of cities, and social and economic activities. Urban areas and industrial agglomerations are large consumers of energy. Long-lasting infrastructure triggers investments in associated capital (cars for low density cities; gas-fired heat and power generation capacity in response to gas pipelines), locking economies into lifestyles and energy consumption patterns (World Bank 2009).

Emerging issues of urbanization, regional integration, and climate change are all linked to infrastructure choices.

Based on the results of recent studies, this section argues that the prioritization among infrastructure projects is essential so that they can benefit from urbanization and regional integration. It also argues that climate change, or more broadly natural disasters, should be taken into consideration in the choice of infrastructure.

4.1 Urbanization and regional integration

Summary of recent studies related to urbanization and regional integration

It is reasonable to discuss regional integration and urbanization together because fragmented production activities are located in industrial agglomerations (usually urban areas). As noted, there is already literature on this, based on theories of new economic geography and fragmentation of production activities.

The first is the World Bank (2008) – *World Development Report (WDR) 2009: Reshaping Economic Geography*. This argues that places do well when governments promote transformations along the dimensions of economic geography: higher densities, shorter distances, and fewer divisions. It concludes that transformations along these three dimensions are essential for development, and should be encouraged. In response to concern about billions of poor people living in urban slums and lagging/remote areas, which is often associated with the view that growth must be spatially balanced, it states that economic growth will be unbalanced, and that to try to spread out growth is to discourage growth itself. It argues further that for growth to be rapid and shared, governments must promote economic integration with respect to urbanization, territorial development, and regional integration. Criticizing an overemphasis on geographic targeting for spatially balanced growth, it reframes policy debates to include all instruments of integration - spatially blind institutions, spatially connective infrastructure, and spatially targeted interventions (Table 4). The spatially blind institutions include not only laws and regulations, but also such public services as basic education, health, water, and sanitation (Table 4). It argues that if these instruments are properly used, growth will still be unbalanced, but development will be inclusive.

Table 4. Economic integration policies for urbanization, territorial development, and regional integration, World Bank 2008[19]

A simple framework for urbanization policies

	Area		
	Incipient urbanization	**Intermediate urbanization**	**Advanced urbanization**
Urban shares	Less than 25 percent	About 50 percent	More than 75 percent
Examples	Kampong Speu, Cambodia; Lindi, Tanzania	Chengdu, China; Hyderabad, India	Greater Cairo, the Arab Republic of Egypt; Rio de Janeiro, Brazil
Dimensions of policy challenge	1-D: Build density	2-D: Build density, reduce distance	3-D: Build density, reduce distance, eliminate division
Instruments for integration			
Institutions	Land rights; basic education, health and water and sanitation	Land use regulations; universal provision of basic and social services	Land use regulation and land taxation; universal provision of basic services
Infrastructure		Transport infrastructure	Transport infrastructure; demand management
Interventions			Slum area development; targeted programs to reduce crime and environmental degradation

A framework for area, territorial, or regional development polices

	Country type		
	Sparsely populated lagging areas	**Densely populated lagging areas in united countries**	**Densely populated lagging areas in divided countries**
Examples (countries)	Chile, China, Ghana, Honduras, Pakistan, Peru, Russian Federation, Sri Lanka, Uganda, Vietnam	Bangladesh, Brazil, Colombia, Arab Rep. of Egypt, Mexico, Thailand, Turkey	India, Nigeria
Dimensions of the integration challenge	Economic distance (1-D)	Economic distance High population densities in lagging areas (2-D)	Economic distance High population densities Internal divisions (3-D)
What policies should facilitate	Labor and capital mobility	Labor and capital mobility Market integration for goods and services	Labor and capital mobility Market integration for goods and services Selected economic activities in lagging areas
Policy Priorities			
Spatially blind institutions	Fluid land and labor markets, security, education and health programs, safe water and sanitation	Fluid land and labor markets, security, education and health programs, safe water and sanitation	Fluid land and labor markets, security, education and health programs, safe water and sanitation
Spatially connective infrastructure		Interregional transport infrastructure Information and communication services	Interregional transport infrastructure Information and communication services
Spatially targeted incentives			Incentives to agriculture and agro-based industry Irrigation systems Workforce training Local roads

19. These are the Tables 7.1 (p. 216), 8.1 (p. 246), and 9.4 (p. 273) of World Bank 2008 with the permission by the World Bank (© 2009 The International Bank for Reconstruction and Development / The World Bank).

A simple framework for regional integration

	Region or neighborhood		
	Close to world markets	**With big countries tar from world markets**	**Small countries far from world markets**
World neighborhoods	Central America and Caribbean, North Africa, Middle East	South America, Southern Africa, East Asia, South Asia	Central Africa, East Africa, West Africa, Central Asia and Caucasus, small Pacific Islands
Dimensions of the regional integration challenge	International division (1-D)	Regional division, economic distance (2-D)	International division, economic distance, low density (3-D)
What policy instruments should facilitate	Integration with large nearby markets	Regional integration Regional and global connectivity	Regional integration Regional and global connectivity Regional compensation mechanisms
Priority instruments			
Institutions	Agreements on trade and factor mobility within region and with large markets nearby	Agreements on trade and factor mobility within region and with large markets nearby Regional provision of public goods	Agreements on trade and factor mobility within region Shared facilities (research, central banks, regulatory bodies)
Infrastructure		Transport corridors connecting to large regional economy Regional power grids, telecoms, water management	Hub-and-spoke infrastructure Regional power grids, telecoms, water management
Incentives			Subsidized human development investments in lagging countries and areas Productive investments in leading countries and areas Preferential market access

Source: World Bank 2008

World Bank 2008 provides Asian LICs with guidance on prioritizing infrastructure investment, as shown in Table 4. First, it emphasizes the roles of connective infrastructure for economic integration in urbanization, territorial development, and regional integration as long as spatially blind institutions are in place. It suggests that governments should refrain from investing in infrastructure for political considerations in incipient urbanization, sparsely populated lagging areas, and countries/areas close to the world market.[20] Second, it suggests that basic public services, including water and sanitation, should be supplied as part of spatially blind institutions because poor public services in rural areas often induce migration for non-economic reasons. While World Bank 2008 provides a useful guide to investing in connective infrastructure, it needs to be adapted to the situation of the Asian LICs.

20. Regarding regional integration (Table 4) of World Bank 2008, "large markets" refers to Europe and the United States; and "the areas close to world markets" refers to Central America and the Caribbean, North America, and the Middle East. It considers that since these areas are already close to the world markets, agreements on trade and factor mobility suffice for regional integration. Some may dispute this logic.
On the other hand, "areas with large countries far from world markets" need both agreements and connective infrastructure. Asian LICs fall into this group; and "big countries far from world markets" include India and China. Nowadays, the fastest-growing markets are in Asia. The shift in the center of gravity in the global economy has implications for the choices Asian LICs make in terms of infrastructure development. Regional integration and connectivity are becoming increasingly important.

The second is ADB-ADBI 2009, *Infrastructure for a Seamless Asia*, which focuses on developing regional infrastructure in Asia, and provides a framework for pan-Asian infrastructure cooperation. The study measures the expected benefits of regional infrastructure through a computable general equilibrium (CGE) model. It also estimates infrastructure investment needs for 2010 to 2020 in Asia, including those of 1,077 listed regional projects. It recommends an institutional framework and financing mechanisms for developing regional infrastructure. The key messages of ADB-ADBI 2009 are as follows:

- The required investment in regional infrastructure for pan-Asian connectivity would produce large real income gains of around $13 trillion for developing Asia during 2010-2020 and beyond.
- A pan-Asian infrastructure forum should be established to help coordinate and integrate existing subregional infrastructure initiatives towards a seamless Asia.
- From 2010 to 2020, Asia will need to invest approximately US$8 trillion in overall national infrastructure, in addition to about US$290 billion in specific regional infrastructure projects - an average total infrastructure investment of US$750 billion per year.
- An Asian infrastructure fund is needed to mobilize Asian and international funds, and to help prioritize, prepare, and finance "bankable" regional infrastructure projects.

ADB-ADBI 2009 identifies 21 high priority flagship regional projects (estimated total cost: $15 billion) that could be implemented by 2015. 18 of 21 projects (excluding three transport projects in Central Asia) involve the following Asian LICs: Afghanistan, Bangladesh, Bhutan, Cambodia, Lao PDR, Mongolia, Nepal, and Vietnam.

ERIA 2010, *Comprehensive Asia Development Plan (CADP),* provides a grand spatial design of economic infrastructure and industrial placement in ASEAN and East Asia, and aims to pursue both a deepening of economic integration and a narrowing of development gaps. ERIA 2010 claims that the mechanics of fragmentation and agglomeration should be more aggressively utilized to further expand international production networks, and that logistics and economic infrastructure is often the key to activating private dynamism for this purpose. It recommends development strategies for countries/areas depending on their stage of development, and particularly the degree to

which they participate in production networks, and it crafts strategies according to the following three tiers:

- Tier 1: countries/areas trying to step up from middle-income to fully developed (examples: Bangkok, Hanoi, Ho Chi Minh, Chennai, Kuala Lumpur, Manila, and Jakarta);
- Tier 2: countries/areas that intend to participate in production networks (examples: Phnom Penh, Vientiane, Yangon, Danang, Kumming, etc.); and
- Tier 3: countries/areas in which the development of long-distance logistics infrastructure would provide new perspectives for industrial development (examples: mountainous areas of Cambodia, Lao PDR, and Myanmar).

One of the important messages of ERIA 2010 concerns the internal mechanism of economic corridors. Economic corridors comprising both more developed areas and less developed areas can help more developed areas step up to the fully-developed stage by shifting or fragmenting cost-sensitive labor intensive processes to less developed areas. ERIA 2010 assesses the economic impact of transport/logistics infrastructure, and found an enormous direct and indirect impact on industrial and economic growth, along with a reduction of development gaps, through the dispersion of economic activities. It also finds that simultaneous construction of multiple economic corridors will induce balanced growth. Moreover, it lists about 700 infrastructure projects, including domestic and regional transport/logistics infrastructure in three sub-regions,[21] and assigns an order of priority to them.

Lessons and Implications for Asian LICs

What conclusions can we draw from these recent studies for the choice of infrastructure investment in Asian LICs? World Bank 2008 sought to rebalance this policy debate, and ADB-ADBI 2009 and ERIA 2010 conducted a simulation analysis of the impacts of connective infrastructure. However, the locational choice of infrastructure investment is problematic because the most promising research is largely theoretical, and because spatial policy debates are often politically charged (Estache and Fay 2010). We carefully draw implications for Asian LICs.[22]

21. Greater Mekong sub-region; Indonesia-Malaysia-Thailand Growth Triangle (with some expansion); and Brunei Darussalam-Indonesia-Malaysia-Philippines East ASEAN Growth Area (with some expansion)
22. Here, we mention only investment in physical infrastructure, but clearly policies and institutions are indispensable if infrastructure is to function effectively.

First, the mechanics of fragmentation and agglomeration should be more aggressively utilized to further expand international production networks, and the logistics/economic infrastructure to contribute to this purpose should be given higher priority than in other parts of the world (ERIA 2010). ERIA 2010 shows that international production networks in East Asia have become the most advanced and sophisticated in the world, and have been one source of growth for East Asian economies. Some Asian LICs including Vietnam are already part of these networks, while others such as Cambodia and Lao PDR definitely have the potential to become part of them. Through economic and logistics infrastructure development, the former group would be able to take greater advantage of positive agglomeration effects, while the latter would be part of a sophisticated production network or would attract more manufacturing activities (ERIA 2010).[23]

Second, LIC governments would have to limit the number of target agglomerations (i.e., urban and industrial areas) and corridors where infrastructure investment will be made due to their scarce resources. If the arguments of World Bank 2008 are followed, Asian LIC governments and donors should refrain from investing in connective infrastructure for the purpose of spatially balanced growth, except in advanced urbanized areas with slums, densely populated lagging areas in divided countries, and small countries far from world markets (Table 4). Since this kind of decision is politically difficult, there is no simple solution.[24] At this stage, two points can be made. First, Asian LICs are in a good position to enjoy a "latecomers advantage" in prioritizing projects. Major economic corridors have been already identified in Asia, and their economic benefits have often been analyzed and compared (like ADB-ADBI 2009 and ERIA 2010). Asian LICs would be able to choose the most promising corridors, mitigating the risk of inefficient investment decision-making. Second, good quality development strategies, master plans, and feasibility studies help policymakers

23. Needless to say, logistics infrastructure is a necessary but not sufficient condition for the development of these two groups. Policy and institutional reforms, for example, in investment and trade are also necessary. However, countries/areas in Tier 3 may not attract quick high-frequency type production networks in the short run, yet reliable infrastructure would open opportunities for such industrial development as tourism and agriculture development (ERIA 2010).

