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## **Infrastructure and Inclusive Growth**

Pernia, Ernesto

Asian Development Bank

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# INFRASTRUCTURE FOR SUPPORTING INCLUSIVE GROWTH AND POVERTY REDUCTION IN ASIA



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ADB

# INFRASTRUCTURE FOR SUPPORTING INCLUSIVE GROWTH AND POVERTY REDUCTION IN ASIA

Asian Development Bank

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# FOREWORD

Over the years, Asia's economy has grown rapidly and the number of poor people has dropped significantly. Gross domestic product per capita more than doubled from \$2,490 in 2000 to \$5,489 in 2009, and the number of poor people—based on the \$1.25 per day poverty line—is estimated to have declined from 903.4 million in 2005 to 754.0 million in 2008. The backbone of this economic progress is infrastructure development, which has become synonymous with economic and overall development. Infrastructure plays a critical role in society and the economy by providing services to households and industries. The availability of transport, electricity, safe water and sanitation, and other key facilities such as schools and hospitals, has a tremendous impact on improving the quality of life of households, especially poor ones. For businesses, infrastructure services facilitate production, transport, and transactions that spur growth, which in turn helps raise incomes and reduce poverty. Infrastructure development also helps countries to better address climate change and reduce vulnerability to shocks and disasters.

Conversely, a lack of infrastructure development signals barriers to growth and overall development. Unfortunately, developing Asia still shows a significant deficiency in infrastructure services, and this varies considerably across countries. About 1.8 billion people in the region are not connected to basic sanitation services, 0.8 billion lack electricity, and 0.6 billion do not have access to safe water. The key challenge is therefore to provide high quality and efficient infrastructure systems that can support more inclusive and higher economic growth. The potential of Asia to match Europe's current standard of living by 2050 is real, but it requires a continuation of the infrastructure development that has supported the growth over the last few decades. The challenges are enormous. In terms of funding, this requires a total investment in the order of \$8 trillion for 2010–2020.

Infrastructure consists of hard and soft components. The hard and visible infrastructure, such as roads, railways, electricity, and telecommunications, must be accompanied and supported by its soft component, such as policies and regulations, to enable the system to perform well and generate impacts. The right mix and synergy of the two is important to ensure that the infrastructure system supports inclusive growth and poverty reduction. Well-functioning and efficient infrastructure promotes inclusiveness by expanding access to vital services and improving economic opportunities for all. This, in turn, reduces poverty.

Governments need to develop partnerships with the private sector to ease their financial burdens, tap additional expertise, and ensure that the infrastructure system functions well and serves its purpose. Partnerships could cover all areas from planning, designing, and constructing, to operating, managing, and monitoring. Governments, however, need to take a lead role in the partnership due to the inherent characteristics of infrastructure, such as its nature as a public good, and the significant externalities, long project cycle, huge costs, land requirements, and appropriate public sector policy and regulation requirements that it entails.

This book is drawn from papers, presentations, and discussions at the 2-day conference on Infrastructure for Supporting Inclusive Growth and Poverty Reduction in Asia, conducted by the Economics and Research Department of the Asian Development Bank (ADB). The conference was held at ADB headquarters, Manila, the Philippines on 14–15 April 2011, as the last part of similar exercises conducted primarily for the developed world in Washington, D.C. and Sydney. The meetings aimed to improve our understanding the economics of infrastructure in a globalized world.

The discussion in this book focuses on three aspects: the role of infrastructure in supporting inclusive growth and poverty reduction, the need for appropriate soft infrastructure, and the role and potential of public–private partnership in infrastructure development. Their underlying premise is that extensive and efficient infrastructure services are essential drivers for economic growth and poverty reduction. Infrastructure development helps to create additional jobs and economic activities, reduce production costs through improved transport and connectivity, expand overall production capacity, connect domestic and international markets and other economic facilities, and improve access to key facilities.

This book is a fruit of collaborative work between ADB and other key stakeholders, including the experts who wrote the conference papers and made presentations, discussants, country policy makers, and other key government officials who participated in the conference. Their names and affiliations are listed in the book. The main motivation to produce this book is to ensure that the knowledge generated can be harnessed and disseminated to a wider audience in line with ADB’s Strategy 2020, which envisages it as a knowledge institution.

Governments, the private sector, development partners, and other key stakeholders need take note of experiences in infrastructure development so that they can learn from and successfully implement best practices. This book is a small step in that direction.

Douglas Brooks provided the overall leadership in implementing the project and preparing this book. Guntur Sugiyarto, the project officer, wrote the book with help from David Green and Akira Murata. Eric Suan has been instrumental in project implementation as well as in preparing the book. ADB’s Department of External Relations, Caroline Ahmad, edited the book and Rhommell Rico did the typesetting.



**Changyong Rhee**  
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January 2012

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# ACRONYMS AND ABBREVIATIONS

ADB	–	Asian Development Bank
ADB I	–	Asian Development Bank Institute
AIM	–	Asian Institute for Management
APEC	–	Asia-Pacific Economic Cooperation
ASEAN	–	Association of Southeast Asian Nations
CAREC	–	Central Asia Regional Economic Cooperation
CBTA	–	cross-border transport agreement
CGE	–	computable general equilibrium
DMC	–	developing member countries
ERD	–	Economic and Research Department
ERDI	–	Development Indicators and Policy Research Division
GDP	–	gross domestic product
GMS	–	Greater Mekong Subregion
ICT	–	information and communication technology
MPAC	–	Master Plan on Association of Southeast Asian Nations Connectivity
PPP	–	purchasing power parity
PRC	–	People’s Republic of China
OECD	–	Organisation for Economic Co-operation and Development
RSDD	–	Regional and Sustainable Development Department
RSID	–	Sustainable Infrastructure Division
SAARC	–	South Asian Association for Regional Cooperation
WEF	–	World Economic Forum
UNESCAP	–	United Nations Economic and Social Commission for Asia and the Pacific

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# EXECUTIVE SUMMARY

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*Infrastructure is synonymous with development, and the lack of infrastructure services signal barriers to growth and overall development. Infrastructure consist of hard and soft components that must work together to ensure the functioning infrastructure.*

*Given the nature of infrastructure, its enormous need and complexity, the government needs to lead and work with the private sector to use the public burden and to utilize private seeking expertise and skill.*

(Guntur Sugiyarto)

Infrastructure is synonymous with development, and the lack of infrastructure services signals barriers to growth and overall development. Infrastructure plays a crucial role in society and economy by providing services to households and industry. For households, the availability of transport, electricity, safe water and sanitation, and other basic facilities has a tremendous impact on improving the quality of life. This is especially the case for poorer households. For industry, infrastructure services facilitate production, transport and trade that all spur economic growth, which in turn helps in reducing poverty. Moreover, infrastructure development can also help an economy to better address climate change and reduce its vulnerability from shocks and disasters.

Infrastructure consists of hard and soft components. The hard or visible component must be combined with the soft infrastructure, which includes policies and regulations. This is to allow the infrastructure system to perform and have the intended impact. The soft infrastructure must also support the hard infrastructure to ensure that the right mix and synergy of the two can support inclusive growth and poverty reduction by expanding access to vital services and improving economic opportunities for all.

Planning, designing, constructing and operating infrastructure systems are difficult tasks and they also require a lot of resources. Therefore, the government needs to work with the private sector in public private partnership to ease the public sector financial and administrative burdens and to utilize private sector expertise and skills. In most cases, the government also needs to take the leading role given the nature and characteristics of infrastructure product.

This book is drawn from the papers, presentations, and discussions at a two day conference on Infrastructure for Supporting Inclusive Growth and Poverty Reduction in Asia, conducted by the Economics and Research Department of the Asian Development Bank (ADB). The conference was held at ADB headquarters, Manila, the Philippines, on 14–15 April 2011. It was the last series of similar exercises conducted in Washington, D.C. and Sydney to advance our understanding of the economics of infrastructure in a globalized world.

The conference in Manila focused on three themes: (i) the role of infrastructure in supporting inclusive growth and poverty reduction, (ii) the need for appropriate soft infrastructure, and (iii) the potential of public–private partnership (PPP) in infrastructure development. Each of these themes elaborates the premise that extensive, efficient infrastructure services are essential drivers of economic growth and poverty reduction.

Infrastructure is a prime element in a nation’s development and a crucial factor in many regional cooperation efforts in Asia and the Pacific. Infrastructure investment is a key determinant whether Asian economies will continue their remarkable success that has brought millions of people to rise out of poverty. The region has the potential to match Europe’s current standard of living by 2050. However, this will require an acceleration of the infrastructure development that has supported the region growth over the last few decades. To maintain the growth momentum, for instance, Asia needs to invest around \$8 trillion in infrastructure over 2010–2020. The challenges are therefore enormous, particularly for the poorer countries that must increase their infrastructure development to accelerate their economic growth to catch up with the others.

Asian economies still show a significant deficiency in infrastructure provision, and this varies considerably across countries. About 1.8 billion people are not connected to basic sanitation services, 0.8 billion lack electricity, and 0.6 billion do not have access to potable water. To meet these challenges, the level of infrastructure development must be scaled up. A better understanding on the economics of infrastructure is therefore crucial.

### **Infrastructure Main Features**

Infrastructure systems include airports, railways, roads, water transport, utilities (electricity, gas, water and sanitation), and information and communication technology services. They move goods and people, and provide services for households and businesses. Infrastructure systems have the following characteristics that demand public sector involvement. They (i) have some aspects of public goods, which inhibit private firms from supplying them efficiently; (ii) create positive and negative externalities that the private sector will not take fully into account; (iii) entail a long project cycle and huge costs that private enterprises in developing countries often cannot afford; (iv) require land use or rights that cannot be accomplished without assistance from the government; and (v) need appropriate public sector policies and regulation, as sometimes the provision of utilities can only be done through local monopolies.

### **Infrastructure Development to Support Inclusive Growth and Poverty Reduction**

The high cost of infrastructure systems makes it particularly important for the decision makers to understand priorities for action and the costs of inaction. A large number of studies have attempted to understand the relationships between infrastructure and growth that lead to poverty reduction, and their results are often inconclusive. This, however, is not surprising, because it is unlikely that one model can fit the myriad

of Asian economies. Moreover, infrastructure comes in numerous forms and affects economic growth and poverty reduction through many pathways.

It is, however, relatively well established that infrastructure can promote inclusive growth, which in turn will reduce poverty directly and indirectly. This can be inferred from the fact that infrastructure development will (i) create additional jobs and economic activities, (ii) reduce production costs through improvements in transport and connectivity, (iii) expand overall production capacity, (iv) provide better connections to markets and other economic facilities, and (v) improve access to key facilities.

Empirical evidence also shows that infrastructure investments have the greatest impact in the presence of other, supportive actions. For instance, rural roads, irrigation systems, and rural electrification programs are more successful at reducing poverty when there are also strong programs in education or health. The experience of the People's Republic of China (PRC), with its long-running rapid growth, has been a laboratory for better understanding the potential impact of infrastructure in promoting inclusive growth and poverty reduction. Infrastructure development in PRC has reduced transport costs, encouraged trade and employment creation, and helped shift the labor from agriculture to nonagricultural activities in urban areas. This promotes inclusive growth and reduces poverty.

Transport infrastructure is particularly important because it underpins trade in goods, which has been an essential part of the growth and development of Asian countries. Accordingly, the dozen landlocked Asian countries need regional transport systems to enable them to participate in global markets to better contribute to the global economy. Cross-border and regional infrastructure systems complement national infrastructure systems, transforming the landlocked countries to land-linked economies that enhance their growth potential. The ADB-supported Greater Mekong Subregion (GMS) Economic Cooperation Program is a successful example of this approach. It has coordinated more than \$12 billion in investments, especially in road networks that provided all-weather connections between mainland Southeast Asia and southern PRC.

While past experiences can be very useful, the nature of infrastructure changes as technology advances. The infrastructure investment needed in the 21st century, for instance, includes information and telecommunication systems that require access to the Internet. Therefore, government policies need to be continually reviewed and revised.

### **Soft Infrastructure, the Crucial Policy Environment**

Soft infrastructure includes the rules and regulations that govern the use and functioning of physical infrastructure. It also refers to the institutions, such as the judicial system, and the state of governance. Soft infrastructure supports the development and functioning of infrastructure services by providing an environment conducive to their efficient delivery. It therefore strengthens the positive effects of infrastructure in promoting inclusive growth and reducing poverty.

To ensure that soft infrastructure promotes inclusive growth and poverty reduction, the policy environment must (i) be clear, consistent, and fairly applied; (ii) reflect international best practices; and (iii) encourage economically viable trade and travel.

Empirical studies using different models and datasets show that soft policies such as documentary requirements and operational fees, can be as important in terms of their impact on trade as tariffs or freight charges. Customs, immigration, quarantine, and security policies, can either form barriers to trade and travel or expedite them. Therefore, simplifying, making transparent, and grouping the processing under a one-stop shop, can promote growth by encouraging trade and building investor confidence.

Environmental policies must also encourage inclusive growth. Transport and energy supply systems may contaminate water sources and lead to air pollution that contributes to global warming. These externalities must be considered in the overall costs and benefits of different investments.

Regional cooperation programs are useful platforms for determining internationally consistent trade promotion policies. They also help countries coordinate their policies and improve their administrative capacity.

Logistics are an important determinant of overall trade costs. The right policy environment will help the logistics industry to grow. Therefore, having appropriate soft infrastructure is central to the challenging task of maintaining competitive industries.

### **Public–Private Partnerships, the Key to Enhancing Infrastructure Development**

PPP can support the development and functioning of infrastructure. As infrastructure development is expensive and technically demanding, involving the private sector in PPP arrangements can lighten the government’s financial burden and multiply the impact of limited public sector resources. Moreover, PPPs can also allow projects to tap private sector administrative and management skills.

PPPs are already common in utility services including energy, water and sewerage, and transport. In the PRC and South and Southeast Asia there are also PPP arrangements in telecommunications and energy. However, the scope for increasing PPP is still enormous, as currently the public sector still accounts for 70% of total financing in developing Asia, while the private sector contributes only around 20%. The remaining 10% comes from official development assistance.

In addition to easing public sector financing requirements and enhancing managerial skills, successful utilization of PPP in infrastructure can help develop countries’ capital markets and encourage investment more generally. However, infrastructure projects must be planned properly since many elements could affect the viability of the project, including future exchange rates, inflation, commodity prices, project financing, and overall economic performance.



Governments must recognize and embrace the key role of PPP in the infrastructure systems. This includes acting as a regulator to ensure that standards, including safety and technical service provision, are set and met.

The increasingly robust democratic institutions of Asian countries can also affect how PPPs are initiated and implemented. They can facilitate consultations to allow equitable and informed decisions about the allocation of risks and benefits in a PPP, but there is also the risk that decisions may take place in a politicized atmosphere. Land-use questions and service rate determinations are examples of onerous political decisions affecting PPPs. Therefore, it is important to build public institutions and legal systems that can help resolve project disputes fairly.

ADB plays a key role in helping developing countries sustain their infrastructure development. This role must continuously be strengthened in view of the increasing need to provide large-scale financing, promote cross-border coordination, and meet international best practices.



# CHAPTER 1

---

## INTRODUCTION

*The inadequacies of Asia's infrastructure networks are a bottleneck to growth, a threat to competitiveness, and an obstacle to poverty reduction.*

(ADB and ADBI, 2009)

### A. Background and Motivation

Asia is home to more than half of the world's population, and occupies more than a quarter of total world's land area. Over the last several decades, the region has made remarkable economic progress. Asia is the home to two of the world's largest economies: the PRC and Japan. The region's economic growth rates are among the highest in the world. During 2011, a year in which the economies of Organisation for Economic Co-operation and Development (OECD) countries were struggling to stay out of recession, the Asian Development Bank (ADB) forecast an average growth rate of 7.3% for developing Asia. Partly as a result of the rapid growth, the number of people living in extreme poverty fell from 903.4 million in 2005 to 754.0 million in 2008. Indeed, if current trends can be sustained, the next few decades could set the emergence of the Asian Century.<sup>1</sup> Under this scenario, by 2050, billions of people in Asia and the Pacific would enjoy the current standard of living of the developed countries of Europe. This would mean an enormous reduction in the incidence of poverty, as hundreds of millions of people would see their income move significantly above the poverty line.

However, there are questions as to whether the region can sustain its remarkable growth. Significant parts of Asia's inland areas and remote islands are still isolated economically and geographically, and their economic potential remains untapped. In addition, over the next few decades, countries will face a number of major challenges such as larger populations, growing environmental pressure, rising income (and non-income) inequality, and climate change.

The international economic environment is becoming increasingly competitive and complex, and less predictable; therefore Asian economies must adapt to new conditions rather than rest on the successes of the past. Over the last few decades, Asia has particularly benefited from the globalization of production processes as international firms have located their factories across Asia, exploiting production cost advantages at various points in increasingly complex supply chains. Participating in this global process and benefiting from the participation requires continual efforts on the part of national governments to ensure that their firms, workers, and business environment are competitive (Brooks and Stone, 2010a).

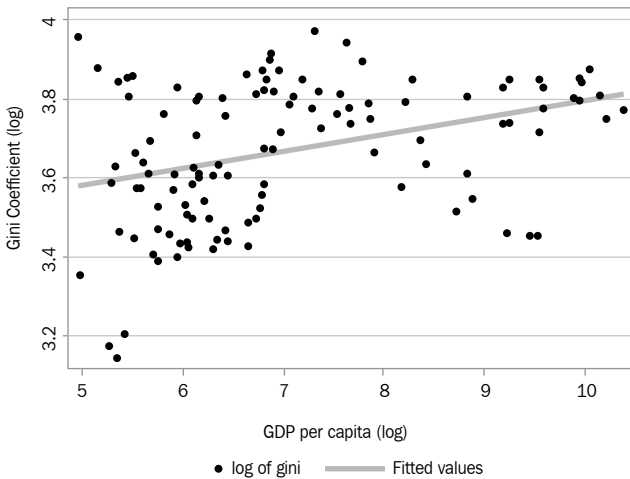
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<sup>1</sup> This is the theme of the 2011 ADB publication *Asia 2050: Realizing the Asian Century*. (ADB, 2011b).

Despite the region’s remarkable progress, the existing large number of poor people signals that the development challenges remain. Furthermore, in many countries, inequality has grown even as living standards have risen. This shows that the benefits of growth have not been shared equitably.

Figure 1 uses the Gini coefficient to show that across developing countries inequality can rise with increases in per capita income. Figure 2 emphasizes this by showing that for the largest developing Asian countries, such as the PRC, India, and Indonesia, inequality has increased over the past 4 decades. But the trend is not universal, as some countries, including Bangladesh, the Republic of Korea, Malaysia, and Pakistan, exhibit improvement in income distribution, while others, such as Thailand and Viet Nam, show less clear trends. This finding indicates that growth is important but it must be inclusive to provide benefits for all. Creating inclusive growth is one of the key tasks for Asia. In this context, one of the most important challenges facing Asian countries is to provide adequate infrastructure—the airports, information and communication technology (ICT) services; railways; roads; utilities (electricity, gas, and water); and water transport needed to support a modern economy. Asia’s continued economic progress will depend on whether it continues to invest in infrastructure systems, and whether the countries can create the policy environment necessary to reap the benefits of these investments.

Figure 1 Inequality and Per Capita Income



Note: For a Gini coefficient, larger values, up to the maximum of 1, signify larger degrees of inequality; lower values, to a minimum of 0, show more equality.

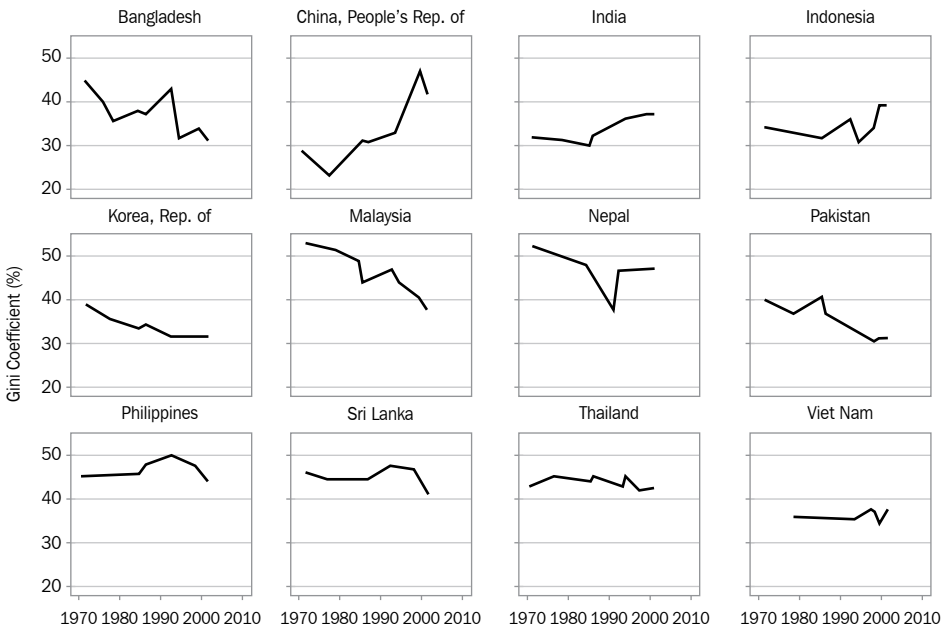
Sources: A. Raychaudhuri and P. De. 2010. Trade in Services in India: Way forward to Reduce Poverty and Inequality. In A. Stoler et al. eds. 2009. *Trade and Poverty Reduction in the Asia-Pacific Region*. Australia: Cambridge University Press.

Infrastructure services span a wide range of sectors. The *hard* infrastructure—the concrete and steel of roads, railway lines, ports and airports, and energy and water distribution lines—is the visible evidence of these services. It is common to equate

the presence of these systems with development itself and, conversely, the lack of infrastructure as a signal of underdevelopment.

The impact of hard infrastructure, however, depends crucially on the enabling policy environment—the *soft* infrastructure. This includes the rules and regulations governing the use of physical infrastructure. For example, roads between countries cannot be used effectively if border crossing systems are too difficult, tourists will not travel if immigration procedures are uncertain, and ships will not move cargo if tariffs are prohibitive. Therefore, soft infrastructure must encourage economic activity and inclusive growth. The role of governance in this context is very important, as it will affect the costs of infrastructure investment and the manner in which the infrastructure systems function within the economy (see Bhattacharyay and De, 2009).

Figure 2 Inequality in Larger Asian Countries



Sources: A. Raychaudhuri and P. De. 2010. Trade in Services in India: Way forward to Reduce Poverty and Inequality. In A. Stoler et al. eds. 2009. *Trade and Poverty Reduction in the Asia-Pacific Region*. Australia: Cambridge University Press.

The infrastructure investment needed to fully realize Asia's potential for inclusive growth is huge. ADB estimates suggest that the countries of Asia and the Pacific will need to invest about \$8 trillion over 2010–2020 (ADB and ADBI, 2009). This is well beyond the financing capabilities of national governments, and far beyond the capacity of ADB, which has been investing about \$800 billion annually. Therefore, collaborations with the private sector in infrastructure financing, construction, and management are essential. Public–private partnerships (PPPs) include a variety of modalities that provide

a mechanism for sharing the financing burden and tapping private sector management capability and skills.

The content of this book is mainly drawn from papers, presentations and discussions at a 2-day conference on *Infrastructure for Supporting Inclusive Growth and Poverty Reduction in Asia*. The Development Indicator and Policy Research Division of ADB's Economics and Research Department organized the conference, which was held at ADB headquarters in Manila, on 14–15 April 2011. The conference was one of a series of related workshops that brought together experts and policy makers from diverse countries and backgrounds to discuss key issues related to the role of infrastructure in economic development (Box 1).

### Box 1 A Series of Workshops Focusing on Infrastructure

The Manila conference capped a series of similar exercises held in different parts of the world, sponsored by different organizations, including ADB. In Sydney, on 18–19 March 2010, experts came together under the theme *The Economics of Infrastructure in a Globalized World: Issues, Lessons, and Future Challenges*. This was continued in Washington, DC, on 10 June 2010, under the title *How Important is Infrastructure? A Look at its Economic Impact in a Globalized World*.

Henckel and McKibbin<sup>a</sup> summarize the focus of the Sydney and Washington, DC conferences as (i) the nature of infrastructure, (ii) the returns expected from infrastructure investment, (iii) how infrastructure can be provided, and (iv) the impact of development on a nation's need and nature of infrastructure provision.

These workshops were useful as setting the stage for the Manila conference. The Manila meeting extended some of the specific discussion, emphasizing developing countries and the role of infrastructure in assuring inclusive growth.

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a Henckel, T. and W. McKibbin. 2010. *The Economics of Infrastructure in a Globalized World: Issues, Lessons and Future Challenges*. This paper summarizes a conference held in Sydney, Australia on March 18-19, 2010 for the Workshops on Economics of Infrastructure in a Globalized World, sponsored by Asian Development Bank, Australian National University, the Brookings Institution, the Lowy Institute for International Policy and Worley Parsons. Draft: 4 June, 2010.

Source: Summarized by the author.

The discussions at the Manila conference were based on the premise that extensive, widely available, efficient infrastructure services are essential drivers of economic growth. Investments in infrastructure and related logistics services can reduce trade costs, increase market access, and improve international competitiveness. Empirical evidence shows that well-developed infrastructure facilitates economic activities, improves economic connectivity between regions and markets, and increases economic integration. By deepening markets, better infrastructure increases economic efficiency and living standards. If the broader development process is well managed, infrastructure

can directly support inclusive growth and therefore poverty reduction. Moreover, in the current economic context of a weak and uncertain recovery from the global crisis, investment in infrastructure can be an important element in government fiscal stimulus packages.

## B. Characteristics of Infrastructure

To understand the impact of infrastructure on economy and the poor, it is important to appreciate the key features of infrastructure.<sup>2</sup> First, infrastructure has the following features of a public good:

- **Nonrival consumption.** Consumption by one person does not diminish the availability for others. For example, in the case of transport on an un-crowded road, as long as there is no congestion, there should be no cost to additional vehicles using the road. When there is no cost to additional use, the most efficient utilization of the infrastructure service would be to allow all possible users without charge up to the point at which congestion appears. This would, however, preclude a private sector supplier from charging for road use to recover costs.
- **Nonexcludability.** If the service is offered to one person, it becomes generally available to others. The classic example of non-excludability is a lighthouse. All people in the region can see the light broadcast. This is different from normal private goods where suppliers can control consumption or use. If there is no control consumption, there is limited scope for private firms to cover their costs by charging user fees.

Because of these characteristics, private enterprises will not supply public goods at optimal levels. This alone justifies government intervention in the provision of infrastructure.

Infrastructure also generates externalities, i.e., costs or benefits that fall on people who are not directly involved in the economic activity or transaction. The pollution generated by transport infrastructure systems is an example of a negative externality.<sup>3</sup> Conversely, new transport systems can have powerful positive spillover impacts (positive externalities) on local economies by stimulating additional economic activity beyond that immediately seen on the new road or railway.<sup>4</sup> Moreover, water and sanitation systems can also have very large and positive spillovers on general public health.

Externalities are not reflected in a private company's supply costs or possible revenues. Again, this means that government intervention is needed to ensure an efficient provision of services and allocation of resources. For some types of infrastructure,

2 Jones (2006) provides a similar discussion, emphasizing (i) economies of scale, (ii) network characteristics, and (iii) that infrastructure "is long-lasting and space-specific, implying high sunk costs."

3 Bhattacharyay (2011) reports that the transport sector is responsible for 23% of all energy-related carbon dioxide emissions.

4 Ghosh and De (2005) discuss the direct and indirect externalities associated with infrastructure, including employment generated.

externalities are a matter of scale. This occurs particularly with telecommunications systems, which are more useful to potential consumers as they reach more and more people. This is an example of *network externalities* (Laffont and Tirole, 2000). For example, it is useless to be the only person with access to internet or e-mail; but as more and more people use the internet or e-mail, access to the systems grows in value. In developing countries, it is often difficult for private companies to take the risks involving establishing network systems, i.e., in investing ahead of demand.

Other features of infrastructure systems that call for a strong role for the public sector to ensure optimal levels of service include the following:

- Infrastructure investment requires a long product cycle and time horizon, and long-term financing. In developing economies, there is often very limited long-term financing available, including to private sector firms.
- Enterprises in developing countries cannot easily handle infrastructure systems because they are extremely expensive.
- Enterprises providing infrastructure services are often natural monopolies, supporting only single service providers in a given locality. Examples include infrastructure distribution systems for electricity, gas, and water; railways; and some telecommunications services. Monopoly service providers necessitate public regulation and competition policy to prevent economic distortions that would limit economic growth. Some of these systems exhibit network externalities, i.e., positive benefits accrue from the scale and number of connections. Therefore, infrastructure systems call for considerable and varied public sector involvement to ensure that the systems are well developed and operate efficiently. The combination of sunk costs and network externalities make the regulatory role of government and how it is carried out particularly central (Jones 2006).
- Infrastructure development may require changes in land use that cannot be accomplished without considerable public involvement. In urban areas, complex, large-scale infrastructure systems cannot be put in place without the public authority to determine the land use.
- Infrastructure services are often important determinants of people's standard of living. The availability of utility services—especially electricity, clean water, and sanitation—strongly influence the non-income aspects of quality of life. Private service providers cannot reap income from the positive externalities of provision of safe water, e.g., improved community health.