24. Some societies may choose to forego economic growth generated by agglomeration and fragmentation in favor of more spatially balanced development to avoid the costs (including loss of social capital) associated with rural/urban migration. This might be applicable, particularly to small, remote LICs that are isolated from international production networks/markets. There are ongoing initiatives to set up "happiness" indices in the UK, Japan, etc. because of the limitations of GDP growth as a measure of progress. One example is Bhutan's Gross National Happiness Index.

choose projects, and also serve as a dialog with stakeholders.[25] Donors should continue to support Asian LICs in these studies (An example is JICA's Master Plan Study for Establishing a Metropolitan Priority Area for Investment and Industry [MPA] in the JABODETABEK Area in Indonesia).

Third, basic public services, including water and sanitation, should be supplied nationwide as part of spatially blind institutions to eliminate the factor of rural people migrating for non-economic reasons. As shown in Figure 3 and Annex, Figure 2, access rates to water and sanitation are generally low in the rural areas of most Asian LICs. Migrations induced by poor living conditions in rural areas would create congestion and slums in urban areas, constraining agglomeration effects.

Fourth, some cities, such as Dhaka (Bangladesh), which rather than benefiting from agglomeration economics already suffers from congestion, need to take immediate measures to alleviate congestion[26], such as building mass transit systems (e.g., urban railways). It is obvious from the experience of Bangkok, Manila, Kuala Lumpur, and other places that megacities will need mass transit systems to manage large urban traffic volumes. Governments should prepare urban development plans including land regulations, since the investment will have a long-term impact on the urban area and national economy as a whole (JICA 2011b). Moreover, central governments should play the chief role because of the weak capacity of local governments, huge capital investment, and complex coordination with stakeholders.

Fifth, the quality of infrastructure "services," such as just-in-time delivery, stable power supply, and reliable communication is indispensable for economies of agglomeration and fragmentation to work. Quality services are supplied by private service providers through technological and business innovation. Private service providers are already active in more developed countries and areas in Asia. Reform and harmonization of service regulations and better connections with more developed neighboring countries/areas should come together to encourage private service providers through economies of scale.

25. Limodio 2011 points out the importance of good project design for successful infrastructure projects.
26. There are other problems affecting living conditions of cities due to congestion. The increase of solid waste caused by urbanization and income growth is another example. There is usually under-investment in waste disposal, with implications for health outcomes and the livability of cities as urbanization progresses.

4.2 Climate change

Further to subsection 3.4, this subsection examines what suggestions can be made on the choice of infrastructure from the perspective of climate change. We discuss first the adaptation of infrastructure to climate change, and then the mitigation of climate change through green infrastructure development.

Adaptation of infrastructure to climate change

The World Bank performed a study called the Economics of Adaptation to Climate Change, including country case studies on three Asian LICs: Bangladesh, Vietnam, and Samoa. World Bank 2010a estimates that the cost between 2010 and 2050 of adapting to a world that is approximately 2°C warmer by 2050 is in the range of US$70 billion to $100 billion a year in developing countries. East Asian and Pacific and South Asia regions (World Bank regional category) are estimated as bearing roughly 45% of the total world adaptation burden (World Bank 2010a). The cost of adapting infrastructure to climate change is no more than 1-2 percent of the total cost of providing that infrastructure as a global average (Hughes, Chinowsky, and Strzepek 2010).

World Bank 2010a estimated the cost of adaptation to climate change in Bangladesh by 2050. The cost of adapting transport infrastructure - road height enhancement, road crossing drainage, and railway enhancement - is US$2,154 million (2005 price) in terms of initial investment and US$43 million in annual recurrent costs, accounting for approximately 40% of the total adaptation cost for tropical cyclones, storm surges, and inland flooding. This will increase new infrastructure investment needs indicated in Table 3 by 2.8% if the adaptation is done during 2010-2020, and will increase annual maintenance costs by 0.7%.[27] A different study in Bangladesh found that the raising of road height (811 km) for climate change adaptation has a significant positive impact (an economic internal rate of return of 63%) (CCC2009).

For urban areas, ADB-JICA-WB 2010 carried out a study on Climate Risks and Adaptation in Asian Coastal Megacities in Bangkok (Thailand), Manila (Philippines), and Ho Chi Minh City (Vietnam).[28] According to the damage assessment, about 70% to 80% of damage costs are attributed to buildings in Manila and Bangkok (for Manila, see the

27. Bhattacharyay 2010 estimates Bangladesh's total investment needs (2010-2020) at US$ 144,903 million, of which 54% (US$78,248 million) is for new investment and 46% (US$66,655 million) for maintenance. The annual maintenance needs are US$6,059 million.
28. This paragraph is based on ADB-JICA-WB 2010. The same discussion is not possible regarding Ho Chi Minh City because a different methodology was used.

subtotal of damage to buildings in Table 5).[29] Infrastructure in the transport, power, water, and sanitation sectors are unlikely to be affected, except for revenue losses during the flooding, because most infrastructure has basically taken possible flooding into account in its design and location in Manila and Bangkok. In Manila, damage to road infrastructure and losses due to traffic disruption is only around 1% of total damage costs (see subtotal [transport-related] in Table 5). Flood protection structures and facilities will have large positive effects on protecting building damage, and transportation infrastructure will also be protected. In Manila, total flood damage can be cut 70% to 80% by constructing flood control structures based on the master plan 1990 (Table 5).

From these two studies, although the adaptation of infrastructure raises infrastructure cost and additional investment is required for flood control structures, flood damage will be significantly reduced. For the adaptation of infrastructure, donor support is justified given the marginal carbon footprint of Asian LICs.

Table 5. Damage assessment of floods in Metro Manila: 30 year return period

Unit: Thousand Philippine pesos in 2008 prices

		P30 SQ EX	P30 SQ MP	B/A	P30 B1 EX	P30 B1 MP	D/C	P30 A1F1 EX	P30 A1F1 MP	F/E
		A	B		C	D		E	F	
Damage to buildings	Residential	1,802,690	399,850	22%	3,660,228	549,440	15%	4,210,760	637,340	15%
	Commercial	22,710,939	2,273,492	10%	35,692,199	7,069,334	20%	39,538,200	10,143,817	26%
	Institutional	158,251	23,534	15%	270,249	85,001	31%	334,200	96,921	29%
	Industrial	4,216,677	1,330,430	32%	9,932,796	2,657,311	27%	11,606,389	3,456,942	30%
	Subtotal	28,888,556	4,027,306	14%	49,555,472	10,361,087	21%	55,689,549	14,335,020	26%
Maintenance cost on flood affected roads	Current roads	5,287	1,103	21%	6,847	1,938	28%	7,483	2,313	31%
	Future roads	244	244	100%	302	302	100%	329	329	100%
Vehicle operating cost	-	40,139	8,374	21%	51,984	14,713	28%	56,812	17,565	31%
Travel time cost	-	374,633	31,761	8%	421,033	74,184	18%	573,888	85,171	15%
Subtotal (transport-related)		420,303	41,482	10%	480,166	91,137	19%	638,513	105,378	17%
Firms' loss of business	Assets (This is already included in damage to buildings.)									
	Sales	10,756,786	3,281,671	31%	11,832,564	4,515,810	38%	12,434,679	5,075,471	41%
Residents's income loss	Formal residents	93,849	39,641	42%	184,247	49,636	27%	196,322	51,927	26%
	Informal residents	4,731	92	2%	5,368	111	2%	5,750	119	2%
	Subtotal	98,580	39,733	40%	189,615	49,747	26%	202,072	52,045	26%
Total (Peso)	-	40,164,225	7,390,192	18%	62,057,817	15,017,781	24%	68,964,813	19,567,914	28%
Total (thousand US$)	-	903,083	166,167	18%	1,395,355	337,671	24%	1,550,658	439,980	28%
% of gross regional product	-	3%	1%	-	3%	1%	-	4%	2%	-

Source: Muto, Morishita and Syson 2010

Notes: P30: 30 year return period flooding
SQ: status quo climate scenario; B1: the least anticipated climate change scnario; A1FI: large climate change scenario.
EX: existing infrastructure; MP: construction of flood protection structures according to the 1990 master plan
US$ 1= 44.475 pesos

29. ADB-JICA-WB 2010 finds that the bulk of the increase (67%) in flooding costs in 2050 is attributable to land subsidence due to overuse of underground water in Bangkok.

Mitigating climate change through green infrastructure development[30]

The annual cost of mitigation in developing countries is estimated at US$140 to 175 billion by 2030; and the present value of mitigation cost in developing countries is 0.5% to 1.2% of their GDP by 2100, which is higher than the global cost (0.3% to 0.7% of world GDP). These costs appear to be marginal in comparison with total costs, and can be absorbed by total available funds. However, financing has historically been a constraint in developing countries, resulting in an underinvestment in infrastructure as well as a bias toward energy choices with lower upfront costs, even when such choices eventually result in higher overall costs.[31]

In this connection, JICA conducted a study on incentives to promote geothermal development in Indonesia (JICA and WESTJEC 2009). In Indonesia, as of 2009, geothermal generation capacity was only 1,196 MW of approximately 27,000 MW of geothermal resource potential. The main barriers hindering geothermal energy development are the development risk of underground resources and the burden of the enormous up-front investment. It is therefore inevitable that the price of geothermal energy will be higher than that of coal-fired energy, although still lower than the price of diesel power plant and heavy-oil plant. PT Persahaan Listrik Negara (PT PLN),[32] a buyer of geothermal energy, is reluctant to purchase geothermal energy at a higher price than coal-fired energy, discouraging private sector investment in geothermal projects in Indonesia. To address this situation, the government has an important role to play in providing appropriate incentives to the private sector.