As will be further discussed in the next section, the arguments for public sector involvement in infrastructure provision are heightened by the fact that the region has lagged in infrastructure investment, especially in relation to the need to support inclusive economic development. Across Asia, deficiencies in transport, electricity, and water services hamper economic growth and burden the poor in particular.



### **C. Coverage and Organization of the Book**

This volume focuses on three fundamental infrastructure issues that are directly linked to ADB's strategy and operations and relevant to its developing member countries. These are (i) the role of infrastructure in supporting inclusive growth and poverty reduction by reviewing empirical evidence from both within and outside the region that was discussed in Manila conference (Chapter 2); (ii) the need for appropriate soft infrastructure, including the policy environment and regulatory institutions (Chapter 3); and (iii) the role of PPPs in infrastructure development (Chapter 4). Chapter 5 provides concluding remarks and summarizes the key policy challenges ahead.



## CHAPTER 2

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# INFRASTRUCTURE TO SUPPORT INCLUSIVE GROWTH AND POVERTY REDUCTION

*There is strong international evidence that infrastructure investment is central both for accelerating growth and for reducing inequality and making growth patterns more pro-poor*

(Jones, 2006)

### A. Introduction

Infrastructure is synonymous with economic development. Roads, railways, and utility systems are needed in every economy, and the lack of infrastructure services signal barriers to growth and underdevelopment. This chapter reviews the importance of infrastructure in Asia's economies, particularly noting its role in promoting inclusiveness and reducing poverty.

Infrastructure development promotes inclusive growth and reduces poverty by creating additional jobs and economic activities; reducing production and transport costs through improved transport and connectivity; expanding overall production capacity; connecting markets and other economic facilities that may extend beyond the country; and improving access to key facilities such as health, education, and other basic services.

Infrastructure in Asia still shows some deficiencies and a wide diversity both in terms of quantity and quality. In developing Asia, millions of families lack of electricity, basic sanitation services, and safe water; and businesses are constrained by the lack of reliable electricity and transport systems. These networks are generally overloaded, unreliable, or expensive, so the economies function below their capacity. There is still huge underinvestment in infrastructure, so the total requirement for infrastructure investment is very large. Just to meet the current level of growth, Asia needs to invest \$8.22 trillion (2008 real terms, Bhattacharyay, 2010b). The scale of the need for infrastructure in Asia is further discussed in the next section.

Much of the discussion in this chapter focuses on the impact of infrastructure development following the framework of analysis adopted in this book. Economic models generally show that infrastructure can enhance the growth potential of an economy, but they differ according to the stage of development and nature of the relationships, especially across sectors and economies.

It is likely that no one model can incorporate the economic structure found in the very diverse developing Asian economies.<sup>5</sup> However, lessons from many studies suggest that infrastructure has the greatest impact when other, supportive actions are present. This is particularly true where infrastructure systems encourage growth to be more inclusive so that it can better reduce poverty. In this context, the experience of the PRC, a laboratory for exploring strategies and tactics for inclusive growth, is highlighted.

Because of its importance in development, transport infrastructure receives special attention in the discussion in this chapter. The role of transport infrastructure for Asia's landlocked countries is especially noted. Cross-border (regional) infrastructure systems can complement national infrastructure in enhancing the potential for regional growth. The final section of this chapter highlights the success of the Greater Mekong Subregion (GMS) Economic Cooperation Program in linking regions in mainland Southeast Asia with southern PRC. Henceforth, transport can also help improve non-income living standards, such as education and health outcomes, by improving access to schools and hospitals.

## **B. Infrastructure in Asia**

Infrastructure systems are often the most visible sign of development in an economy. Anyone who travels from a rich city such as Singapore to a nearby poorer island, or from Bangkok to an isolated upland town in Thailand, will notice immediately the differences in the availability and quality of infrastructure. In more developed urban areas, transport, roads, and rail systems are widely available, allowing people and goods to move relatively efficiently. Utility services are also relatively more available, providing homes and businesses with electricity, telecommunications, and water. Richer urban areas trade in world markets, while poorer (and rural) areas lack many dimensions of economically meaningful connectivity. Jones (2006) notes that development in Asia has led to the concentration of infrastructure in urban areas to support export-led activities.

Infrastructure development is a key pathway to poverty reduction. Unfortunately in today's Asia, "An infrastructure deficit is constraining market-led growth and access to social services in many countries." (ADB, 2008a.) Firms and farms do not grow in less-connected areas; and in these locations, people lack access to goods and services, including those for education and health that could build human capital. Businesses cannot compete since utility services are not available at commercially viable rates. Functioning infrastructure systems, therefore, can be a good measure of development.

Table 1 illustrates the wide diversity of infrastructure availability in South Asia. In 2005, India and Sri Lanka had 9–10 times the road density of Nepal and 20–28 times that of Afghanistan. Another study shows a similarly wide divergence: in Thailand more than 98% of the extensive road network is paved, while in Bangladesh

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<sup>5</sup> See also Henckel and McKibbin (2010) who conclude that "There is little evidence that output elasticities with respect to the inputs of the aggregate production functions differ across countries." It is this hope that encourages researchers to estimate models across countries. Some of the results of these studies are discussed in the body of this paper.

the figure is only 10%.<sup>6</sup> In South Asia, there is evidence of convergence, as the rate of growth of investment in roads in the countries with less coverage (including Afghanistan, Bhutan, and Nepal) are several times greater than those with greater coverage (India and Sri Lanka). Conversely, air connectivity measured by outcomes shows less convergence. Relatively well-connected countries such as Bhutan, the Maldives, and Sri Lanka have larger proportional travel and higher growth rates in travel than less well-connected countries such as Bangladesh, Nepal, and Pakistan.

Utilities show similar disparities. People in India and Pakistan are served with more than 6 times as much electricity as those in Nepal. However, these numbers mask the shortages and constraints that exist in many areas of Southeast Asia. Terada-Hagiwara (2011) reports, using World Bank enterprise surveys, that nearly one-third of firms in India are hampered by a lack of electricity, while in Bangladesh, Nepal, and Pakistan, three-quarters or more of firms face this constraint (see also Straub and Hagiwara, 2011). In Indonesia, key economic centers such as Java and Bali suffer from electricity outages, while some parts of other islands do not have an electricity grid connection.<sup>7</sup> Lack of electricity not only hampers existing business, but also dampens investment generally. In Pakistan, for instance, a survey of 650 small and medium-sized manufacturing enterprises concluded that almost 80% were discouraged from making investments due to the uncertainty and unreliability of electricity services.<sup>8</sup>

On internet use, there is a huge divide between the developed regions of Asia and other areas. East Asia's internet usage is more than 5 times that of South Asia or in the Pacific.<sup>9</sup> To bridge the digital divide it is important to design and build infrastructure systems that will be needed in the future to also help Asian economies become more competitive in international markets.

In terms of infrastructure quality, the variation between Asian countries is also very significant. Singapore ranks second among 142 countries in the latest World Economic Forum Global competitiveness Report, Japan ranks 13th, the PRC 69th, India 86th, Pakistan 109th, and Bangladesh 129th.

When comparing countries and sectors, it is important to note that different forms of infrastructure reflect different aspects of a country. The transport coverage in different countries reflects their history as much as their different policy environments. Similarly, the coverage of maritime infrastructure usage in South Asia reflects countries' economic geography as much as their economic policies. Landlocked Afghanistan and Nepal cannot turn to water transport to the same degree as the island of Sri Lanka or India, with its huge coastline. On the other hand, the use of electricity, although also affected by economic geography and resource availability, is a more comparable basic indicator of development given that urban dwellers everywhere expect to be connected to electricity.

6 In total, Bangladesh has 239,226 kilometers of paved roads (Ahad, 2011) compared to Thailand that has 390,026 kilometer (Rabilwongse, 2011).

7 For details of electricity shortages in Java and Bali, see Pratono (2011).

8 For information on electricity shortages in Pakistan, see Jafri (2011).

9 Straub and Terada-Hagiwara (2011) show the huge differences in service provision between regions, globally.

## 12 Infrastructure for Supporting Inclusive Growth and Poverty Reduction in Asia

Table 1 **Infrastructure Coverage in South Asia**

Country Name	1991	2001	2005	Growth Rate (%)*	
				1991-2005	2001-2005
<b>Road density (km per sq km of surface area)</b>					
Afghanistan	0.032	0.032	0.053	5.469	16.144
Bangladesh	0.098	0.144	0.150	4.422	0.963
Bhutan	0.051	0.072	0.171	19.608	34.522
India	0.715	1.018	1.100	4.592	2.233
Maldives					
Nepal	0.047	0.090	0.118	12.589	7.835
Pakistan	0.223	0.324	0.325	3.812	0.102
Sri Lanka	1.476	1.512	1.483	0.040	-0.479
<b>Railway density (km per 1000 sq km of surface area)</b>					
Afghanistan					
Bangladesh	19.067	19.063	19.826	0.332	1.001
Bhutan					
India	19.000	19.092	19.264	0.116	0.226
Maldives					
Nepal			0.401		
Pakistan	11.022	9.786	9.786	-0.934	0.000
Sri Lanka	22.283	22.085	22.085	-0.074	0.000
<b>Air transport, passengers carried per 1000 population</b>					
Afghanistan	14.275				
Bangladesh	9.589	11.030	11.525	1.682	1.123
Bhutan	13.324	57.668	77.111	39.895	8.429
India	12.368	16.332	25.149	8.612	13.496
Maldives	42.222	188.697	248.923	40.796	7.979
Nepal	32.351	25.671	17.701	-3.774	-7.762
Pakistan	46.932	42.502	34.436	-2.219	-4.744
Sri Lanka	51.700	91.732	143.578	14.809	14.130
<b>Maritime cargo (million tonnes per seaport)</b>					
Afghanistan					
Bangladesh	1.900	3.835	4.129	9.737	1.858
Bhutan					
India	14.158	29.469	48.905	20.452	16.488
Maldives					
Nepal					
Pakistan	11.290	13.345	26.445	11.186	24.541
Sri Lanka	6.254	8.247	13.143	9.179	14.842
<b>Fixed line and mobile phone subscribers (per 1000 population)</b>					
Afghanistan	2.378	1.222	43.532	144.218	865.706
Bangladesh	2.081	5.975	71.004	276.001	272.076
Bhutan	4.164	23.418	110.818	213.445	93.304
India	6.705	35.449	127.674	150.347	65.041
Maldives	34.276	110.507	564.065	128.805	102.609
Nepal	3.312	11.343	25.706	56.346	31.656
Pakistan	10.155	24.333	115.866	86.748	94.040
Sri Lanka	7.402	61.863	234.684	255.879	69.840
<b>Electric power consumption (kWh)</b>					
Afghanistan					
Bangladesh	50.012	103.587	139.554	14.92	8.680
Bhutan					
India	295.023	402.019	457.325	4.584	4.853
Maldives					
Nepal	36.847	87.633	68.820	7.231	4.853
Pakistan	297.264	373.544	425.026	3.582	3.445
Sri Lanka	160.132	276.667	344.158	9.577	6.099

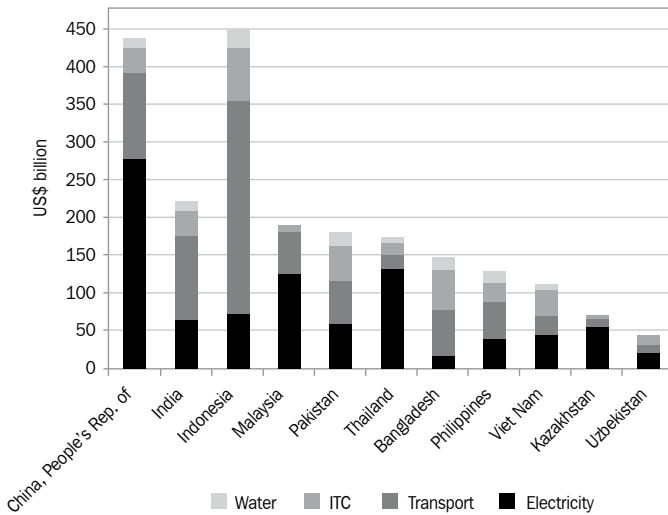
Note: \* Annual average growth rate  
km = kilometer, kWh = kilowatt-hour, sq = square.

Source: De (2009).

The requirement for investment in infrastructure across Asia is huge. Kim (2011) summarizes some of the needs, noting that an estimated 0.8 billion people lack electricity in their homes, 1.8 billion people are not connected to basic sanitation services, and 0.6 billion do not have access to safe water. The demand for safe water and sanitation will increase with the continued growth of urban areas. In Asian cities, more than 0.5 billion people live in slums with little access to urban services, and approximately half of Asian roads are still unpaved.

Bhattacharyay (2010b) estimated that maintaining the existing rate of growth in infrastructure provision over 2010–2020 in Asia would require investing \$8.22 trillion (2008 real terms).<sup>10</sup> Nearly half of this amount would be for energy infrastructure, more than one-third for transport, and the rest would be for other areas such as ICT and water and sanitation. Figure 3 provides a sector breakdown of anticipated infrastructure needs for the larger developing countries in Asia.

Figure 3 Infrastructure Needs in Larger Asian Countries, 2010–2020 (US\$ billion)



Source: Bhattacharyay (2010b).

The estimates take into consideration both the potential for aggregate economic growth and increasing urbanization that put pressure on existing infrastructure systems. The larger countries (the PRC, India, and Indonesia) are expected to absorb most of this investment. In addition to the estimates of national infrastructure needs, \$320 billion would be needed for cooperative cross-border infrastructure projects through 2020. These are projects that, if implemented over the present decade, would accelerate regional trade and development (Bhattacharyay 2010b).

<sup>10</sup> These estimates attempt to blend realistic demand and supply scenarios. Jones (2006), projecting from the last half of the previous decade, provided an alternative perspective, suggesting that East and South Asian countries would need to invest 6.5%–7.0% of GDP to avoid deficiencies in infrastructure service provision that limit growth.

Significantly, more than 32% of the projected \$8 trillion infrastructure expenditures are needed to replace or maintain existing structures (Table 2). Politically, maintenance is less attractive than new infrastructure projects. Partly because of this, there has been systemic underfunding of activities to keep infrastructure running efficiently. Insufficient provision of funding for infrastructure maintenance is a recurrent theme, and it eventually necessitates much larger investments (Sharan et al, 2007). It will be important to find politically credible institutional mechanisms to ensure that adequate maintenance is carried out.

Table 2 **Infrastructure Needs in Asia and the Pacific, by Sector, 2010–2020, (\$ million)**

Sector/Subsector	New capacity	Replacement	Total
Energy (electricity)	3,176,437	912,202	4,088,639
Telecommunications	325,353	730,304	1,055,657
Mobile phones	181,763	509,151	690,914
Landlines	143,590	221,153	364,743
Transport	1,761,666	704,457	2,466,123
Airports	6,533	4,728	11,261
Ports	50,275	25,416	75,691
Railways	2,692	35,947	38,639
Roads	1,702,166	638,366	2,340,532
Water and Sanitations	155,493	225,797	381,290
Sanitation	107,925	119,573	227,498
Water	47,568	106,224	153,792
<b>Total</b>	<b>5,418,949</b>	<b>2,572,760</b>	<b>7,991,709</b>

Source: Asian Development Bank and Asian Development Bank Institute. 2009. Infrastructure for Seamless Asia. Tokyo: Asian Development Bank Institute.