JICA and WESTJEC 2009 calculates the selling price of coal-fired power at 8.2 US cents/kWh and that of geothermal power at 11.9 US cents/kWh. They simulates two power supply scenarios by 2016:[33] the business-as-usual case (all 25,800MW new power plants to be coal-fired), and the geothermal promotion case (23,400 MW to be coal-fired, and 2,400 MW to be geothermal). As a result, the benefit of geothermal energy is estimated at 17.7 US cents/kWh, comprising an energy value (benchmark price) of 8.2 US cents/kWh;[34] fuel cost reduction value of 0.3 US cents/kWh; saved fuel export value of 5.7 US cents/kWh; increased tax revenue of 1.6 US cents/kWh; and carbon dioxide

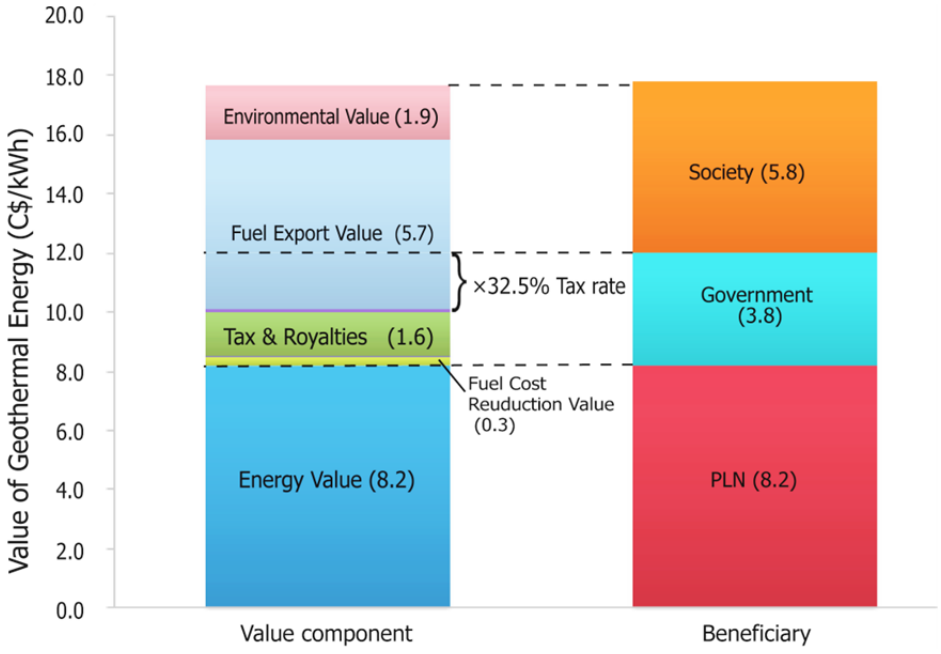
30. The summary of the JICA study on geothermal energy development in Indonesia is taken from JICA and WESTJEC 2009, with reference to Kaneko et al. 2010.
31. This paragraph is taken from World Bank 2009.
32. National Electric Company in Indonesia
33. According to the power development plan of the government, 25,800MW new generation plants are to be constructed from 2007 to 2016.
34. The calculated selling price of coal-fired power is considered as the benchmark price.

reduction value of 1.9 US cents/kWh (Figure 7).[35] This shows that the benefit of geothermal development exceeds the generation cost (i.e., selling price). After examining the cost of various incentive options, JICA and WESTJEC 2009 recommends the following three incentives to the Indonesian Government:

- a feed-in-tariff incentive of 11.9 US cents/kWh for 15 years (2012-2025);
- a reduction of 5% corporate income tax and feed-in-tariff of 10.9 US cents/kWh for 15 years; and
- a geothermal development promotion survey to be conducted by the government in the initial stage.

Figure 8 shows the positive net benefit of the Indonesian government for the implementation of the feed-in-tariff incentives. The government's cost is 3.7 US cents/kWh (11.9 US cents/kWh minus 8.2 US cents/kWh) for 15 years per geothermal plant, and its benefit is 3.8 US cents/kWh for 30 years per plant during its project life. If the government achieves its geothermal development target (9,500MW) by 2025, its total cost (2012-2039) amounts to US$20,958 million (net present value US$3,490 million), while the benefit (2012-2054) is US$27,140 million (net present value US$ 4,797 million). In addition, if the benefit to society (5.8 US cents/kWh) is considered, it is clear that geothermal development will bring significant benefits to the national economy.

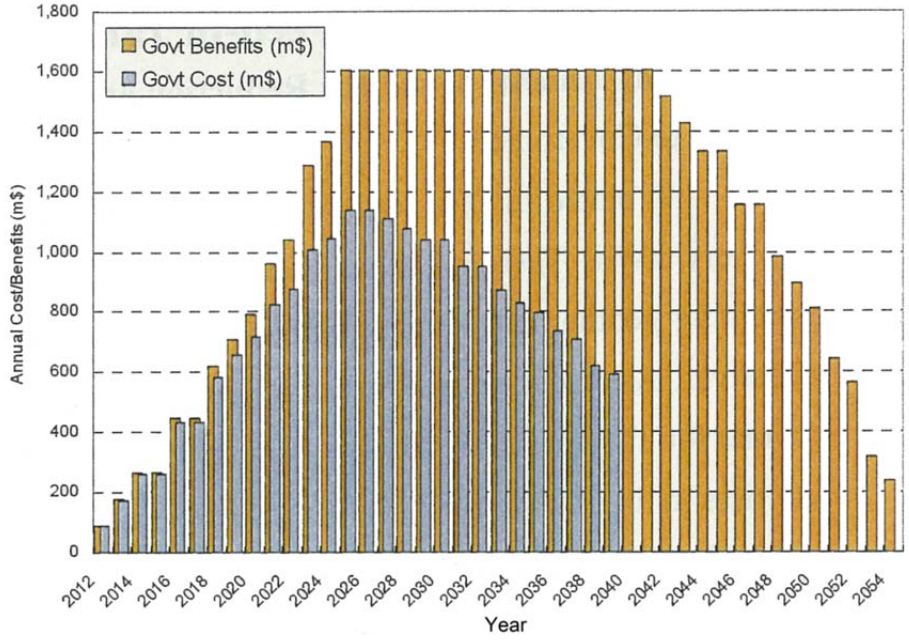
Figure 7. Total value of benefits of geothermal power and its beneficiaries



Source: JICA and WESTJEC 2009

35. The assumed oil price is 100 US$/barrel, and the assumed CO_2 price is 20 US$/ton.

Figure 8. Costs and benefits of policy interventions (feed-in-tariff incentive)



Source: JICA and WESTJEC 2009

Lessons and implications for Asian LICs

In Asian LICs, the adaptation of infrastructure, such as road height raising, is effective, as seen in the analysis for Bangkok and Manila where flooding has already been taken into account in infrastructure construction. Flood-control structures and measures can further reduce the negative impact of flooding. In Asian LICs, it would be advisable to see if the infrastructure in major coastal cities has already considered the possibilities of intensified flooding. For future investment, flood-proofing design and urban planning are essential for minimizing the negative impact of flooding.[36] In this sense, the mainstreaming of climate change, and more broadly natural disasters, in infrastructure development is useful and necessary. For the adaptation of infrastructure, donor support is justified given the marginal carbon footprint of Asian LICs.

To promote green infrastructure, it is useful to perform a thorough cost and benefit analysis, like the one on geothermal projects in Indonesia. The Indonesian study showed that geothermal development, by changing energy sources, will have a positive impact not only on reducing greenhouse gases, but also on the national welfare. It offers

36. As previously mentioned, the bulk of the increase in flooding costs in 2050 is attributable to land subsidence in Bangkok (ADB-JICA-WB 2010). Regulations on this issue are required not only in Bangkok but also other cities dependent on underground water.

an instructive study of diversifying the power generation mix, a high priority for Asian LICs as they enhance their energy security. A similar exercise is certainly useful in other sectors including transport (roads vs. lower emission transport modes). The mitigation of climate change can shift demand among competing sub-sectors, resulting in a change of resource allocation, and infrastructure planning should take this into account.

5. Public Private Partnerships (PPP) in infrastructure

As already seen, Asian LICs have begun attracting more private sector investment in infrastructure, albeit still limited to a few countries and sectors. Asian countries will provide useful lessons for Asian LICs as to how they can attract more private investment.[37]

5.1 Lessons learned from the region[38]

Transport sector

Roads: Apart from increasing traffic demand, the revival of PPP in roads 2001-2006 was facilitated by the willingness of governments to provide support to attract the private sector, such as through capital grants, availability payments, and guarantees (Queiroz and Izaguirre 2008[39]). However, governments need to be aware of the potential costs and risks of such support (such as contingent liabilities); and the monopolistic feature of road concessions strongly requires good governance, including competitive selection, regulatory oversight of contracts, and information disclosure (Queiroz and Izaguirre 2008). In Malaysia, government support was one of the key factors for success, in addition to amicable relations between the government and private investors, and a clear institutional framework (CTI and MRI 2010). CTI and MRI 2010 finds weaknesses in the Malaysian government's role in project planning, value-for-money analysis, viability evaluation of projects, and selection of financing options; due diligence in demand and revenue forecasting; and transparency in the tender process and handling of unsolicited proposals. As to Thailand's road PPP, CTI and MRI 2010 also points to similar weaknesses in addition to inadequate coordination among government organizations.

37. This paper deals with both foreign and domestic private sector investment.
38. This subsection does not explicitly mention examples and lessons learned from China mainly because its economic size is so different from that of Asian LICs, though the author does not deny that China would offer useful examples and lessons. In addition, the telecommunications sector is not included here because it attracted a large portion of successful private investment.
39. Queiroz and Izaguirre 2008 investigates road PPP worldwide (not exclusively in developing Asia).

Railway: While the dominant form of PPP in the world is concession, that of Asia is greenfield,[40] meaning that the private entities are more exposed to investment risks in railway PPP in Asia. Regarding urban rail, one key factor is how risk (particularly demand risk) is allocated between parties; and the other is the high capital costs of urban rail systems, suggesting that some form of public support is likely (Menzies and Mandri-Perrott 2010[41]). The monolithic, vertically integrated, state-owned railway is no longer the preferred option (Kessides 2004). However, the state-owned model still exists in Asia (including Bangladesh and Vietnam), resulting in poor service and insufficient investment. The lessons in urban rail are also valid in the Asian region, as seen in Thailand (where the Skytrain was restructured), Malaysia (where the STAR and PUTRA lines were nationalized), and the Philippines (where MRT-3 receives a huge subsidy from the government of the Philippines) (Harclow 2004; Paderanga 2011).

Seaports: It would be difficult to draw sector specific lessons from past PPP projects because the number of cancelled or distressed projects is small. The number of seaport PPP projects worldwide (1990-2009) was 348, of which the number of cancelled or distressed projects was eight (8). In developing Asia, the number of seaport PPP (1990-2009) was 141, of which the number of cancelled or distressed projects was only one (1). One of the characteristics of seaport PPP in developing Asia is that greenfield is preferred to concession, in contrast to the world trend.[42] Experience shows that ports with private participation are successful in expanding cargo handling and efficiency gains due to privatization and deregulation (Kessides 2004).

Airports: Similarly, PPP in this sector appears to be successful based on the number of cancelled or distressed projects (Andrew and Dochia 2006). The number of airport PPP projects worldwide (1990-2009) was 132, of which the number of cancelled or distressed projects was eight (8). In developing Asia, the number of airport PPP (1990-2009) was 36, of which the number of cancelled or distressed projects was two (2). Also, greenfield is

40. Source: World Bank and PPIAF, PPI Project database 2011. The number of railway PPP projects (1990-2009) in the world is 110, of which 66 are concessions and 28 are greenfield. In Asia, the number of railway PPP projects (1990-2009) is 28, of which only one is a concession and 21 are greenfield.
41. Menzies and Mandri-Perrott 2010 investigates railway PPP worldwide (not exclusively in developing Asia).
42. Source: World Bank and PPIAF, PPI Project database 2011

preferred in developing Asia, while concession is dominant worldwide.[43] One of the two cancelled/distressed projects in developing Asia was a passenger terminal BOT project in Manila International Airport in the Philippines. The contract (financial closure in 2001) was declared invalid in 2004 by the country's Supreme Court because of a deficient bidding process. The government of the Philippines took over the terminal in 2004, paid US$64 million to the private consortium in 2006, and currently operates and maintains the terminal. This is a result of the weak institutional capacity of the government, lack of proper tender procedure, lack of transparency, and other factors.[44]

For the transport sector in general, based on the recent experience in Europe and Central Asia, Monsalve 2009 broadly summarizes the key success factors that appear to be valid for the Asian region from the above discussions:

- Project selection and design: modesty and realism in planning and implementation; comprehensive feasibility studies; value-for-money analysis; appropriate risk sharing; and adequate return for lenders and sponsors;
- Procurement and contract monitoring: open and competitive procurement; and caution with unsolicited proposals;
- Legal and institutional framework: appropriate and stable legal and regulatory framework; central unit lead in preparation; and the role of international financial institutions.

Electricity and energy sector

Along with the telecommunications sector, the electricity and energy sector has substantial private sector investment in Asia. Among the various lessons, the most important is that substantial risks are created for the public interest when governments promote rapid investment in an unreformed electricity sector by offering independent power producers (IPP) long-term power purchase agreements (PPA) with state-owned, single buyer utilities. In the 1990s, to solve the electricity supply shortage, many Asian countries invited IPPs by offering them long-term PPAs - involving hard currency

43. Source: World Bank and PPIAF, PPI Project database 2011. The number of airport PPP projects worldwide (1990-2009) is 132, of which 62 are concessions, followed by 32 greenfield, 19 divestiture, and 19 management and lease. In developing Asia, of a total of 36 airport PPP projects (1990-2009), greenfield (13) is the most preferred, followed by divestiture (11), concession (8), and management/lease (4).
44. The description of the Manila International Airport in this paragraph is based on CTI and MRI 2010.

payments and government guarantees - with state-owned, single buyer utilities. In the 1997 Asian financial crisis, currency depreciation swelled the debt of state-owned utilities because they were reluctant to adjust the tariff to a cost-reflective level to pass on the increased cost of electricity to customers. The governments and state-owned utilities had to renege on, delay, or renegotiate the PPAs, which meant they lost the confidence of foreign investors.[45]

Learning from this lesson, many Asian countries have been proceeding power sector restructuring, including the unbundling of state-owned utilities, and tariff regime reform. Governments have also become very cautious in providing government guarantees to IPPs, which is one of the reasons for the stagnation of PPP in the energy sector after 1997 (Annex, Figures 5 and 6), in addition to lost investor confidence.

Water and sanitation sector

In a review of urban water utilities worldwide, Marin 2009 states that the most consistent contribution by private operators has been the improvement of service quality and operations efficiency instead of direct investment. Other factors for success include: well-designed sector reforms, contracts with realistic targets and timelines, proper regulation that may differ from country to country, the transparency of regulation, and the incorporation of social goals/considerations (such as subsidies for low-income groups or for the negative impact on employees) (Marin 2009).

These lessons are valid for water PPPs in the Asian region, where mixed outcomes are found, for example, in Manila (Philippines) and Jakarta (Indonesia). In these two cities, a city area was divided into two zones, in each of which a concession was granted for water services. In Manila, while water services were improved after privatization in both zones (JBIC 2004), the private operator in the western zone went bankrupt due to foreign currency debt inherited from the previous public utility and was taken over by another private operator.[46] In Jakarta, since water tariff adjustment was constrained due to political considerations during the 1997 Asian financial crisis, the concessionaires could not make a timely investment to achieve service targets (ORIX 2011). Another important reason in Jakarta was the widespread development of private wells, and the absence of regulation and control over the use of the aquifer (Marin 2009).

45. This paragraph is taken from Kessides 2004, pp178-180.
46. The eastern zone concessionaire inherited a smaller debt from the previous public utility than the western zone concessionaire (JBIC 2004).

Summary

At the upstream level, Asian LICs need a good business climate and a wide range of reforms in policy, sector, legal, regulatory, and institutional frameworks as is often stated in many studies (e.g., Leigland 2010). In particular, tariff regime reform is a key to ensuring the financial sustainability of PPP projects.

At the project level, Asian LIC governments should be clear about the roles to be played by the private and public sectors, and prepare bankable and well-designed PPP projects (Leigland 2010). Expectations for (large) capital investment by the private sector should be modest, except in sectors such as energy and telecommunications, although governments should always explore any possibility in other sectors. From the above review, government support (viability gap funding, investment cost sharing, etc.) is useful or even necessary to encourage private sector investment (say, the urban rail sector). Operational efficiency is another important contribution of PPP, as seen in the water sector, while governments need to be responsible for capital investment.

Leigland 2010 states, based on experience since the late 1990s, that PPP projects such as the following can work in poor countries: merchant telecommunications projects, independent power producers, port concessions, toll road projects, water projects, small-scale PPP, and rail concessions, with due attention to project-specific constraints and lessons learned. He emphasizes the need for support from donors and international financial institutions.

5.2 Scaling up PPP in Asian LICs

What should Asian LICs do to attract more PPP for infrastructure? To look into this question, we present two examples. One is the efforts of the government of Indonesia in the areas of policy, the regulatory framework, and government support mechanisms. The other is JICA's technical assistance to the government of the Philippines to identify bankable PPP projects and PPP modalities.

Strengthening regulatory framework and public support: Indonesia

Indonesia provides a holistic model of government efforts to refine policy, the regulatory framework, the public support system, and other aspects to attract PPP in the country (Box 1). When the government of Indonesia held the Infrastructure Summit in 2005, the infrastructure shortfall because of budget cuts during the 1997 Asian financial

crisis was a serious constraint to economic growth and poverty reduction. The government considered PPP as an indispensable option to scale up infrastructure development. It revitalized a national committee to promote PPP, and started creating modalities and institutions for government support. It also transformed the market structure of infrastructure sectors from a national monopoly to an open market. Moreover, the government prepared the "PPP Book" citing candidate PPP projects. It is now creating a showcase project for each sector.

Box 1. Improvement of policy, regulatory framework, and government support in Indonesia

- Presidential Regulation (PR) No. 42/2005 amended by PR No. 12/2011 aims at revitalizing KKPPI (National Policy Committee on the Acceleration of Infrastructure Provision).
- PR No. 67/2005 amended by PR 13/2010, specially stipulates that direct (capital) government support, including land acquisition, and government guarantees (contingent support) can be provided. The following specific measures have been or will be taken:
  - The Indonesia Infrastructure Guarantee Fund (IIGF) was established in December 2009 to provide government guarantees or credit enhancements to PPP projects. Related PR No. 78/2010 and MOF regulations were issued.
  - The Indonesia Infrastructure Financing Facility (IIFF) was established to play a catalyst role in co-financing with commercial lenders to provide longer-term debt.
  - The Center for Government Investment (PI) under MOF will provide pre-financing for land acquisition.
  - The Project Development Facility (PDF) was created to fund PPP project preparation and transaction under different government contracting agencies.
  - A new law on land acquisition drafted by the National Land Agency (BPN) is under parliamentary deliberation (as of August 31 2011).
  - Bappenas issued Permen 4/2010 on due diligence guidelines for the implementation of PPP projects.
- The following infrastructure laws were amended to transform the market structure from a monopoly to an open market: telecommunications (1999), oil and gas (2001), water (2004), roads and bridges (2004), railways (2007), sea transport and ports (2008), air transport and airports (2009), land transport (2009), and electricity (2009).
- Preparation of PPP Book 2010 containing one hundred candidate projects. (Note: The government of Indonesia prepared a list of 91 candidate projects in 2005. The PPP Book (2010) has been updated to PPP Book 2011).

Source: Indra 2011 and Hayakawa 2011

Selecting PPP modality for road projects: Philippines

The Philippines has long been very active in public private partnerships in infrastructure. The total investment for 1990-2009 amounts to US$50,446 million for 103 projects.[47] However, the outcomes are mixed or even poor in comparison with neighboring countries (Paderanga 2011), even though many PPP projects were proposed or implemented since the so-called BOT (build, operate, and transfer) Law of 1994.

To help the government of the Philippines promote PPP, JICA conducted a study titled "Preparatory Survey for Public Private Partnership (PPP) Infrastructure Development Projects in the Republic of the Philippines" (CTI and MRI 2010). CTI and MRI 2010 selected high-priority projects from a long-list of candidate PPP road projects, and proposed PPP schemes that are considered to be suitable in terms of viability with appropriate public financing (i.e., government and official development assistance) to address viability gaps.

Among general PPP modalities, CTI and MRI 2010 set five types of PPP modalities applicable to selected road projects in the Philippines: Type 1 (pure BOT scheme), Type 2 (BOT scheme with upfront government subsidy), Type 3-a/b (segment division including two sub-types: the government segment is leased to a special purpose company (SPC) for a fee, or free of charge), Type 4-a/b (service payment, including two sub-types: with government subsidy and without government subsidy), and Type 5 (lease). Table 6 summarizes the conditions for the application of each PPP modality to candidate PPP projects.

47. Source: World Bank and PPIAF, PPI Project database 2011

Table 6. Conditions applicable to each PPP modality

PPP Type		Applicable Conditions
Type 1 Pure BOT Scheme		・Applicable to a project for which Project FIRR is **over 11% or close to WACC**.
Type 2 Pure BOT Scheme with Upfront Subsidy		・ Applicable to a project for which Project FIRR is **between 7% and 12%**. ・ Upfront subsidies of various sizes should be studied to check if NPER is positive. (Max. subsidy is limited to 50% of the project cost in accordance with BOT law.)
Type 3 Segment Division Type	(a) GRP Segment to be leased to SPC	・ Applicable to a project for which Project FIRR is **between 6% and 12%**. ・ Various segment divisions as well as GRP segment lease fees should be studied. ・ Need to check if NPER is positive or not. ・ Not applicable to a project of limited length (say less than 5 km). ・ A project should be divided so that a segment completed earlier than another can function by itself.
	(b) GRP Segment to be leased to SPC free of charge	・ Applicable to a project for which Project FIRR is **between 4% and 10%**. ・ If IRR for SPC and Equity IRR become quite high (say about 22% or more), GRP segment should be leased to SPC. ・ Not applicable to a project of limited length (say less than 5 km). ・ A project should be divided so that a segment completed earlier than another can function by itself.
Type 4 Service Payment Type	(a) With GRP Subsidy	・ Applicable to a project for which Project FIRR is **between 0% and 6%**. ・ Need to check if GRP subsidy is within a reasonable range.
	(b) Without GRP Subsidy	・ Applicable to a project for which Project FIRR is **between 5% and 9%**. ・ IRR for SPC and Equity IRR should be within a reasonable range (say about 22%). ・ When this type is applied to a project with Project FIRR of about 11% or more, the toll revenue becomes much higher than the service fee, which means that the government makes a substantial profit. Thus such projects should adopt Type 1 or Type 2
	Common to above	・The government must allocate a budget for payment of the service fee for the full duration of the operation period (usually 30 consecutive years). This type thus requires a firm and sustainable commitment by the government.
Type 5 Lease Type		・Applicable to project for which Project FIRR is **between 0% to 6%**. ・When this type is applied to a project for which Project FIRR is over about 6%, the private sector's financial return becomes unreasonably high. For this reason, other types with higher participation of the private sector should be studied, or toll rates should be set low.

Source: CTI and MRI 2010

Notes: GRP: Government of the Republic of the Philippines
Some minor adjustments are made from the original table in CTI and MRI 2010.

Table 7 shows an example of selecting a suitable PPP modality for a candidate project. The following criteria are applied for selecting an appropriate PPP modality for each project:

- The financial internal rate of return (FIRR) for a special purpose company (SPC) shall be higher than the weighted average of capital cost (WACC) (CTI and MRI 2010 uses 11.5% as the WACC.).
- The equity FIRR shall be higher than 15%.
- The net public expenditure reduction (NPER) shall be positive.

- If a project satisfies all the above three conditions, a PPP modality with the highest NPER will be selected from among the available options.

Since the project FIRR of this project is 9.14%, Type 2 (a BOT scheme with an upfront subsidy) and Type 3 (segment division) are mainly examined given the conditions stated in Table 6. Type 3-a (segment division between the SPC and the government, with the government segment leased to the SPC for a fee) is proposed as the best option for this project from the above four criteria, provided that the government utilizes a concessional loan. In this framework, the SPC's FIRR is estimated at 15.11%, the equity FIRR at 16.83%, and NPER at 8,742 million Philippine pesos (equivalent to US$189 million[48]), as shown in Table 7.