### C. Measuring the Impact of Infrastructure on Growth

Numerous studies have examined the role of infrastructure in promoting economic growth (see Raychaudhuri and De, 2010 for an example). Some use the analytical framework described at the beginning of this chapter, while others try and identify more direct, quantitative links between infrastructure development and economic growth. The studies are important to help understand the benefits of infrastructure investments and the costs of inaction. However, the subject is complex since there are many types of infrastructure and multiple paths linking infrastructure and economic performance. Rural roads and ICT systems, for instance, can have very different impacts because a poor rural economy has different needs and potential than a relatively more prosperous urban economy. Similarly, landlocked countries and islands require different infrastructure systems. Accordingly, the impact of infrastructure spending in one sector of a country at a particular time may not provide any useful lessons for a different country facing different circumstances.

Because of the complexity of the subject, a variety of methods have been used to quantify the effect of infrastructure on an economy. Box 2, for instance, shows a



scattergram that describes the relationship between the availability of infrastructure and per capita income (a measure of development) in South Asia. While it is too simplistic to reflect the wide diversity of infrastructure and economic potential of different countries, the relationship shown in the graph strongly suggests that infrastructure can provide a positive context for growth.

Raihan (2011) uses the more complex computable general equilibrium (CGE) model based on the social accounting matrix (SAM) to look at the impact of infrastructure investment on Bangladesh by emphasizing the flows of products and funds in the economy. The impact of infrastructure investment is estimated by simulating a 20% rise in expenditures in construction, social services, transport, and utilities and looking at the resulting changes across the economy. The increase in infrastructure-related expenditures was estimated to raise overall gross domestic product (GDP) by more than 8% and increase the incomes of a broad range of people by 6%–8%.

Other studies have taken as their starting point on the relatively new work being done in economic geography (see, for example, Straub and Terada-Hagiwara, 2011). A micro approach looks for the impact of infrastructure on trade flows with “trade costs” as the intermediary variable between the stock of infrastructure and the level of trade transactions. These studies often ascribe high rates of return to infrastructure investment, especially in low-income countries. Li (2011) provides an example of this approach using a case study of infrastructure investment in railways in western PRC between Urumqi and Lanzhou. Critically, the initial conditions included congestion in rail cargo transport so that capacity investment would clearly and unambiguously reduce trade costs. The investment in infrastructure reduced the price differences of goods in the two cities by as much as 30%. Overall, Li estimated that the returns to investment for the improved railway system could range from 10% to 50%.

An alternative approach using macro data is to model an economy using a production function in which infrastructure is one input distinguishing different elements, including different types of infrastructure that can contribute to overall growth. The nature of production specification is important as infrastructure affects the marginal impact of other factors of production.

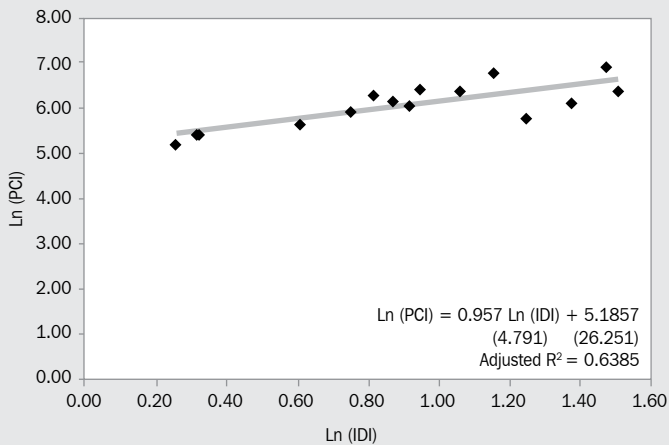
In the past, these growth accounting studies have suffered from measurement problems, especially in trying to consistently measure the stocks or flows of infrastructure services in different economies.<sup>11</sup> Moreover, a causal relationship between infrastructure and economic growth has been difficult to establish: more infrastructure may encourage growth, but richer countries can more easily afford more infrastructure. This two-way relationship inhibits a simple statement about the impact of infrastructure investment on growth (Roland-Holst, 2006). Finally, there is no reason why there should be any small set of common structural forms that could be used to model very diverse countries.<sup>12</sup>

11 Straub and Terada-Hagiwara (2011) describe the issues that hamper our understanding of any simple determination of the relationship between infrastructure and growth.

12 Straub and Terada-Hagiwara (2011) raise this concern by saying there is no reason to assume a “common underlying technology.”

### Box 2 Illustrative Relationship between Infrastructure and Development in South Asia

The figure illustrates the simple relationship between measures of real per capita income and an index of the availability of infrastructure services (including energy, financial services, information and communication technology, and transport) for the countries and time periods noted. The data show a strong positive relationship between infrastructure service availability and per capita income in South Asia. Moreover, the background analysis suggests that this relationship might strengthen over time. There are, however, a host of methodological issues that need to be acknowledged. For instance, richer countries can better afford to pay for infrastructure services, and the causal relationship may partly run from living standards to infrastructure and not only the reverse.



- Notes: IDI = infrastructure development index, Ln = natural log, PCI = per capita income.  
 1 Data arranged in cross-section pooled framework for the years 1991, 2000, and 2005 for five South Asian countries—Bangladesh, India, Nepal, Pakistan, and Sri Lanka.  
 2 Data in parentheses are t-values, significant at 1% level.
- Sources: IDI scores were taken from Kumar and De (2008), and PCI scores (taken at constant 2000 US\$) were sourced from World Bank. 2008 World Development Indicators.CD-ROM. Secondary source: Prabir De. 2009. Regional Cooperation for Regional Infrastructure Development: Challenges and Policy Options for South Asia. *Research and Information System for Development Countries*. Discussion Paper 160.

To ease these methodological issues, the World Bank maintains a comprehensive database that provides a variety of indices of infrastructure stock taking into account both the quantity and quality of services (Canning, 1998). This database allows for more rigorous examination of the relationship between infrastructure provision and economic performance. Researchers can estimate the impact of infrastructure on growth by calculating the rates of return of investment in various sectors. Some studies have suggested that the economic returns on investment projects in recent years have averaged 30%–40% for telecommunications, more than 40% for electricity generation, and more than 200% for the construction of new roads (Estache, 2006).

While much of the focus of the general literature has been on land transport, especially roads, some studies have also shown that ports infrastructure can also significantly reduce the costs of trade in Asian economies.<sup>13</sup> Jones (2006) cites work suggesting that the huge inefficiency in the principal international seaport in Bangladesh has cost the country \$0.5–\$1.0 billion each year.

Straub and Terada-Hagiwara (2011) look at various infrastructure sectors and countries and conclude that “for most infrastructure indicators, the growth rate of stocks has a positive and significant impact on per capita GDP average growth rate...” in East Asia, the Pacific, and South Asia. However they could not find widespread indirect impacts, i.e., infrastructure did not appear to enhance the productivity of other factors of production.<sup>14</sup>

Some researchers found different relationships depending on the country. Estache (2006) reports that investment returns seemed to be higher in low-income countries than in middle-income countries. This would be consistent with the argument put forward by Jones (2006) asserting that in areas with less infrastructure there would be a larger return to infrastructure investments; i.e., poorer countries have relatively more to gain from infrastructure investment than richer ones. This conclusion is however not universally supported; for example, Hulten (1996) and Aschauer (1998) argue that public capital investments do not influence the growth of low- and middle-income countries as much as richer countries.

The uncertainty, ambiguous results, and debate over the relationship between infrastructure and growth reflect the basic nature of infrastructure: it comes in many forms and its quality also affects its impact. Moreover, each economy is different in terms of its economic structure and its need of infrastructure. A fundamental conclusion of this book is that the impact of infrastructure investment depends on the context in which the investment is made and the way in which it is used. Figure 4 reinforces this conclusion, showing that there is no clear relationship between the availability of infrastructure services and productivity growth. The impact of infrastructure on growth depends not only on the amount of public investment, but also on the use of the systems. Crucially, the quality of governance in a country affects the return to infrastructure investment and the impact of infrastructure systems on growth.

#### **D. Infrastructure for Supporting Inclusive Growth: The Framework of Analysis**

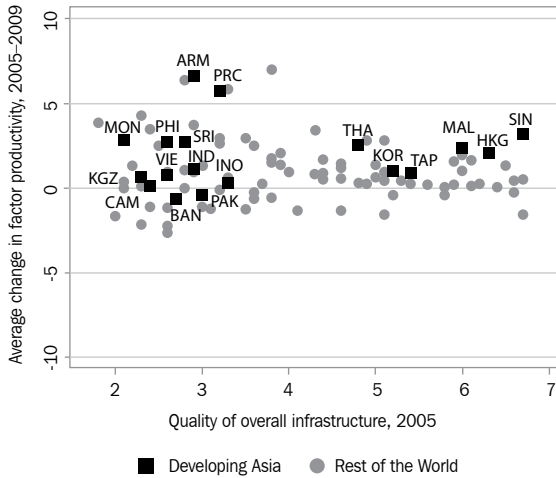
This section examines how infrastructure can affect income equality, an important consideration in the context of infrastructure’s effects on poverty. The framework of analysis developed in this book states that infrastructure development promotes inclusive growth which in turn reduces poverty. Infrastructure development achieves this by (i) creating additional jobs and economic activities, (ii) reducing production

13 See for example, Raychaudhuri and De (2010), Limao and Venables (2001), De (2007 and 2009a), and Brooks and Hummels (2009).

14 A noticeable impact on total factor productivity was, however, found for the PRC, the Republic of Korea, and Thailand (Straub and Terada-Hagiwara, 2011).

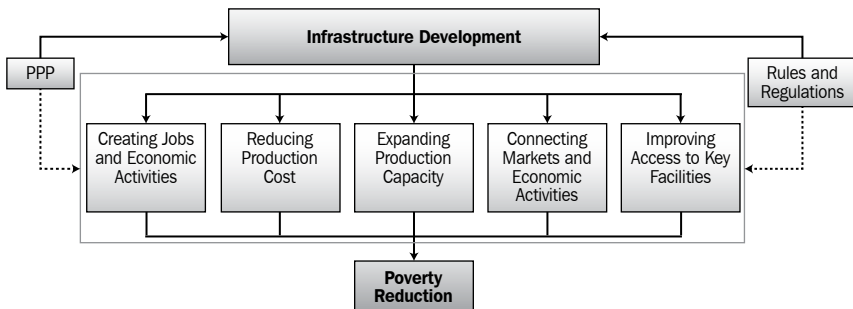
costs through improvements in transport and connectivity, (iii) expanding the overall production capacity, (iv) connecting markets and other economic facilities, and (v) improving access to key facilities. Through increasing inclusiveness, infrastructure will reduce poverty directly and/or indirectly. The schematic representation of this framework is summarized in Figure 5.

Figure 4 **Average Productivity Growth and Infrastructure Availability**



Notes: ARM=Armenia; BAN=Bangladesh; CAM=Cambodia; HKG=Hong Kong, China; IND=India; INO=Indonesia; KGZ=Kyrgyz Rep.; KOR=Rep. of Korea; MAL=Malaysia; MON=Mongolia; PAK=Pakistan; PHI=Philippines; PRC=People's Rep. of China; SIN=Singapore; SRI=Sri Lanka; TAP=Taipei, China; THA=Thailand; VIE=Viet Nam  
 Sources: S. Straub and A. Terada-Hagiwara. 2011. Infrastructure Growth in Developing Asia. Paper presented at the conference on Infrastructure for Inclusive Growth and Poverty Reduction at the Asian Development Bank. Manila. 14–15 April. p. 2.

Figure 5 **Framework to Analyze Infrastructure for Inclusive Growth and Poverty Reduction**



Note: PPP = public-private partnership.  
 Source: Developed by the author.

The following paragraphs describe the components of the framework in more detail and provide some illustrative anecdotal evidence of the effects of infrastructure in relation to the framework of analysis.

**Creating Jobs and Economic Activities.** Expenditure on infrastructure can itself stimulate economic activity, but the improvement in economic opportunity further creates employment. Infrastructure investments stimulate the economy by creating jobs in the construction and manufacturing sectors and generate considerable spinoff activity in the rest of the economy.

- The United States (US) interstate highway system that connects the US to Canada and Mexico reduced trade barriers and costs . As a result, the Canada-U.S. and Mexico-U.S. trade flows grew 7–10 percentage points per capita. Most significantly, by increasing trade, the highways raised the relative demand for skilled manufacturing workers in counties with a high endowment of human capital (Michaels, 2006).

**Reducing Production Cost.** Infrastructure can improve connectivity, lowering transport costs and reducing spoilage.

- Developments of highways in the US reduce the costs of truck firms (Keeler and Ying, 1988) and overall inventory costs (Shirley and Winston, 2004). Construction of railways is significantly associated with smaller price differences and volatility, larger inter-regional trade volumes, and higher incomes across regions of India (Donaldson, 2009).

**Expanding Production Capacity.** Infrastructure investment expands the production possibility frontier, increasing the overall production capacity of the economy. Energy infrastructure in particular provides critical inputs to modern production processes.

- Telecommunications infrastructure generates positive impact on economic development (Röller and Waverman, 2001) and road infrastructure has a positive effects on productivity (Fernald, 1999).
- A recent review of Latin America’s experience (World Bank, 2003) offers several examples. In Guatemala improved access to electricity, water and telephones for poorer groups lead to more equal incomes. Expansion of infrastructure services to rural areas in El Salvador reduced the time required to reach markets and generated huge gains for poorer groups. Improving road quality had a significant impact on income and, especially, on wage employment in Peru.

In India, the use of electric pumps in well irrigation was promoted in place of diesel pumps. This led to increased agricultural productivity through greater land use, decreased reliance on rainfall, and the adoption of higher-yielding crops. Improving access to electricity has created a multiplier effect by increasing hours and rate of commercial activities so that working hours increased from 9 to 14 hours per day; turnover increased by 34%. The electrified businesses employ more workers and pay higher wages than nonelectrified businesses (Choe, 2011).

**Connecting Markets and Economic Activities.** Improvements in transport and communication enhance market efficiency by better connecting markets and other economic facilities. Telecommunications infrastructure also provides the tools and information necessary for markets to work better.

- A new railway link between two districts lowers their bilateral trade cost, allowing consumers to buy goods from the cheapest district, and producers to sell more of what they are best at producing. The construction of cellular phone towers in South India improved efficiency in fish markets (Jensen, 2007), and the US Interstate Highway system has a positive impact on the skilled wage premium (Michaels, 2006).