Table 7. Result of simulation of PPP modalities for a road project (Philippines)

Project Name: NLEx-SLEx Link Expressway

	PPP Modality					
	Pure BOT	BOT with subsidy (50% of construction cost)	Segment Division (60:40)		Service Payment	Lease
			GRP Segment's Lease Fee 100%	GRP Segment's Lease Fee 0%		
Project FIRR	9.14	9.14	9.14	9.14	9.14	9.14
IRR for SPC	9.45	15.53	15.80 [15.11]	17.99	-	-
Equity IRR	8.51	17.81	18.03 [16.83]	22.20	-	-
NPER	7,459	-453	-555 [8,742]	-1,996 [6,836]	-	-
Remarks		- Amount of subsidy needs to be reduced. - This is also a recommended scheme; however, use of a soft loan for subsidy is difficult.	- Recommended, on the condition that GRP segment be reduced or GRP utilize a soft loan.		-	-

Source: CTI and MRI 2010

Notes: Figures in [ ] show when the Government of Republic of the Philippines (GRP) utilizes a soft loan from multilateral and/or bilateral sources.
Cells are highlighted when IRR for SPC is less than 11.5%; when equity IRR is less than 15%; or when NPER is negative.

Lessons and Implications for Asian LICs

A statistics and literature review of PPP suggests that Asian LICs can expect more PPP in infrastructure. It is also true, however, that they are constrained by small markets, weak government capacity, and other factors. They should be clear about the contributions of the private sector, and their expectations for (large) capital investment by private investors should be modest. There is a tendency for government support (such as

48. US$1 = 46.21 Philippine Pesos as of May 2010

viability gap funding and investment cost sharing) to be necessary, and this may be more so in Asian LICs. It must be recognized that government support has fiscal implications. As continually emphasized, reforms of policy, regulatory frameworks, and institutions are essential. The example of Indonesia is typical. It is also worth noting that it takes time for reforms to produce results, as demonstrated in the case of Indonesia. The reforms and institutional environment differ among Asian LICs, necessitating a country-specific approach.

In addition to reforms, identifying bankable PPP projects is a key to encouraging the private sector (Leigland 2010). The Philippines case illustrates this point. Through this sort of exercise, governments would know what projects they can offer for PPP, and what the fiscal implications of such projects would be. The private sector, on their side, would be informed as to what projects they can participate in, and what support they would receive. This sort of exercise can also reduce the upstream project preparation cost for the private sector. Bankable PPP projects can be better formulated if the roles to be played by the private and public sectors are clearly delineated.[49]

6. Improving infrastructure service efficiency and regulation by the public sector

In Asian LICs, it is expected that the public sector will continue to be the main financier and provider of infrastructure services, even though PPP increases with an improved investment climate, policies, and institutions. Governments also continue to be regulators of infrastructure. Therefore, it is indispensable to improve public sector performance in these areas. Despite this recognition, there appears to have been little progress in investigating effective solutions according to a recent study (Estache and Fay 2010).

It is important to recognize that there are constraints in applying policy and reform options to restructure state-owned monopolies and boost public infrastructure service efficiency in Asian LICs. Even if state-owned monopoly models are ineffective, it does not necessarily mean that they should be immediately privatized. It is essential to

49. In the transport sector, multi-modal transport and logistics studies can identify the required infrastructure services in a coordinated manner that maximizes synergies across modes of transport. This would assist in establishing sub-sectoral priorities and also in increasing the rate of return on projects, thereby incentivizing private participation. This sort of exercise is also possible in other sectors where synergies between sub-sectors are expected. Apparently, the Indonesian geothermal study (Subsection 4.2) is the case because it examined allocation of different power generation sources.

carefully examine whether alternative models will fit a specific country and sector context (political, cultural, social, technological, etc.).

Unbundling is often considered as a reform option; nevertheless, whether to apply unbundling of infrastructure or not requires due consideration in Asian LICs. First, unbundling can be effective when there is sufficient market size and density where competition takes place among multiple providers. In most Asian LICs, markets are so small that competition may be difficult. Second, unbundling is effective in a mature and developed network infrastructure, but it may not work when infrastructure stock is insufficient and new investment is necessary. Since Asian LICs lack sufficient infrastructure and require new investment in the future, the feasibility of unbundling should be carefully examined, particularly in small countries.[50]

Concerning the public sector performance of developing countries, there is an argument on pockets of effective organizations in weak governance countries ("pockets of excellence"). According to Leonard 2010, it is well established that even in countries that have poor governance and weak public sectors, exceptional, well-functioning government and government-supported agencies do exist. Some attribute their existence to internal managerial factors including leadership and good management, and others, while accepting the importance of these internal factors, believe that these "pockets" are generated by their place in the country's political economy (Leonard 2010). He cautions the naive view that such pockets can be easily replicated, and political determinism.

From this argument, until a country's political economy becomes more conducive to better performance, internal management reforms of public providers and operators would be an effective approach. As for revenue generating infrastructure, corporatization and management reforms would be explored. In non-revenue generating infrastructure, such as rural roads, corporatization would not be feasible, but management reforms can work even in a government department with limited autonomy (Fujita 2011[51]).

Regarding the regulatory framework, a realistic approach is also needed in Asian LICs. Often, independent regulatory bodies are a powerful tool for efficient market regulation. It should be noted that even developed countries spent a long time in

50. Discussion of unbundling in this paragraph is taken from Kessides 2004.
51. Fujita 2011 analyzed factors for the effectiveness of the Local Government Engineering Department (LGED) in charge of rural infrastructure (feeder roads, bridges, small irrigation, etc.) in Bangladesh. The LGED handles approximately 14 to 16% of the annual development budget of the government of Bangladesh.

establishing independent regulatory bodies. Asian LICs, with institutional and regulatory contexts different from other developed countries and with limited human resources, should explore a regulatory framework with a realistic and long-term perspective (Kessides 2004; ADB-JBIC-WB 2005).

7. Conclusions

This paper discusses important policy challenges for Asian LICs in scaling up infrastructure development, albeit with limitations in the coverage of issues and countries. One of the characteristics of this paper is that, from beginning to end, it focused Asian LICs that were very often on the periphery of this sort of discussion. One might feel that the lessons and policy implications are not always particular to Asian LICs. However, it is understandable because Asian LICs are diverse, and because in some cases, Asian LICs do better than other developing Asian countries, as shown in the comparison of infrastructure statistics in Section 2. Infrastructure challenges are more or less common to developing Asian countries though difference between countries lie in the degree of the challenges. The main conclusions of this paper are as follows:

While infrastructure development and services in Asian LICs have progressed over the decades, the quantity and quality of infrastructure vary among the countries and are still insufficient. Governments should expand their efforts for scaling up with long-term visions. Because of the heterogeneity of Asian LICs, the author does not intend to provide a prescription applicable to all countries. Instead, a country-specific approach is emphasized with due consideration to different political, institutional, economic and social conditions.

Due to financial and capacity constraints, it is inevitable for governments to prioritize infrastructure investment. The governments should prioritize connective infrastructure to benefit from economies of agglomeration and fragmentation, and better connection to fast-growing large markets, although the trade-off between economic efficiency and spatially balanced growth is a difficult issue. In particular, some large Asian LICs are very well positioned to become part of sophisticated regional production networks. In infrastructure development, climate change (and more broadly, natural disasters) need to be taken into account or mainstreamed because infrastructure determines socioeconomic activities and energy consumption for the long term, once it is constructed. The adaptation of infrastructure (e.g., raising road heights) can effectively reduce the disruption of economic activities. The mitigation

of climate change through green infrastructure can not only decrease greenhouse gases by changing energy sources; it can also benefit the national economy, provided that the government provides effective incentives to reduce risks. While we looked at only a case of geothermal power generation in Indonesia, a similar exercise for other sectors (e.g., transport) would be useful.

It is encouraging that PPP in Asian LICs is increasing, though the countries and sectors in which they are applied are limited. Most Asian LICs are constrained by small market size. To scale up PPP, LIC governments should be clear about the contributions of the private sector (in such areas as capital investment and operational efficiency). Expectations of (large) capital investment by the private sector should be modest, except in such sectors as power and telecommunications, although possibilities should always be explored in other sectors. Governments should continue to improve their policy and regulatory framework, and strengthen institutional capacity and government support modalities (such as viability-gap funding and investment cost-sharing). In addition, the identification and preparation of bankable PPP projects is a useful exercise for both governments and the private sector.

The public sector will continue to be the main supplier and regulator of infrastructure investment and services in Asian LICs. The improvement of public sector performance is essential in infrastructure. However, there seems to be neither a short-term solution nor a blueprint applicable to all LICs. Long-term efforts need to be made with due consideration to the political and institutional context of each country.

On the above issues, donors should provide financial, technical, and capacity development support to Asian LICs to scale up infrastructure with a long-term perspective. In particular, donor support is justified for adapting infrastructure to climate change given the historical marginal carbon footprint of Asian LICs. Moreover, while small and land-locked LICs deserve donor support (including preferential trade treatment) due to their disadvantageous conditions, research on effective infrastructure should be explored in these countries.

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Annex Tables

Annex Figures

Table 1. Electricity infrastructure in Asian LICs

	Country	Electric power consumption (kWh per capita)			Electric power transmission and distribution losses (% of output)		
		2000	2008	% change	2000	2008	% change
Large LICs	Afghanistan	-	-	-	-	-	-
	Bangladesh	95	208	119.2%	15	5	-68.5%
	Cambodia	29	113	293.4%	19	13	-30.3%
	Lao PDR	-	-	-	-	-	-
	Mongolia	1,080	1,473	36.4%	19	11	-45.2%
	Myanmar	75	97	29.1%	31	27	-13.4%
	Nepal	58	89	54.7%	21	19	-8.8%
	Papua New Guinea	-	-	-	-	-	-
	Timor-Leste	-	-	-	-	-	-
	Vietnam	295	799	170.9%	14	10	-26.8%
Small LICs	Bhutan	-	-	-	-	-	-
	Kiribati	-	-	-	-	-	-
	Maldives	-	-	-	-	-	-
	Samoa	-	-	-	-	-	-
	Solomon Islands	-	-	-	-	-	-
	Tonga	-	-	-	-	-	-
	Vanuatu	-	-	-	-	-	-
Other developing Asia	Brunei Darussalam	7,539	8,308	10.2%	1	5	320.1%
	China	993	2,455	147.2%	7	6	-19.8%
	Fiji	-	-	-	-	-	-
	India	402	566	40.8%	28	23	-15.4%
	Indonesia	402	591	47.0%	11	10	-7.3%
	Malaysia	2,742	3,490	27.3%	8	3	-65.4%
	Pakistan	374	436	16.7%	24	21	-13.8%
	Philippines	501	588	17.3%	14	13	-9.9%
	Sri Lanka	296	409	38.1%	21	11	-48.0%
	Thailand	1,462	2,079	42.2%	8	6	-23.2%
	Tuvalu	-	-	-	-	-	-