**Improving Access to Key Facilities.** Infrastructure development promotes poverty reduction in its multidimensional ways as poverty reduction involves more than narrow economic growth and includes noneconomic aspects, such as improved access to road, schools, health and other key facilities.

- Rural road project reduces transport costs of the most remote households by around \$75 per ton, raising incomes by about 50%. But the gains is small compared to that from improved access to nonfarm earnings opportunities in town. This suggests that there may be potentially important complementarities between rural road construction and urban economic development.
- Investments of the Rural Infrastructure Development Fund led to improvement in access to modern agroeconomic practices, improved accessibility to inputs, and reduced transport costs. There is also a positive change in intangible benefits such as changes in asset holding patterns, increased job availability, increased credit absorption, improvement in access to education and health, and improved quality of life. Improved connectivity due to the construction of bridge reduced costs of transporting farm inputs and outputs, vehicle operating cost, travel time, etc so that commercialization and diversification crops nonfarm activities, access to education and health services have improved.

**Rules and Regulations (Soft Infrastructure) and Public–Private Partnerships (PPP).** The impact of infrastructure on an economy depends greatly on the policy environment within which the investment is made. The soft infrastructure is a critical factor for the functioning and efficacy of infrastructure. The need for infrastructure development is so enormous so that that all efforts need to be made to maximize the limited public sector resources. PPPs provide private enterprises to assume some responsibilities for funding and/or management, allowing the government to afford more infrastructure development. Therefore, both soft infrastructure and PPP enhance the development and functionality of infrastructure.

## CHAPTER 3

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# INFRASTRUCTURE AND INCLUSIVE GROWTH

Inclusive growth requires: *“economic growth and employment opportunities, social inclusion, social protection, as well as good governance and institutions...”*

(ADB, 2011a)

### A. Infrastructure and Poverty Reduction

**E**mpirical evidence from Asia and the rest of the world shows the positive role of infrastructure in improving the quality of life, especially for the poor. Infrastructure is more than an input to businesses; its services also meet people’s basic needs and wants. Straub and Terada-Hagiwara (2011) make this point and further note that utility services can account for an important part of household spending: Water utility services, for instance, may account for a significant fraction of poor households’ budget. Although they only make up 0.8% of the household budget of the poor in the PRC and 3.2% in Cambodia, they account for 16%–33% of total spending of the poorest households in Indonesia. Similarly, energy expenditures can account for significant shares of the total spending of the poorest families, ranging from 2.9% in Viet Nam to 7.6% in the PRC, 9% in Indonesia, and 24% in Cambodia. For this reason alone, a more efficient provision of infrastructure services, allowing for lower charges, can raise the real incomes, including for the poor.

Infrastructure can have a strong impact on the incidence and depth of poverty by supporting inclusive growth, i.e., economic growth that can facilitate a meaningful and sustainable poverty reduction (World Bank, 2009). Infrastructure affects enterprise productivity, and a lack of access to utility services such as electricity is a significant barrier to doing business, especially for small firms. ICT services can also be a powerful stimulus to increase productivity across sectors, which in turn can lead to increased employment and income levels and a reduction in poverty.

ADB (2011a) distinguishes three requirements for inclusive growth, all of which have some relationship to the availability and efficiency of infrastructure services:

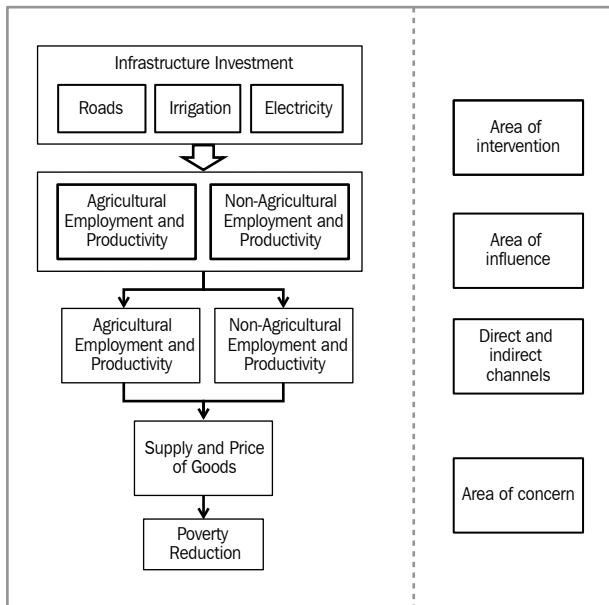
- **High, efficient, and sustained growth to create productive jobs and economic opportunity** by promoting growth and affecting the nature of this growth. Transport, information technology, and utilities provide much of the context for growth.

- Social inclusion to ensure equal access to economic opportunity.** The ability to access health and education depends on the availability of health and education facilities as well as transport infrastructure; utility services to a large extent determine housing quality; and information technology affects the ability to participate in society. Hence, better infrastructure can increase social inclusion and improve access to economic opportunity.
- Social safety nets.** Increasingly, the availability of infrastructure and information technology affects both the need for social assistance and the ability to access this assistance.

The impact of infrastructure on inclusive growth also depends on whether a country practices good governance (especially in the management of development), and the adequacy of its health and education expenditures, which determine how people can respond to increasing economic opportunities.

Figure 6, adapted from Ali and Pernia (2003), highlights the mechanisms by which infrastructure development projects can reduce poverty. The framework shows the areas of intervention or sectors and that the impact includes agriculture and nonagriculture sectors. The impact is manifested through direct and indirect channels and there is also possibility of adverse impact that should be of concern. Roads, electricity and irrigation are selected as examples because investment in these areas can have a clear impact

Figure 6 Framework to Analyze Infrastructure for Inclusive Growth and Poverty Reduction

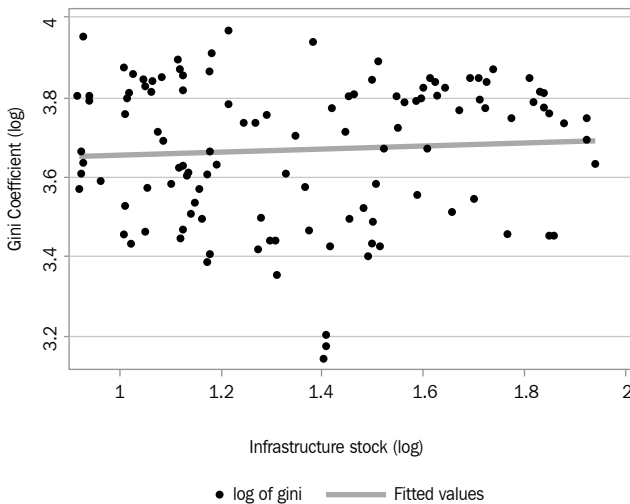


Source: Adapted from E. Ali and E. Pernia. 2003. Infrastructure and Poverty Reduction: What is the Connection? ERD Policy Brief Series. No. 13. Manila: Asian Development Bank.



on increasing employment and productivity in both the agriculture and nonagriculture sectors. Growing opportunities for employment and higher returns to working can enhance aggregate supply, thereby lowering living costs and helping raise real incomes and standards of living, leading to sustainable poverty reduction. This is the theory or expected outcome. Figure 7 shows that empirically there is only a limited relationship between inequality, as measured by the Gini relationship, and infrastructure provision across countries. Models can be used to determine the relationship between infrastructure and poverty or inequality and derive policy implications.

Figure 7 **Inequality and Infrastructure**



Sources: A. Raychaudhuri and P. De. 2010. Trade in Services in India: Way forward to Reduce Poverty and Inequality. In A. Stoler et al. eds. 2009. *Trade and Poverty Reduction in the Asia-Pacific Region*. Australia: Cambridge University Press.

Calderon and Serven (2005), for example, examine the experiences of 121 countries during 1960–2000, testing for the impact of infrastructure stocks on growth and inequality. They find that infrastructure has a significant and positive impact on growth and a significant and negative impact on inequality. These results are robust to changes in the infrastructure measures used. Accordingly, they argue that as infrastructure raises growth it lowers income inequality. In this context, infrastructure development is a win-win solution for poverty reduction.

A wide variety of studies have come to similar conclusions. For instance, Raihan (2011) finds a relationship at the district level in Bangladesh between generalized measures of availability of public services and the incidence of poverty. He constructed a measure of public service availability that indicates the presence of education and health facilities, roads, and public utility coverage. This indicator helps explain the incidence of poverty in a multivariate regression analysis: higher levels of service provision are found in districts with less poverty.

Brenneman and Kerf (2002) argue that investment in energy and transport services expand access to and benefits from education, building capacity among poor; while investments in sectors such as energy, sanitation, transport, and water positively affect health outcomes. At a more disaggregated level, Songco (2002) finds that community-driven infrastructure development in Viet Nam was a good example of programs to reduce rural poverty. In contrast, uneven application of infrastructure investment and uneven policies produce uneven results. Steinberg and Lindfield (2011) illustrate this point with reference to Dharavi, India, in which in spite of real improvements in income, in many urban areas living conditions have “deteriorated” (Box 3).

However, positive relationships will not always be found in any given country or project, or at any given time. Not all countries succeed in fostering inclusive growth, and some experience high rates of poverty and rising inequality even during periods of growth. As with the impact of infrastructure on growth, it is likely that there is no single relationship governing the impact of infrastructure on poverty independent of time. Rather, the relationship is dependent upon the path of development generally and infrastructure investment specifically.

**Box 3 A Series of Workshops Focusing on Infrastructure**

In Dharavi, Mumbai, India, one can see a family of 12 living in an 8 meter by 2 meter room with sleeping areas stacked up to 3 meters high for use in three shifts. The area has only 1 water tap for every 10 houses, and 16 public latrines serving 3,000 people. The people earn their living in a variety of occupations: dyeing cloth, tannery work, making garments and pottery, and recycling. Cumulatively, the people earn millions of dollars annually, however, a lack of infrastructure services, especially clean water, affects sanitation. The Dharavi case shows that even if infrastructure spurs economic activity and incomes, it does not necessarily or always positively affect all aspects of the community’s standards of living.

Sources: Summarized by Choe (2011) from *A Flourishing Slum: The Resident of Dhavari*, *The Economist*, 19 December 2007 (Available: <http://www.economist.com/node/10311293>).

Understanding the likely impact of infrastructure investment on a country also depends crucially on the nature of its development path. It is clear that poor countries, often with obvious deficiencies in infrastructure, need infrastructure investment, and poor economies need to improve their infrastructure systems. However, middle-income countries also have requirements which are more complex. They need to establish systems to help build new businesses so that the economy can accomplish the structural change necessary to avoid the middle-income trap.<sup>15</sup> Box 4 describes the importance of infrastructure in helping countries avoid the middle-income trap,

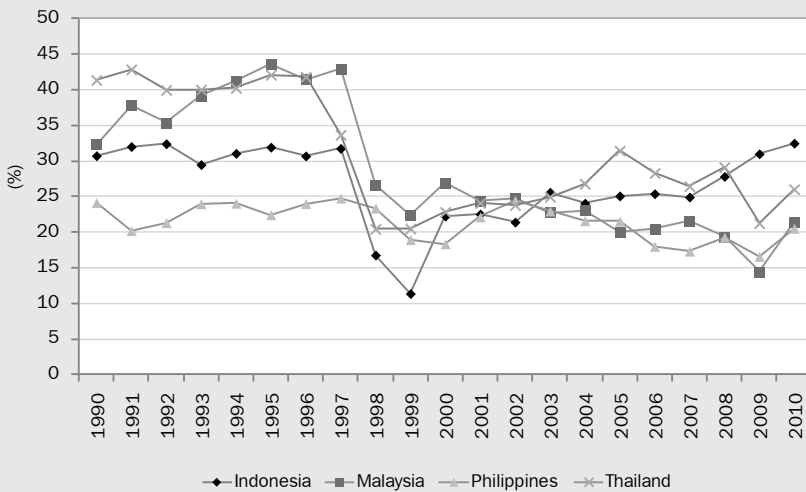
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15 This is the condition whereby the middle-income country can achieve middle-income status successfully but cannot accelerate growth further to transform into a fully developed economy in spite of a history of rapid growth.

**Box 4 Infrastructure to Escape the Middle-Income Trap**

Many of Asia’s developing countries have seen sustained, robust economic growth over decades. Poverty has fallen in many countries. However, the movement above middle-income status is much less common. Besides the Republic of Korea, only Singapore and other relatively atypical economies have made this transition. This is what is sometimes called the “middle-income trap”; the seeming inability to continue undeniable success in moving past poverty to joining the club of rich countries.

The middle-income trap seems evident in Southeast Asia where Indonesia, Malaysia, and Thailand saw a clear fall-off in growth after the 1997/1998 Asian Financial Crisis. As the figure shows, one reason for this has been the failure of investment to recover from the shock.



Source: Statistical Database System, Asian Development Bank.

Investment and infrastructure are two of the key means of avoiding or breaking out of the middle-income trap. ADB’s *Asia 2050* describes the situation as one in which countries need to “make a timely transition from resource-driven growth, with low-cost labor and capital, to productivity-driven growth.”<sup>a</sup> To ensure that the economy can make this difficult structural change, it will be necessary not only to fill in the missing infrastructure links that have hindered growth in the past, but also to build the systems that can encourage new businesses to start and flourish.

a ADB. 2011. *Asia 2050: Realizing the Asian Century*. Manila. p. 4.

Source: Summarized by the author.

As infrastructure is developed and growth appears, the nature of the influence of infrastructure on growth and poverty reduction will change. Infrastructure alters the structure of an economy and the relationships of different variables. Therefore, their relationship is very dynamic. This applies to different forms of infrastructure. Moreover, different regions in large economies will also likely show different interrelationships

between infrastructure, growth, and poverty. Thus it is important to continually study or track the structural changes across countries, regions, and periods to better understand how these important investments in infrastructure can enhance inclusive growth and reduce poverty.

As noted one page 7, the extent to which infrastructure investments can lead to poverty reduction depends on an enabling policy environment, including good governance. Box 5 sets this in the context of the more general issue of the relationship between growth and poverty reduction. The broader policy environment within which the infrastructure systems operate is of key importance in this regard. For example, the extent to which irrigation or other infrastructure systems can affect agricultural productivity may also depend on education levels. The relatively high skill base and literacy in Kerala, India, helps ensure that infrastructure has a positive impact on the incidence of poverty. Similarly, in their country study of the Philippines, Balisacan and Pernia (2003) find that investment in roads can significantly reduce poverty, but only where there are also higher levels of schooling.

#### Box 5 **Do We Need to Grow to Reduce Poverty?**

There is clear evidence to suggest that infrastructure can help generate the right kind of growth—inclusive growth that can lead to significant, sustainable poverty reduction. Looking beyond this, there is the question of whether infrastructure without growth can also bring about poverty reduction. The mechanism in this case might be that infrastructure would result in the redistribution of income or directly affect living conditions. For instance, investment in water supply systems can widen the provision of safe, clean water, improving non-income aspects of poverty. Safe water can dramatically improve health conditions in poor regions, even without significant changes in economic activity.