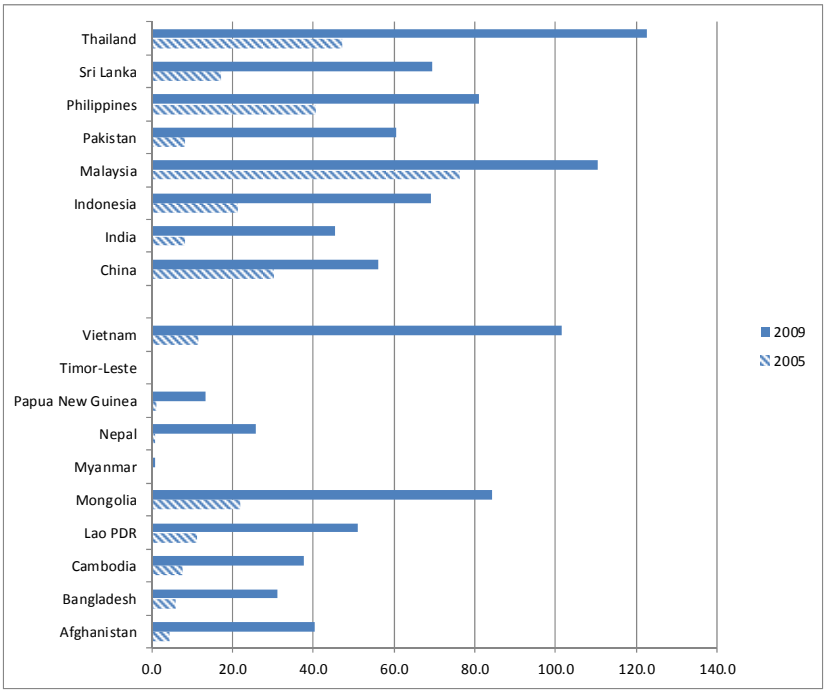
Source: World Bank 2011

Table 2. ICT infrastructure in Asian LICs

	Country	Mobile cellular subscriptions (per 100 people)			Telephone lines (per 100 people)		
		2005	2009	% change	2005	2009	% change
Large LICs	Afghanistan	4.5	40.3	799.1%	0.4	0.4	16.3%
	Bangladesh	5.9	31.1	428.6%	0.7	0.9	34.3%
	Cambodia	7.7	37.8	393.2%	0.2	0.4	54.0%
	Lao PDR	11.2	51.2	357.7%	1.5	2.1	35.4%
	Mongolia	21.9	84.2	285.3%	6.1	7.1	15.5%
	Myanmar	0.3	0.9	236.4%	1.0	1.6	55.7%
	Nepal	0.8	26.0	3010.2%	1.8	2.8	57.1%
	Papua New Guinea	1.2	13.4	990.6%	1.0	0.9	-14.4%
	Timor-Leste	-	-	-	-	-	-
	Vietnam	11.5	101.5	779.1%	19.1	35.2	84.4%
Small LICs	Bhutan	5.5	46.9	746.6%	5.1	3.8	-25.6%
	Kiribati	0.7	1.0	44.4%	4.6	4.1	-10.6%
	Maldives	69.6	147.9	112.4%	11.0	15.8	43.4%
	Samoa	13.4	84.4	529.6%	10.9	17.8	63.7%
	Solomon Islands	1.3	5.7	352.8%	1.6	1.6	0.3%
	Tonga	29.3	51.0	73.9%	13.5	29.8	121.0%
	Vanuatu	5.9	52.7	799.3%	3.2	3.0	-6.4%
Other developing Asia	Brunei Darussalam	62.9	106.7	69.5%	22.7	20.2	-11.1%
	China	30.2	56.1	85.9%	26.9	23.6	-12.4%
	Fiji	24.8	75.4	204.4%	13.6	16.1	18.6%
	India	8.2	45.4	451.9%	4.6	3.2	-30.0%
	Indonesia	21.4	69.2	223.6%	6.2	14.8	139.6%
	Malaysia	76.2	110.6	45.1%	17.0	15.7	-7.8%
	Pakistan	8.2	60.7	640.1%	3.4	2.4	-28.7%
	Philippines	40.7	81.0	99.1%	3.9	4.5	13.2%
	Sri Lanka	17.1	69.4	306.2%	6.3	16.9	167.6%
	Thailand	47.2	122.6	159.6%	10.7	10.4	-2.8%
	Tuvalu	12.5	-	-	8.5	-	-

Source: World Bank 2011

Figure 1. Mobile cellular subscriptions (per 100 people)



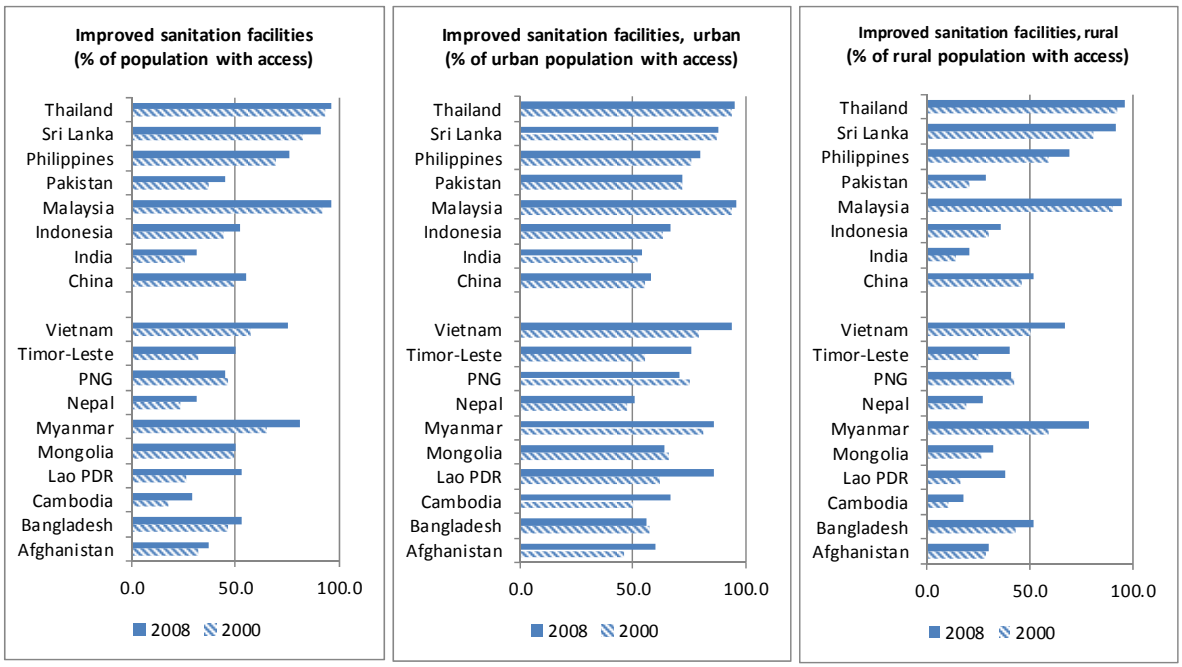
Source: World Bank 2011

Table 3. Water and sanitation infrastructure in Asian LICs

		Improved water source (% of population with access)						Improved sanitation facilities (% of population with access)					
		Total		Urban		Rural		Total		Urban		Rural	
	Country Name	2000	2008	2000	2008	2000	2008	2000	2008	2000	2008	2000	2008
Large LICs	Afghanistan	21.0	48.0	36.0	78.0	17.0	39.0	32.0	37.0	46.0	60.0	28.0	30.0
	Bangladesh	79.0	80.0	86.0	85.0	77.0	78.0	46.0	53.0	57.0	56.0	43.0	52.0
	Cambodia	46.0	61.0	64.0	81.0	42.0	56.0	17.0	29.0	50.0	67.0	10.0	18.0
	Lao PDR	48.0	57.0	77.0	72.0	40.0	51.0	26.0	53.0	62.0	86.0	16.0	38.0
	Mongolia	66.0	76.0	88.0	97.0	37.0	49.0	49.0	50.0	66.0	64.0	26.0	32.0
	Myanmar	66.0	71.0	80.0	75.0	60.0	69.0	65.0	81.0	81.0	86.0	59.0	79.0
	Nepal	83.0	88.0	94.0	93.0	81.0	87.0	23.0	31.0	47.0	51.0	19.0	27.0
	Papua New Guinea	39.0	40.0	88.0	87.0	32.0	33.0	46.0	45.0	75.0	71.0	42.0	41.0
	Timor-Leste	52.0	69.0	69.0	86.0	47.0	63.0	32.0	50.0	55.0	76.0	25.0	40.0
	Vietnam	79.0	94.0	94.0	99.0	74.0	92.0	57.0	75.0	79.0	94.0	50.0	67.0
Small LICs	Bhutan	91.0	92.0	99.0	99.0	88.0	88.0	62.0	65.0	87.0	87.0	54.0	54.0
	Kiribati	62.0	-	77.0	-	50.0	-	33.0	-	47.0	-	22.0	-
	Maldives	91.0	91.0	100.0	99.0	87.0	86.0	81.0	98.0	100.0	100.0	74.0	96.0
	Samoa	89.0	-	92.0	-	88.0	-	100.0	100.0	100.0	100.0	100.0	100.0
	Solomon Islands	70.0	-	94.0	-	65.0	-	31.0	-	98.0	98.0	18.0	-
	Tonga	100.0	100.0	100.0	100.0	100.0	100.0	96.0	96.0	98.0	98.0	96.0	96.0
	Vanuatu	72.0	83.0	93.0	96.0	66.0	79.0	41.0	52.0	57.0	66.0	36.0	48.0
Other Developing Asia	Brunei Darussalam	-	-	-	-	-	-	-	-	-	-	-	-
	China	80.0	89.0	98.0	98.0	70.0	82.0	49.0	55.0	55.0	58.0	46.0	52.0
	Fiji	-	-	93.0	-	-	-	-	-	96.0	-	-	-
	India	81.0	88.0	93.0	96.0	76.0	84.0	25.0	31.0	52.0	54.0	14.0	21.0
	Indonesia	77.0	80.0	90.0	89.0	67.0	71.0	44.0	52.0	63.0	67.0	30.0	36.0
	Malaysia	97.0	100.0	99.0	100.0	93.0	99.0	92.0	96.0	94.0	96.0	90.0	95.0
	Pakistan	88.0	90.0	95.0	95.0	85.0	87.0	37.0	45.0	72.0	72.0	20.0	29.0
	Philippines	88.0	91.0	93.0	93.0	82.0	87.0	69.0	76.0	76.0	80.0	59.0	69.0
	Sri Lanka	80.0	90.0	95.0	98.0	77.0	88.0	82.0	91.0	87.0	88.0	81.0	92.0
	Thailand	96.0	98.0	98.0	99.0	95.0	98.0	93.0	96.0	94.0	95.0	92.0	96.0
	Tuvalu	94.0	97.0	95.0	98.0	93.0	97.0	83.0	84.0	87.0	88.0	79.0	81.0

Source: World Bank 2011

Figure 2. Access to improved sanitation (% of population with access)



Source: World Bank 2011

Table 4. Selected fiscal statistics of Asian LICs, % of GDP, 5 year average (2006-2010)

（%）

		Total revenue	Taxes	Grants	Total expenditure	Capital expenditure	Overall budgetary surplus/deficit
Large LICs	Afghanistan	7.4	3.4	5.9	19.4	11.2	-5.9
	Bangladesh	10.9	8.7	0.7	15.4	5.6	-3.8
	Cambodia	12.4	10.0	2.4	17.2	7.5	-2.3
	Lao PDR	14.0	12.3	3.2	20.3	8.8	-2.8
	Mongolia	33.9	28.8	0.3	33.5	6.8	-1.1
	Myanmar	6.2	3.2	0.0	6.4	3.6	-0.2
	Nepal	13.0	10.8	2.5	17.7	6.1	-2.2
	PNG	29.2	26.9	4.6	33.1	15.3	0.8
	Timor-Leste	94.8	8.2	0.0	92.8	25.3	2.0
	Vietnam	28.1	23.8	0.5	29.4	9.2	-1.3
Small LICs	Bhutan	20.1	9.7	12.4	33.9	16.9	-1.8
	Kiribati	76.5	21.5	33.5	90.4	24.4	19.0
	Maldives	29.7	14.1	3.3	45.2	10.5	-11.6
	Samoa	26.1	22.6	7.2	35.3	10.6	-3.0
	Solomon Islands	32.0	28.2	5.3	36.2	6.1	1.1
	Tonga	23.8	19.9	4.0	26.6	1.2	1.1
	Vanuatu	19.2	17.1	3.8	21.7	2.5	1.3

Source: Calculated by author from ADB2011

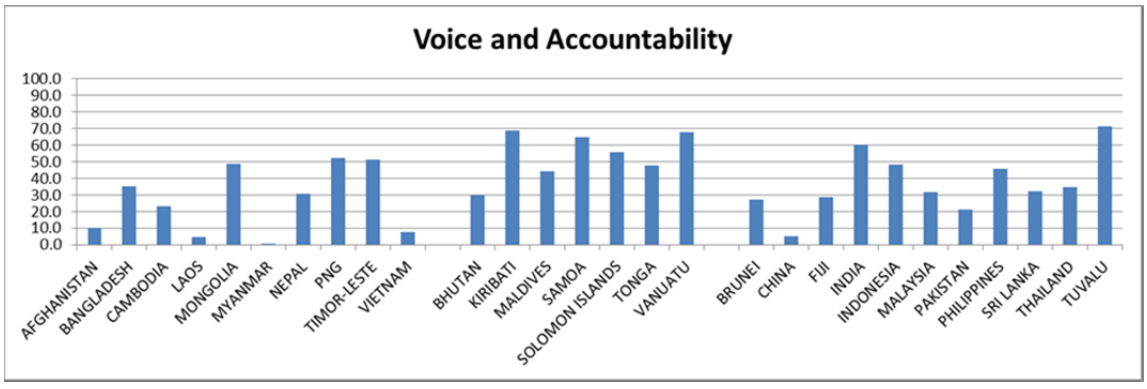
Notes: The figures for Afghanistan, Bhutan, and Vanuatu are the averages of 2005-2009.
The figues for Myanmar are the averages of 1996-2000.
Afghanistan's grants and overall budgetary surplus/deficit are the 4-year averages of 2005-2008.
Vietnam's overall budgetary surplus/deficit is the 5-year average of 2005-2009.