It is harder to argue that income poverty might be significantly affected by infrastructure in the absence of growth. Empirically, it seems that growth is a prerequisite for infrastructure-led poverty reduction. For example, using cross-country regression analysis, Jalilian and Weiss<sup>a</sup> found that measures of infrastructure had no significant relationship to poverty headcount measures, independent of growth. But considered along with growth, infrastructure had a significant impact on poverty reduction.

This may be seen as corollary to the more general observation that growth per se may not reduce poverty in all circumstances; but with a pro-poor economic regime, significant growth can provide for sustainable poverty reduction, and infrastructure can be seen as growth-enabling investments.

a Jalilian, H. and J. Weiss. 2006. Infrastructure and Poverty: Cross Country Evidence. In Weiss, J. and Khan, H.A., eds, *Poverty Strategies in Asia: a Growth plus Approach*, Edward Elgar, Cheltenham.

Source: Summarized by the author.

## B. Infrastructure and Non-Income Poverty

While much of the discussion in this chapter focuses on income-based measures of poverty, as, infrastructure can also improve social goals—the non-income aspects of the quality of life for the poor. Health outcomes depend on the availability of water and sanitation services (Box 3), but they also reflect the ability to travel to health service providers. For example, maternal mortality is a function of whether women can get to health facilities if and when problems surface in pregnancy. Similarly, education services are available to all only if transport exists to allow children to travel to school.

Electricity is another service that can have broad impacts on economic opportunities and quality of life. Providing affordable and reliable access to electricity services is one way to lower the costs of establishing and growing businesses that can raise income opportunities. Balisacan and Edillon (2005) provide evidence on the importance of rural electrification in reducing poverty in the Philippines, where the proportion of households without electricity is about 30%. They show that rural electrification results in high economic returns, and they note that its impact on the poor can be greater than other comparable investments. Electricity is more than simply an input for businesses; expanding electricity services to a community can also improve the housing situation. Therefore, a lack of electricity in households is one non-income measure of poverty.

Although providing a new infrastructure service, improving service provision by lowering costs and prices, or reducing shortage and outage times can improve economic opportunities and lives, there is no automatic relationship. A recent review of World Bank-sponsored rural electrification schemes found that they have a pro-rich bias, and rural electrification did not guarantee that the poorest and those living in more isolated areas of the rural sector would benefit (World Bank, 2008).

Pursuing balanced development (i.e., investing in infrastructure across different sectors and regions) can help ensure that infrastructure investments have a positive impact on inclusive growth. Encouraging investments and improvements in the provision of ICT services, for instance, can raise the efficiency of physical infrastructure in transport and other areas. ICT can lower search costs for marketing and improve logistics, encouraging trade, transport, travel, and economic activity generally (Brookes and Stone, 2010).<sup>16</sup> Good governance will also be an important determinant of whether or not infrastructure investment will contribute to achieving inclusive growth.

To redress historically uneven growth across different regions, poorer regions need to improve their structures and systems that allow for affordable access to infrastructure services. Continuation of unbalanced infrastructure investment can lead to unequal development patterns across countries and regions. Ghosh and De (2005) used data for 18 major Indian states for 1970–2000 and found that physical and social infrastructure facilities were highly significant factors in determining the inter-state level of development (see also Ravallion and Datt, 1999).

<sup>16</sup> Similarly, Fink, Matoo, and Neagu (2002) found that trade can be hampered by high telecommunications costs.

### C. Transport Infrastructure and Inclusive Growth

Perhaps the most visible and ubiquitous of infrastructure systems, transport infrastructure can have a powerful impact on economic growth and poverty reduction. According to a study of ADB-financed infrastructure projects by Hansen (2010), road projects have had a particularly strong impact on both economic and social development.

Reflecting a strong belief that connectivity is a key to continued development, the countries of Southeast Asia are focusing on transport infrastructure in a new Master Plan on ASEAN Connectivity (Box 6). Within ASEAN, the Lao People's Democratic Republic (Lao PDR), a landlocked country, stands to gain considerably from this program that links Laotian producers to markets within the country and across its borders.

**Box 6 The Master Plan on Connectivity among  
Members of the Association of Southeast Asian Nations**

Recognizing the importance of connectivity, the Association of Southeast Asian Nations (ASEAN) put forward a master plan to better link the 10 Southeast Asian countries with improved transport and information and communication technology services, and increased supplies of energy. The Master Plan on ASEAN Connectivity (MPAC) builds on the very successful Greater Mekong Subregion Economic Cooperation Program that provided all-weather roads connecting economic centers in mainland Southeast Asia with each other and with southern People's Republic of China. The MPAC focuses on transport systems, especially roads, filling in the most important gaps in the ASEAN Highway Network but also completing the Singapore–Kunming Railway Link. The ASEAN Highway Network connects all 10 ASEAN economies, covering 36,000 kilometers with the heart of international connections located in Thailand. The Singapore–Kunming Railway Link connects the port of Singapore with southern People's Republic of China, traversing the center of mainland Southeast Asia. In maritime Southeast Asia, the foci of the MPAC are on building the highway system on the different islands, and encouraging low-cost ferry services to better connect the islands with each other.

The MPAC recognizes the importance of institutions, programming a wide range of economic reforms to ensure that hard infrastructure, once built and paid for, is used by new and growing businesses. A particular goal is to eliminate barriers to trade in logistics services.

A major source of financing for the implementation of the MPAC is the new ASEAN Infrastructure Fund. Supported by the Asian Development Bank, the fund is expected to leverage more than \$0.5 billion in capital to support at least \$13 billion in investment.

Source: Summarized by the author.

The large number of landlocked countries in the region is a matter of concern, especially in terms of balancing growth across the region.<sup>17</sup> The economic disadvantages of being landlocked are clear: individuals and firms in those countries face higher costs and thus lower scale economies for trading in international markets. Infrastructure

17 There are 12 landlocked countries in Asia: Afghanistan, Armenia, Azerbaijan, Bhutan, Kazakhstan, Kyrgyz Republic, the Lao PDR, Mongolia, Nepal, Tajikistan, Turkmenistan, and Uzbekistan.

development that links the countries with the centers of growth and world marketplaces can change this unfortunate geographic setting and boost overall growth in the region. Limão and Venables (1999) provide very striking measures of the problem of landlocked countries: “The median landlocked country has only 30% of the trade volume of the median coastal economy. Halving transport costs increases that trade volume by a factor of five.”

While transport infrastructure systems can be very expensive, in some instances they offer the chance to radically alter a country’s potential for growth. For example, Nepal shares borders with the PRC and India, and transport corridor investment that better connects Nepal with its neighbors will increase mobility of goods and people and foster trade and overall economic growth (Bhattacharyay, 2011).

Inclusive transport infrastructure development works by improving connectivity between lagging regions and national, regional, or global markets. Many forms of transport, including railways and waterways, can support sustainable poverty reduction through better linking producers to markets. Transport improvements, especially in rural areas, can promote employment and income opportunities as well as improve non-income poverty indicators.

Networks of local roads connected to highway systems that link poor areas to economic centers or more advanced regions can help lagging regions catch up with more developed ones. Because of the importance of bridging the urban–rural development divide, considerable effort has been made to understand the potential impact of this type of infrastructure investment, in particular how to better connect rural areas.

For example, Fan, Hazell, and Thorat (1999) employed a simultaneous equation model to investigate the impact of different types of public expenditure on production and poverty through a variety of channels. The researchers applied the model to India; and Fan, Zhang, and Zhan (2002) subsequently applied it to the PRC. The objective of the Indian study was “to estimate an econometric model that permits calculation of the number of poor people raised above the poverty line for each additional million rupees spent on different expenditure items.” In India, over the period studied, the Fan, Hazell, and Thorat (1999) study concluded that spending on roads that can have the largest impact on poverty, partly because it raises agricultural productivity, but also because it has a positive impact on wages and employment. Similarly, the succeeding study by Fan, Zhang, and Zhan shows that rural roads had the highest impact on rural poverty reduction in the PRC context.<sup>18</sup>

Other studies using different methodologies similarly show to the importance of transport infrastructure in ensuring inclusive growth:

18 Similar results have been found for India and Bangladesh. Fan, Zhang, and Zhan (2002) state that “Similar to the findings for India and Bangladesh, rural roads had the highest impact on rural poverty reduction in [the People’s Republic of] China. Jones (2006) also states that “The robustness of the finding of a significant impact of rural (and especially all-weather, paved) roads on poverty reduction emerges from a number of other studies within the region....”

- Rural roads in West Bengal were found to help increase agricultural productivity, raising income levels and expanding household consumer choices among poor farmers (Raychudhuri, 2004).
- The development of all-weather rural roads in the Lao PDR, a country with extremely difficult upland topography and many villages without access to such a road, appears to lower the rural poverty incidence by 7 percentage points (Warr, 2006).
- A case study involving seven poor counties from Zhumadian City to Xinyang City in Henan province, the PRC, found that better transport significantly improves local economies, increasing tourism visits, promoting development of agricultural and nonagricultural industries, and raising farm incomes (Dong and Fan, 2004). With better access, people in previously isolated rural areas are more mobile and, as was also found in other studies, transport infrastructure reduces the cost of rural-to-urban migration.

While roads tend to be a focus in most countries, the nature of the infrastructure needed depends greatly on a country's basic geography. Bangladesh, for instance is a "country of a thousand rivers, large and small" and therefore an economically efficient inland water system is one key to future growth prospects (Ahad, 2011). However, regular flooding and monsoon rains are complicating factors in the provision of reliable transport systems in this country.

#### **D. Urban Infrastructure**

The urban environment depends crucially on infrastructure. Urban areas often exist because of trade networks, and businesses locate in close proximity to reap the economies of agglomeration. These dynamics will not succeed without infrastructure. Ports must work efficiently and connect to road and rail networks, and electricity and potable water need to be available.

Urban centers have very different infrastructure problems to rural areas, especially for transport. In rural areas, for instance, the lack of connectivity must be addressed in an economically efficient fashion. Urban areas usually have existing transport systems—at least roads—and the main issues are how to reduce congestion, make trade and travel easier and more efficient, and allow multi-modal systems to work. Urban economies are often based on international trade and transport systems that link to sea and airports. Jakarta and Manila are only two of the many Asian cities struggling daily with traffic congestion that raises the costs of doing business and reduces the quality of life.

All cities struggle to plan, manage, and achieve efficient and equitable infrastructure service provision, and very few manage to solve their infrastructure problems. Beyond congested transport systems, many urban areas also have electricity supplies that are expensive and unreliable. Asian cities often lack large-scale, functioning water supply and sanitation systems. These infrastructure deficiencies exacerbate



substandard housing and relegate about one-third of people in Asia's cities to living in slums (Steinberg and Lindfield, 2011).

The challenge of providing adequate infrastructure in urban areas is assuming increasing importance as Asia becomes more urbanized. ADB estimates suggests that by 2015, 48% of the population in the region—more than 1.9 billion people—will be living in urban areas (Steinberg and Lindfield, 2011).

Urban areas have been the engines of growth for Asia, and for them to continue to play this role, infrastructure investments will need to increase. Beyond the needs for businesses, as incomes rise, ensuring clean, healthy living environments becomes imperative so that expensive water and sanitation services will need to be installed and operated. Moreover, environmental concerns will also be increasingly difficult to balance against narrow economic issues in urban areas.

While infrastructure systems are generally thought of as large in scale, in some cases they need to meet small-scale requirements. In many Asian urban areas, for example, there are unmet needs for footpaths with adequate drainage so that they can be used in rainy season.<sup>19</sup> This is a relatively simple concept, but in practice it requires private land for public purposes and may necessitate formal recognition of slum dwellers—often a politically and legally contentious move. Similar challenges are also present for electricity, telecommunications, and transport in slum areas.

The difficulty of determining how to use and pay for land in a crowded urban area means that urban infrastructure requires considerable consultation and coordination among stakeholders, including government agencies. As discussed more fully in Chapter 4, the capacity of public sector agencies to make decisions and implement policies is crucial to ensuring that the potential impact of infrastructure investment is realized in the urban setting.

## **E. Regional Infrastructure**

The development of regional infrastructure systems to improve connectivity is especially beneficial to landlocked countries, where the availability of outward transport networks can result in development that reduces poverty. The Greater Mekong Subregion (GMS) Economic Cooperation Program has helped build roads through landlocked Lao PDR, providing access to the sea through Thailand and Viet Nam, and in the north to the PRC (Box 7). For isolated border areas, access to neighboring countries may offer the only opportunities to expand trade and production.<sup>20</sup>

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<sup>19</sup> See, for instance, Jorgensen and Dasgupta (2011).

<sup>20</sup> Bhattacharyay (2011) notes that transport connectivity can be a powerful force for transforming isolated areas, helping to reduce the “desperation and tension” found in areas deprived of contact with the wider world. Henckel and McKibbin (2010, pp. 4–5) emphasize that infrastructure can link landlocked countries to neighbors allowing them “to absorb beneficial growth spillovers” in regional growth.

**Box 7 The Greater Mekong Subregion Cooperation Initiative**

The Greater Mekong Subregion (GMS) comprises the five mainland Southeast Asian countries of Cambodia, the Lao People's Democratic Republic, Myanmar, Thailand, and Viet Nam; and the People's Republic of China participating through Yunnan Province and Guangxi Zhuang Autonomous Region.

Initiated in 1992, supported by the Asian Development Bank, this program has coordinated plans, investment, and policy reforms to change a formerly fragmented regional economy into a single economic zone. The GMS Program has been a significant feature in helping national programs to encourage robust growth and sustainable poverty reduction in all participating countries. Focusing in roughly 12 sectors and several key economic corridors, more than \$12 billion in infrastructure investment has been mobilized. The GMS has built all-weather road networks, connected national railways, and constructed cross-border electricity transmission systems. The countries have also pursued an extensive program of soft infrastructure reforms to facilitate the use of the hard infrastructure. Particularly important have been the efforts under the Cross-Border Transport Agreement, which encourages trade, travel, and transit. These have enable trucks to move from one country to another with minimal border-crossing delays.

Source: Summarized by the author.

Regional cooperation complements national networks and facilitates access to crucial services. While much of the focus in policy and the literature is on transport connectivity, there is also strong potential to cooperate across borders in energy and water systems. In South Asia, for example, there are notable opportunities to introduce cross-border electricity infrastructure to allow trade between India and the surrounding member countries of the South Asian Association for Regional Cooperation (SAARC), easing costly electricity shortages and reducing long-term supply costs (ADB, 2011b). The need for regional infrastructure in Asia is estimated about \$320 billion through 2020.