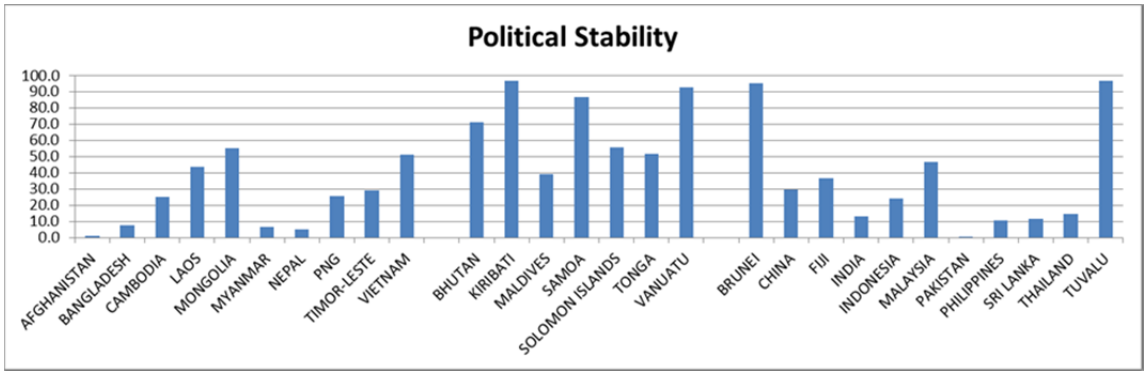
Table 5. Governance Indicators (2009) of Asian LICs

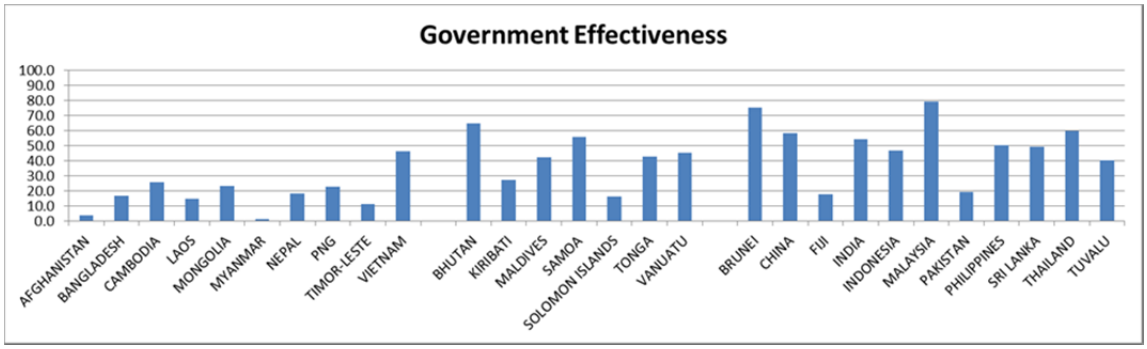
	Country	Voice and Accountability	Political Stability	Government Effectiveness	Regulatory Quality	Rule of Law	Corruption Control
Large LICs	AFGHANISTAN	10.0	0.9	3.3	2.9	0.5	1.4
	BANGLADESH	35.1	7.5	16.7	23.3	27.8	16.7
	CAMBODIA	23.2	25.0	25.7	39.0	16.0	8.6
	LAOS	4.7	43.9	14.8	14.3	18.4	9.5
	MONGOLIA	48.8	55.2	22.9	40.5	43.4	23.8
	MYANMAR	0.5	6.6	1.0	1.0	3.8	0.0
	NEPAL	30.8	5.2	18.1	23.8	17.9	25.2
	PNG	52.1	25.5	22.4	32.4	17.0	3.8
	TIMOR-LESTE	51.2	29.2	11.0	11.0	9.0	15.7
	VIETNAM	7.6	51.4	46.2	31.0	41.5	36.7
Small LICs	BHUTAN	29.4	71.2	64.8	13.8	59.4	75.2
	KIRIBATI	68.7	96.7	27.1	7.6	59.9	54.8
	MALDIVES	44.1	39.2	42.4	37.1	52.8	29.5
	SAMOA	64.5	86.8	55.7	45.2	67.5	61.0
	SOLOMON ISLANDS	55.5	55.7	16.2	8.1	29.2	43.8
	TONGA	47.9	51.9	42.9	28.6	54.2	28.6
	VANUATU	67.8	92.9	45.2	25.2	63.2	68.6
Other developing Asia	BRUNEI	27.0	95.3	75.2	82.9	72.2	79.0
	CHINA	5.2	29.7	58.1	46.2	45.3	36.2
	FIJI	28.4	36.8	17.6	20.0	24.1	25.7
	INDIA	60.2	13.2	54.3	44.3	55.7	46.7
	INDONESIA	48.3	24.1	46.7	42.9	34.4	28.1
	MALAYSIA	31.8	46.7	79.5	60.0	65.1	58.1
	PAKISTAN	20.9	0.5	19.0	33.3	19.3	13.3
	PHILIPPINES	45.5	10.8	50.0	52.4	35.4	27.1
	SRI LANKA	32.2	11.8	49.0	43.3	53.3	44.8
	THAILAND	34.6	14.6	59.5	61.9	50.9	51.0
	TUVALU	71.1	96.7	40.0	14.8	83.0	52.9

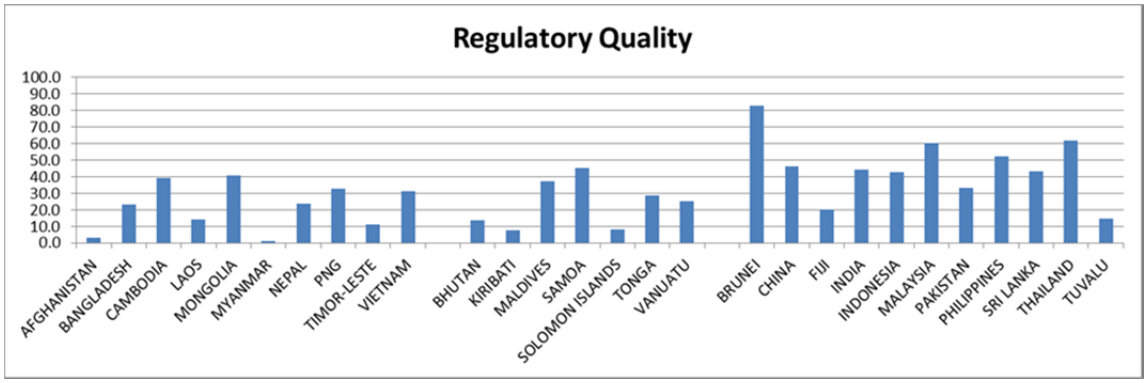
Source: World Bank worldwide governence indicators (downloaded on Septemer 6, 2011)

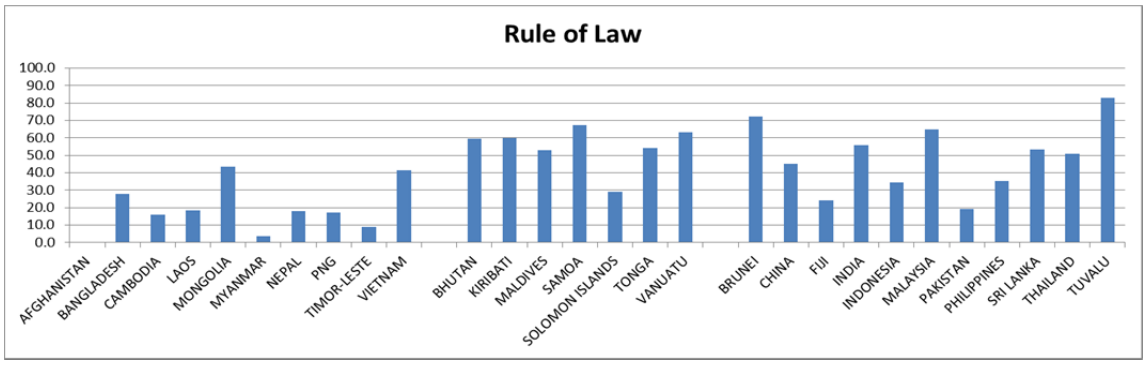
Figure 3. Governance indicators (2009) of Asian LICs

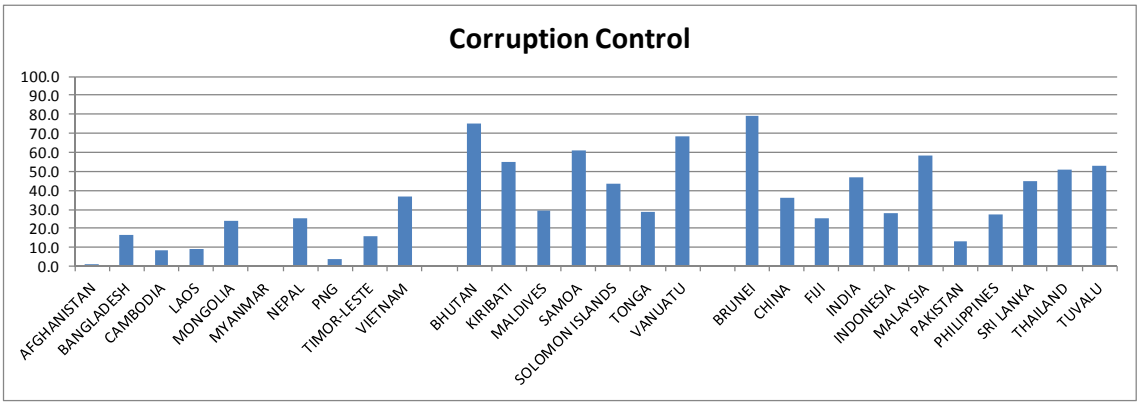












Source: World Bank worldwide governance indicators (downloaded on September 6, 2011)

Table 6. 2010 IDA Resource Allocation Index (IRAI)

Country	A. Economic Management				B. Structural Policies				C. Policies for Social Inclusion/Equity						D. Public Sector Management and Institutions						IDA Resource Allocation Index (IRAI)
	1	2	3		4	5	6		7	8	9	10	11		12	13	14	15	16		
	Macro. Mgt.	Fiscal Policy	Debt Policy	Ave.	Trade	Financial Sector	Business Regulatory Environ.	Ave.	Gender Equality	Equity of Public Resource Use	Building Human Resour.	Social Protection & Labor	Pol. & Instit. for Environ. Sustain.	Ave.	Property Rights & Rule-based Govern.	Quality of Budget. & Finan. Mgt.	Effic.of Revenue Mobil.	Quality of Public Admin.	Transpar., Account. & Corrup.in Pub. Sec.	Ave.	
Afghanistan	3.5	3.0	2.5	3.0	3.0	2.0	2.5	2.5	2.0	3.0	3.0	2.5	2.5	2.6	1.5	3.5	3.0	2.0	2.0	2.4	2.6
Bangladesh	4.0	4.0	4.0	4.0	3.0	3.5	3.5	3.3	4.0	3.5	4.0	3.5	3.0	3.6	3.0	3.0	3.0	3.0	3.0	3.0	3.5
Bhutan	4.5	4.5	4.5	4.5	3.0	3.0	3.5	3.2	4.0	4.0	4.5	3.5	4.5	4.1	3.5	3.5	4.0	4.0	4.5	3.9	3.9
Cambodia	4.5	4.0	3.5	4.0	4.0	2.5	3.5	3.3	4.0	3.5	3.5	3.0	3.0	3.4	2.5	3.5	3.0	2.5	2.0	2.7	3.4
Kiribati	2.5	3.0	3.5	3.0	3.0	3.0	3.0	3.0	2.5	4.0	2.5	3.0	3.0	3.0	3.5	3.0	3.0	3.0	3.0	3.1	3.0
Lao PDR	4.0	4.0	3.0	3.7	3.5	2.0	3.0	2.8	3.5	4.0	3.5	2.5	4.0	3.5	3.0	3.5	3.5	3.0	2.5	3.1	3.3
Maldives	2.5	2.0	2.5	2.3	4.0	3.0	4.0	3.7	4.0	4.0	4.0	3.5	4.0	3.9	3.5	3.0	4.5	3.5	3.0	3.5	3.4
Mongolia	3.5	3.0	3.5	3.3	4.5	2.5	3.5	3.5	3.5	3.5	3.5	3.5	3.0	3.4	3.0	4.0	3.5	3.5	3.0	3.4	3.4
Nepal	3.5	4.0	3.0	3.5	3.5	3.0	3.0	3.2	4.0	4.0	4.0	3.0	3.5	3.7	2.5	2.5	3.5	3.0	2.5	2.8	3.3
PNG	4.0	3.5	4.5	4.0	4.5	3.0	3.0	3.5	2.5	4.0	2.5	3.0	2.0	2.8	2.0	3.0	3.5	3.0	3.0	2.9	3.3
Samoa	4.0	4.0	5.0	4.3	5.0	4.0	3.5	4.2	3.5	4.5	4.0	3.5	4.0	3.9	4.0	3.5	4.5	4.0	4.0	4.0	4.1
Solomon Islands	3.5	2.5	3.0	3.0	3.0	3.0	2.5	2.8	3.0	2.5	3.0	2.5	2.0	2.6	3.0	2.5	3.0	2.0	3.0	2.7	2.8
Timor-Leste	3.0	3.5	4.0	3.5	4.5	2.5	1.5	2.8	3.5	3.0	3.0	2.5	2.5	2.9	2.0	3.0	3.0	2.5	3.0	2.7	3.0
Tonga	3.0	3.0	2.5	2.8	5.0	3.5	3.0	3.8	3.0	4.0	4.0	3.0	3.0	3.4	4.0	3.5	4.5	3.5	3.5	3.8	3.5
Vanuatu	4.0	3.5	4.5	4.0	3.0	3.0	3.5	3.2	3.5	3.5	2.5	2.5	3.0	3.0	3.5	4.0	3.5	3.0	3.0	3.4	3.4
Vietnam	4.0	4.5	4.0	4.2	3.5	3.0	3.5	3.3	4.5	4.5	4.0	3.5	3.5	4.0	3.5	4.0	4.0	3.5	3.0	3.6	3.8
77 IDA eligible countires avarage	3.7	3.5	3.4	3.5	3.8	3.1	3.2	3.4	3.4	3.5	3.5	3.1	3.1	3.3	2.9	3.3	3.5	3.0	2.9	3.1	3.3

Source: World Bank IDA Resource Allocation Index-2010

Notes: 77 IDA eligible countries in 2010 (Myanmar, and Somalia excluded as not rated).
For the calculation of the cluster averages, all criteria are equally weighted within a cluster; overall IRAI is calculated as the mean of the score of four clusters.Scale: 1 = Lowest, 6 = Highest.

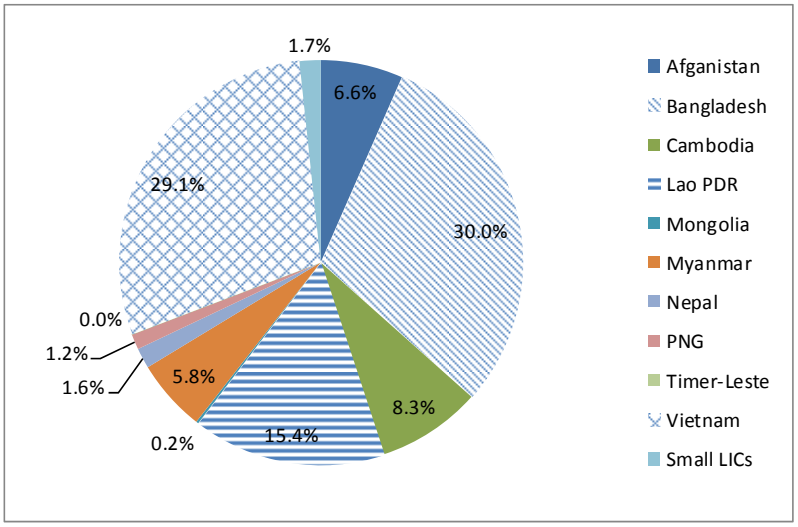
Table 7. Private sector investment in Asian LICs, by primary sector and year (1990-2009)

(Investment: million US$)

Year	Energy		Telecom		Transport		Water and sewage		Total	
	No.	Investment	No.	Investment	No.	Investment	No.	Investment	No.	Investment
1990-1994	2	138	7	164	2	10	0	0	11	312
1995-1999	19	2,471	11	941	5	255	2	110	37	3,777
2000-2004	14	2,862	13	1,807	5	147	1	174	33	4,990
2005-2009	26	4,776	15	7,974	10	1,007	1	92	52	13,849
Total	61	10,247	46	10,886	22	1,419	4	376	133	22,928

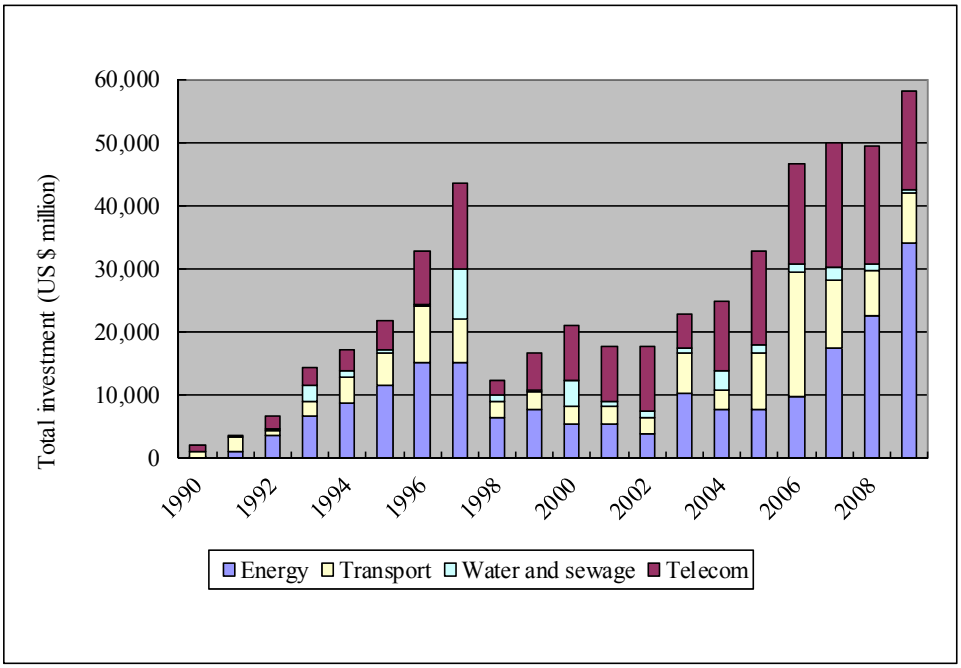
Source: World Bank and PPIAF, PPI Project database, 2011

Figure 4. Private sector investment in infrastructure in Asian LICs, by country (1990-2009)



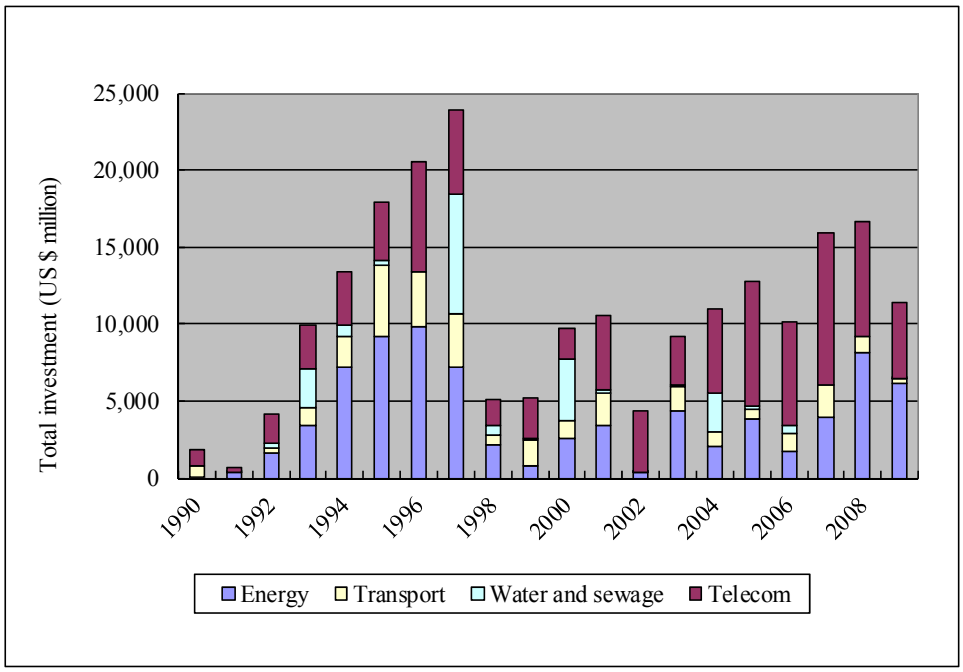
Source: World Bank and PPIAF, PPI Project database 2011

Figure 5. Private sector investment in infrastructure (Developing Asia, Total)



Source: World Bank and PPIAF, PPI Project database 2011

Figure 6. Private sector investment in infrastructure (Other Developing Asia, less China & India)



Source: World Bank and PPIAF, PPI Project database 2011

Abstract (in Japanese)

要約

本ペーパーは、アジア低所得国のインフラ整備に関する政策課題を議論する。アジア低所得国は長年に亘りインフラを整備してきたが、概してその質・量ともに依然不十分であり、次の点に留意して改善を図る必要がある。第1に、政府の財政力や様々な能力の制約のため、インフラ事業の優先順位付けが不可欠である。まず、集積経済、生産工程細分化、急成長する大規模市場の恩恵を享受するため、ロジスティックス等の地域をつなぐ(spatially connective)インフラを整備すべきである。また、気候変動（適応、緩和）は、インフラの設計や優先順位づけに従来以上に考慮される必要がある。第2に、アジア低所得国では、政府の資金・能力不足を補完する官民パートナシップ型インフラ事業が近年増加傾向にある。更なる増加のため、民間部門の役割明確化、投資環境・政策制度の改善、採算性ある案件の形成等に、政府は取り組む必要がある。第3に、今後も公共部門がインフラの整備・規制の中心を担うであろうが、その改善には各国事情に即した粘り強い努力が必要である。最後に、ドナーは、インフラ整備の促進のため、資金供与・技術協力・能力開発を通じて引き続き支援すべきである。