Regional energy trade can enhance energy security. The cooperative development of hydroelectric resources in Nepal and Bhutan can reduce India's demand for petroleum fuel. Similarly, in Southeast Asia, the Lao PDR's hydro resources can reduce Thailand's oil and gas imports. One example of infrastructure project that has supported the development of Laotian hydropower for export to Thailand is the Theun-Hinboun Hydropower Project.

Effective regional cooperation is necessary for cross-border infrastructure to successfully raise growth prospects. Governments on either side of the border must agree on the planning, financing, construction, and operation of infrastructure projects. The technical issues of border transit must be solved to allow transmission systems to work harmoniously; and the benefits, costs, and risks must be carefully examined, agreed to, and apportioned between the countries involved. This may present a considerable challenge as there is often an asymmetric distribution of costs and benefits (ADB and ADB Institute, 2009). Thus, for a particular project to be implemented, a mechanism

will be needed to redistribute the benefits so as to cover the costs equitably. For instance in the GMS, roads that link Bangkok to Kunming through the Lao PDR would primarily benefit businesses in the PRC and Thailand, but the infrastructure is primarily in the Lao PDR. The project needed to be structured so that the main beneficiary countries would shoulder more of the costs. Similarly, even if costs and benefits are equally distributed, if the countries have very different economic circumstances, there still a need for a cross-subsidization from richer to poorer. In Central Asia, the rehabilitation of the road connecting Bishkek in the Kyrgyz Republic and Almaty in Kazakhstan had to address this issue. The international assistance provided to rehabilitate the road considered the lesser financial resources of the Government of Kyrgyz Republic in apportioning loans and grants to the two countries.

Finally, as with national infrastructure projects, cross-border infrastructure projects can result in negative impacts. Transport infrastructure brings with it local pollution and the possibility of negative activities such as illegal logging, smuggling, and the trafficking of people and endangered wildlife (ADB and ADB Institute, 2009). Regional infrastructure requires regional collaboration to ensure that while regional goods are encouraged, regional “bads” are discouraged.

In some areas there are formal mechanisms, organizations, or institutions that provide support for the countries to reach and implement agreements. Asia has many such regional cooperation institutions. Examples include ASEAN, the Brunei Darussalam–Indonesia–Malaysia–Philippines East ASEAN Growth Area, Central Asia Regional Economic Cooperation (CAREC), the GMS, and SAARC.<sup>21</sup> These bodies provide structures for consultation and planning, and organize technical assistance and capacity building. They can help ensure that national programs are consistent with international standards. In some instances they provide the means to finance infrastructure projects. A particular focus of many of these initiatives is to ensure that poorer countries with less capacity can participate in the activities and benefit from the cooperation.

## **F. Assessing Infrastructure Impacts**

### **1. Computable General Equilibrium Model Analysis.**

To better examine the relationships between infrastructure, growth, and poverty reduction, Fan, Zhang, and Zhang (2002) and Raihan (2011) developed computable general equilibrium (CGE) models that incorporate different sectors in an economy-wide equilibrium context by optimizing the behavior of producers and consumers.<sup>22</sup> Substitution mechanisms are specified to allow for an understanding of the impact of changing cost structures brought by infrastructure development. Dissou and Didic (2011) emphasize that CGE models, unlike typical regression modeling, allow for complex relationships, such as how the nature of the financing of infrastructure investment affects the overall impact of the program.

21 Bhattacharyay (2011) lists 12 regional cooperation initiatives or organizations that can have some impact on cross-border or regional infrastructure coordination.

22 The discussion in this section is abstracted from Li (2007).

The Fan, Zhang, and Zhang model examines several aspects of infrastructure investment in the PRC. First, there is a short-term impact of the financing and building infrastructure facilities that stimulates the economy. Then, as the infrastructure facilities become operational, transport, telecommunication, electricity, and irrigation services become more widely available in the longer term. The model examines both the short- and long-term impacts by assuming an increase of road investments of 10%. As part of the simulation, it is further assumed that this increase would reduce the costs of migrating from rural areas to cities by 1% and increase the productivity of agricultural workers by 0.1%.

The results suggest that in the short run, a 10% increase in infrastructure can increase both GDP and overall economic welfare by 0.4%, resulting in increased output and labor demand in 15 of the 49 sectors. Employment opportunities for rural migrants rise by 3.8%, and overall rural out-migration increases by 4.6%. The migration enhances the impact of infrastructure investment in easing rural employment pressure by increasing, for instance, off-farm jobs by 1.7%. The workers in the expanding sectors earn higher wages, with the average wage of semiskilled nonagricultural labor rising by 1.2% and that of skilled nonagricultural labor by 2.6%. Agricultural incomes also increase: the average wages of semiskilled agricultural labor rise by 0.9% and skilled agricultural labor by 1.2%. Therefore, rural household welfare improves following the investment in infrastructure.

Similarly Raihan uses a CGE model to examine the impact of infrastructure investment in Bangladesh. This simulation exercise focuses on the possible impacts of low transport costs—lowering expenditures on the transport by 25%. By making trade and travel easier, lower transport costs led to a 06% rise in real GDP and a 1.4% fall in prices. International trade also rose, with both exports and imports rising by more than 0.8%. Income increases across groups and the incidence of poverty falls, confirming the pro-poor effect of reducing the transport margin.

## **2. Infrastructure Development in the People's Republic of China.**

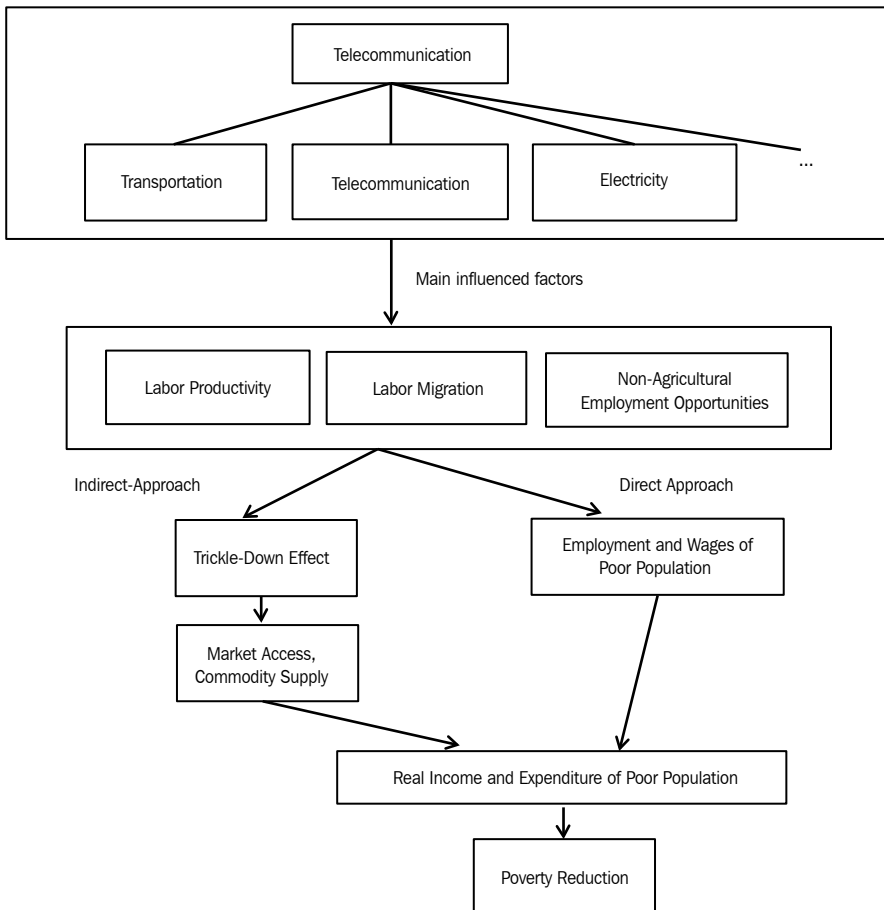
Given the astonishing growth of the PRC economy, a wide range of studies have been conducted to better understand the potential of growth in infrastructure investment for improving poverty reduction in the country. Running through the various studies is the finding that inclusive growth in the PRC has involved shifting labor from agriculture to urban areas. Migration may be a more important factor in the PRC economy than in other developing countries.

This emphasis on structural change in the labor market in the PRC economy can be seen in Figure 8. This diagram, from Sugiyarto (2007), shows that infrastructure can have a direct impact on poverty through (i) improving productivity and therefore wages and living standards, (ii) reducing the costs of labor migration from rural to urban areas, and (iii) enhancing opportunities for nonagricultural employment. As shown in the figure, these channels can work either directly upon particular people or areas or indirectly through trickle-down effects. The first channel would be signaled by

an increase in the employment of rural poor, while the second would manifest itself as more general economic progress without necessarily any differential positive impact on rural areas.

Fan, Zhang, and Zhan (2002), using provincial data between 1970 and 1997 in the PRC, found that government investment in electricity, irrigation, roads, and telecommunications could help raise growth levels generally and contribute to the reduction of rural poverty and regional inequality. This was ascribed to increased opportunities for rural nonfarm employment following infrastructure investment and system expansion. Conversely, a lack of infrastructure investment could exacerbate income inequality. In 1997, for instance, although 69% of people lived in rural areas, rural investment was only 21% of total investment, exacerbating a significant rural–urban development gap.

Figure 8 Infrastructure and Poverty Reduction in the People's Republic of China





## CHAPTER 4

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# SOFT INFRASTRUCTURE: ROLE OF POLICY AND REGULATION

*A supporting environment of predictable legal and judicial rights and procedures, equitable and enforceable competition policy, and a sound but not unduly restrictive regulatory framework are crucial for physical infrastructure investment to be efficient.*

(ADB Institute, 2011)

### A. Introduction

The case for physical infrastructure affecting growth is often clear: transport is needed to move goods from producers to consumers, power systems provide the energy for economically productive activity, and telecommunications provide the information flows necessary for trade and production. The importance of soft infrastructure is sometimes less visible. However, the impact of inappropriate policies is apparent when systems function poorly, especially in international trade and travel: roads linking countries will not be used if border crossings are too difficult, tourists choose not to travel if immigration procedures are too uncertain, and ships do not move cargo if tariffs are prohibitive. Soft infrastructure provides the institutional base for productive activity, and reforms in this area can have very positive impacts on national and regional economies.

Soft and hard infrastructure are complements. Coordinated improvements can yield benefits such as lowered trade costs and expanded scope for economic activity, and conversely, a lack of coordination leads to lower growth.

The key message of this chapter is that soft infrastructure, including the policies and regulatory institutions at different levels of national administration, plays a crucial role in the development and functioning of infrastructure systems and the broader economy. (Jones, 2006)

- **A legal system that provides protection and due process for the private sector.** This is crucial for a well-functioning economy, but is also needed to provide confidence for private sector involvement in infrastructure projects
- **Financial and payments systems that can support trade.** Goods only flow across borders if payments can flow in the opposite direction.
- **Fiscal policies that can support maintenance of existing infrastructure systems.** This is a matter of fiscal resources, but is also a question of governance.

Maintenance activities tend to be less visible, and therefore less politically attractive, than new infrastructure projects. As a result, infrastructure may not be properly maintained.

Key themes from the discussion in this chapter are that the policy environment governing the use of infrastructure must (i) be clear, consistent, and fairly applied; (ii) reflect international best practices; and (iii) encourage economically viable trade, travel, transport, and transit. Good policies will encourage a private sector that can provide an engine of growth for a national economy. Infrastructure systems—both hard and soft—also need to be designed to cope with inevitable, if unpredictable, natural disasters (Box 8). As noted, the need for appropriate soft infrastructure is particularly evident in the transport sector.

The development of a logistics industry is of key importance to ensuring that both exports and imports have the policy environment—the soft infrastructure—to encourage trade. The logistics industry is responsible for getting goods from seller to buyer, and its firms need to provide competitive services, keeping trade costs low.

#### Box 8 Natural Disasters Stress Infrastructure Provision

Asia and the Pacific is a region prone to natural disasters. The 2011 earthquake and tsunami in Japan are reminders that the region is part of the Ring of Fire, accounting for 75% of the world's volcanoes and subject to unpredictable earthquakes.<sup>a</sup> Similarly, the 2011 floods in Bangkok, Manila, and parts of Pakistan are reminders that some areas of Southeast Asia face storms and devastating rainfall. Infrastructure, particularly urban infrastructure, is vulnerable to natural disasters. Electricity, railways, roads, telecommunications, utility gas, and water transport all are subject to service disruption in the event of earthquakes or typhoons. Global warming is likely to increase the frequency and intensity of storms. Infrastructure systems need to be designed with this eventuality in mind. Equally, government agencies need to develop the capacity to more effectively deal with problems related to disasters. In the wake of the 2004 Indian Ocean earthquake and tsunami and Cyclone Nargis in 2008, the Association of Southeast Asian Nations has focused on building regional capacity for nations to help one another.

a Rosenberg, M. 2011. Pacific Ring of Fire: Ring of Fire—Home to Earthquakes and Volcanoes of the Earth. <http://geography.about.com/cs/earthquakes/a/ringoffire.htm>

Source: Summarized by the author.

## B. Soft Infrastructure as an Integral Part of Governance

The impact of infrastructure on an economy and its efficient use will generally reflect the wider governance regime, i.e., the manner in which development is managed in the country and region. Bhattacharyay and De (2009) emphasize that a necessary prerequisite for transport infrastructure to fulfill its potential is that “soft infrastructure, such as relevant rules, regulations, and standards, needs to be in place.” Developing both hard and soft infrastructure are complementary activities, each necessitating



and supporting the effectiveness of the other. The experience of the Lao PDR, where considerable efforts to build both hard and soft infrastructure are ongoing, provides an instructive example (Box 9).

#### Box 9 The Lao People's Democratic Republic Needs both Hard and Soft Infrastructure

The Lao People's Democratic Republic (Lao PDR) is a poor landlocked country still struggling to make the transition from a centrally planned economy to one that relies upon market institutions. In this process, it has made very large leaps in reducing obstacles to market-based development. It has opened to trade with neighboring countries and international markets.<sup>a</sup>

Recognizing the need for trade connectivity and the restrictions of its landlocked geography, the country is a member of the Greater Mekong Subregion (GMS) regional cooperation initiative. It has benefited from all-weather roads linking the country to regional economic centers. Similarly the GMS initiative helped the Lao PDR gain international support for developing its hydroelectric facilities and find export markets for its electricity in Thailand.

In spite of these efforts, the Lao PDR remains a country with limited infrastructure, especially in its many rural areas. It has 15 kilometers of road per 100 square kilometers of land area (2006), compared to 46 for Viet Nam and 35 for Thailand.<sup>b</sup> Bridging this development divide within the country and between the country and its neighbors remains among the government's most significant challenges.

Beyond the need to "fill in the map" with hard infrastructure, the country must make the effort to raise decision-making capacity to ensure that systems are economically viable. Pricing must reflect economic value, and service extensions must fit within long-term development planning, not political expediency. The rules, procedures, and administration of systems that affect international trade and foreign investment need to be consistent with international practices. On these matters, the Lao PDR receives assistance from a wide range of international partners, and through its participation in the GMS regional cooperation initiative and membership of the Association of Southeast Asian Nations.

a Menon, J. and P. Warr. 2008. Roads and Poverty: a General Equilibrium Analysis for Lao PDR. In *Infrastructure and Trade in Asia*, Cheltenham. Edited by D.H. Brooks and J. Menon. UK: Edward Elgar Publishing, pp.115–142.

b World Bank. Indicators data on road density. <http://data.worldbank.org/indicator/IS.ROD.DNST.K2> (accessed October 2011).

Source: Summarized by the author.

A number of studies have looked at the association between different measures of governance and infrastructure. Bhattacharyay and De (2009) examine six physical infrastructure indicators (for airports, electricity, railways, roads, seaports, and telecommunications) against measures of governance based on World Bank data. In the sample for 30 Asian countries, all cases showed a positive and significant relationship: better governance, broadly measured, was associated with better infrastructure services.<sup>23</sup>

23 The material is described in Bhattacharyay (2011) who notes that the original work emphasized regional infrastructure projects.

Infrastructure programs often require considerable administrative capacity. It is often advisable to bring in private sector management and technical skills, instead of developing them within government agencies. Harnessing the private sector can also ease financing burdens for the government, allowing it to focus on building the needed skills and institutions to provide the appropriate regulation to ensure that infrastructure projects meet social goals.

It is particularly important not to see each country in isolation. Most Asian countries believe that trade is an effective strategy for development. The explosive growth in such diverse countries as the PRC, India, and Viet Nam has in part been ascribed to policy reforms and investments to encourage both international and domestic trade. But to engage in trade, producers and consumers must be connected to markets. With respect to international connectivity, local policies need to be consistent with global standards: “Rules, regulations, and standards must meet at least a common regional structure, but preferably an international design” (Bhattacharyay and De, 2009).

Increasingly, an important part of infrastructure policy will be to establish and respect environmental norms. Infrastructure can have powerful impacts on the environment, both positive and negative. Road transport causes air pollution, whereas mass transit systems can reduce this externality for a given level of economic activity. Electricity generation can be based on petroleum fuels, which are responsible for local air pollution and global warming, or on renewable fuel sources. At each step in building national infrastructure systems, the national government must balance environmental issues against other considerations, including financial concerns.

## **C. Policies to Encourage Connectivity**

### **1. Trade Costs in Asia**

While some countries in the region are preeminent world trading centers, across a wide swath of Asia and the Pacific firms face significant costs that burden and discourage trade. While the discussion often focuses on exports, the picture for imports is broadly similar. Imports suffer from administrative burdens that raise the costs to households and firms. There may be distinct asymmetries between the two flows, especially in localities that depend on exporting natural resource-based commodities. For example, ports in the less-developed islands in archipelagic Southeast Asia often need to maintain facilities for handling bulk cargoes of the locality’s exports, while facilitating the imports of the wide range of consumer goods that maintain living standards even in poorer areas of middle-income countries.

Table 3 provides a sketch by region of some measures of the costs of trade for Asia and the Pacific. Interestingly, although the regions are composed of countries with a wide range of policies and capacity, there is little variation among them in the average number of documents that need to be processed. The East Asian countries, long renowned for their participation in international trade, require an average of seven documents to expedite an export shipment; South Asia, with a reputation for trade-

discouraging administration, requires only two more. However, the OECD average of five suggests that there is scope for continued reform throughout Asia.

While the number of documents to be processed may seem innocuous, it is only one of the many elements that impose delays and costs on exporters. Overall, the average time to complete export shipments in East Asia is more than twice the OECD figure. Moreover, the larger the number of documents, the more approvals are needed from government officials, and the greater the likelihood that corrupt officials will take the opportunity to charge illegal fees to expedite shipments. Streamlining government operations is important on its own, but it is also part of improving governance more generally.

Table 3 **Costs of Exporting, by Region, 2006–2007**

Economy Name	Documents for Export (number)	Time for export (days)	Cost to Export (US\$ per container)
Developing Asia and the Pacific	8	33	1202
East Asia (16)	7	23	789
East Asia (15)	7	24	773
Central and West	9	59	2252
The Pacific	7	25	1018
South Asia	9	33	1180
Other developing	7	28	1325
OECD 1	5	10	908
World	7	27	1239

- Notes: 1 Czech Republic, Hungary, Mexico, Poland, Slovak Republic, Turkey and Republic of Korea are not included in OECD average as they are grouped into developing countries. Other 23 OECD economies are included.  
 2 The world aggregated were estimated based on available data from 179 countries.  
 3 East Asia (15): Brunei Darussalam; Cambodia; People's Republic of China; Hong Kong, China; Indonesia; Korea, Rep. of; Lao People's Democratic Republic; Malaysia; Mongolia; Myanmar; Philippines; Singapore; Taipei, China; Thailand; Viet Nam.  
 4 East Asia (16): East Asia (15) and Japan.  
 5 Central and West Asia (8): Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, Uzbekistan.  
 6 South Asia (7): Afghanistan, Bangladesh, India, Maldives, Nepal, Pakistan, Sri Lanka.

Source: World Bank. Doing Business Database. <http://www.doingbusiness.org> (accessed 10 July 2008).

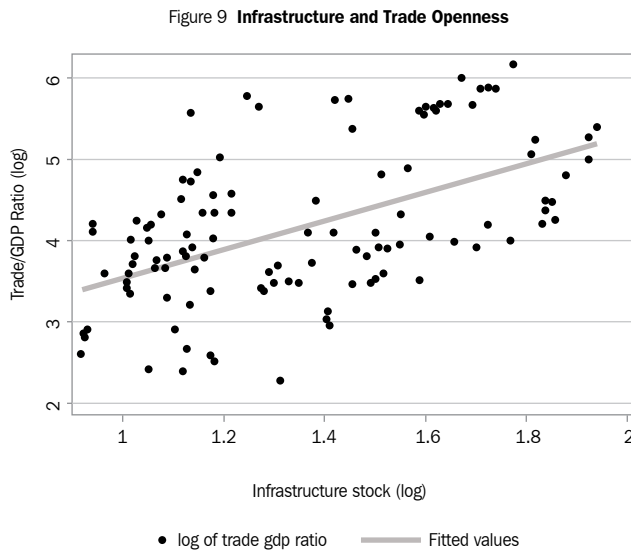
On balance, taking into account labor and other costs, the total costs of exporting from East Asian countries are slightly lower than from the OECD (Table 3, column 4). However, in other parts of Asia and the Pacific, the costs are significantly higher. Partly owing to documentary and time delays, exporters in Central and West Asia face twice the costs of their counterparts in the OECD and East Asia. This is partly a matter of geography: Central Asia depends on long-distance truck traffic, while East Asian exports can access relatively inexpensive ocean shipping. However, the presence of physical challenges only serves to reemphasize the need for governments to make greater efforts to reduce any costs over which they have control, including soft infrastructure.

## 2. Policy Reforms to Lower Costs and Expand Trade

Programs to improve in a coordinated fashion trade-related hard and soft infrastructure can reduce total effective trade costs. This can be one of the most important pathways

for infrastructure to enhance growth. The point cannot be overstated: for small countries, landlocked nations, or isolated regions within larger countries, infrastructure can dramatically change economic geography.

Empirically, trade openness and the stock of infrastructure show a positive correlation (Figure 9). This reflects the fact that infrastructure can lower trade costs and increase trade, but it also shows that Asian countries believe that trade is a good strategy for development and are willing to invest in trade-related infrastructure and to adopt policies that encourage trade.<sup>24</sup>



Sources: A. Raychaudhuri and P. De. 2010. *Trade in Services in India: Way forward to Reduce Poverty and Inequality*. In A. Stoler et al. eds. 2009. *Trade and Poverty Reduction in the Asia-Pacific Region*. Australia: Cambridge University Press.

Recognizing this, there is much that can be done to improve infrastructure connectivity. Brooks and Stone (2010) note that across Asia, border crossings are served by facilities that lack capacity to handle existing traffic volumes and customs procedures lack the transparency and predictability that could discourage corruption.

The literature and policy discussion on this subject shows that customs, immigration, quarantine, and security policies are especially important for encouraging trade. Each has its own challenges, but all require transparent procedures and administration in an atmosphere free of corruption, a shift from paper forms to electronic systems, and capacity among government staff.

- **Customs.** Examining cargo at border stations can be costly, especially individual trucks. Single-stop and single-window customs arrangements and pre-border

<sup>24</sup> Green (2008) discusses the relationship between trade and development in Southeast Asia.

inspections can help. The GMS Program has focused especially on making it easier for trucks transiting third countries to move quickly across borders; for instance, easing the movement of cargo from Bangkok through Laotian territory to Kunming. Similarly, CAREC has worked to reduce border delays and corruption that impedes trade and travel between the PRC and Kazakhstan. For example, a study by Ma and Zhang (2009) of port facilities in Shanghai concludes that the difficulties posed by overloaded, inefficient physical infrastructure are exacerbated by unpredictable customs procedures. In Suzhou Park, also in the PRC, Hausman, Lee, and Subramanian (2005) find that money and time costs could be lowered in free-trade zones by better customs procedures. In Pakistan, putting in place a computerized customs system at the Karachi International Container Terminal reduced the clearance time for containers from 4–5 days to less than 1 day (Jafri, 2011). Policy reforms of this type spur investment broadly in an economy (Weiss, 2008).

- **Immigration.** Transparent, predictable border crossing for people would reduce uncertainty and encourage travel for business or tourism. ASEAN has worked for a number of years to provide ASEAN-wide visas that would enable businessmen and tourists to travel more easily across the region. This would give an important boost to the establishment of the ASEAN Economic Community.
- **Quarantine.** Predictable, reliable sanitary and phytosanitary rules and regulations are imperative for the export of crops and animal or fishery products that have limited shelf lives, especially for countries with a comparative advantage in exporting agricultural products. National standards must be compatible with those of export markets.
- **Security.** OECD markets require higher and higher security standards to reduce the risk of terrorism or environmental impacts from accidents. National exports must meet these standards. If not addressed, this issue could exacerbate the development divide across Asia. Trade centers, such as Singapore, help define international standards, but ports and airports in poorer countries will struggle to meet increasingly expensive and technically demanding standards.

One way in which infrastructure systems can support trade is by encouraging trade diversity. Shepherd (2009) notes that most trade studies focus on existing trade; for instance, estimating the sensitivity of existing trade flows to changes in tariffs or other trade-related costs. However, easing trade barriers and trade costs can also open up new markets for existing goods and services, as well as allow new goods and services to be traded. Shepherd suggests that more diversified economies tend to have higher growth prospects and exhibit less poverty; however, diversification needs to be weighed against the gains from specialization.<sup>25</sup>

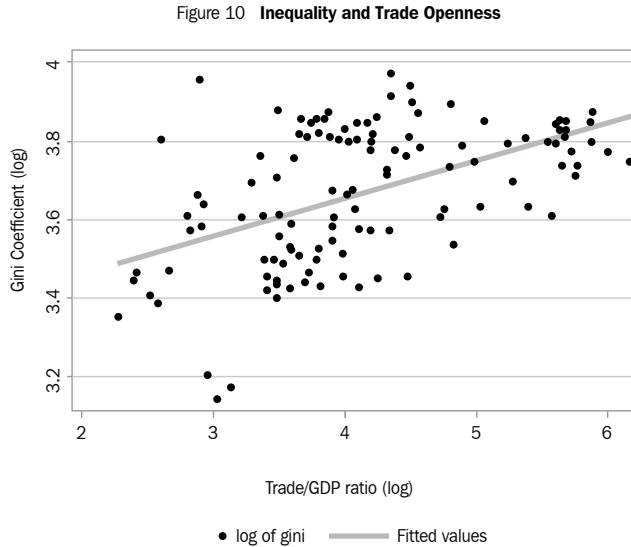
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25 Duval and Utoktham (2009), in a study sponsored by the United Nations Economic and Social Commission for Asia and the Pacific, also conclude that enhancing trade facilitation infrastructure and institutions can encourage export diversification, especially by expanding the markets served.

Reflecting the diversity of policies and the range of statistical measures of these policies, researchers have studied the issue of how policy affects trade in different ways. Generally, however, the literature supports the proposition that improvements in soft infrastructure can lead to higher levels of trade both within a country and internationally. For example:

- Khan (2006) provided a framework that shows soft policy deficiencies as costs imposed on trade. Similar to tariffs or nontariff barriers (quotas and technical restrictions), soft policy deficiencies, such as delays in customs clearance or the need to pay bribes to move goods along transport routes, are costs that affect trade volumes and therefore income from trade-related occupations. Although a comprehensive dataset is not available, Khan suggests that these broadly defined costs may be much higher than the more familiar tariff and nontariff barriers. Charges for shipping services (documentation fees, container handling charges, and government taxes and levies) may account for much of total real trade costs and could be greater than the basic freight transport expenses. Policy reforms to introduce more appropriate soft infrastructure can lead to lowered trade costs and higher trade volumes.
- Patunru, Nurridzki, and Rivayani (2009) found that in Indonesia the policies affecting the efficiency of port operations are the constraints to trade rather than the hard infrastructure of the ports themselves. Abe and Wilson (2009) suggest that enlarging port capacity by 10%, either through hard or soft infrastructure improvements, is equivalent to lowering tariffs by 0.3%–0.5%.
- Wilson, Mann, and Otsuki (2003) argue that improving the efficiency of port operations and lowering regulatory barriers can each encourage trade. Looking at trade between Asia-Pacific Economic Cooperation (APEC) countries, they estimate that flows could rise by about one-fifth if all APEC countries with below-average performance moved 50% toward the average performance.
- Martinez-Zarzoso and Marquez-Ramos (2008) focus on statistics such as the number of days and documents required to conduct trade as measures of nontariff trade costs. They calculate very precise measures of what might be called “elasticities of trade with respect to costs.” For example, they conclude that a decrease of just \$1 in the cost of exporting one standard container results in exports rising by almost \$11,000. Similarly, reducing the time required to export goods by one day leads to a 0.22% increase in exports.
- Portugal-Perez and Wilson (2010) constructed a set of measures of the provision of hard and soft infrastructure services, using factor analysis to narrow down a large set of possible indicators. These indicators were set against export performance. The authors conclude that improvements in infrastructure quality would encourage exports, with physical infrastructure having an especially large impact.

Lower trade costs have been shown to encourage trade and economic growth; however not all growth is inclusive, and therefore the impact on inequality of lower trade costs is more ambiguous.<sup>26</sup> Trade by itself it does not present sufficient conditions to achieve inclusive growth. Figure 10 reinforces this conclusion by showing that inequality tends to be associated with trade openness.



Sources: Raychaudhuri, A. and P. De. 2010. *Trade in Services in India: Way forward to Reduce Poverty and Inequality*. In A. Stoler et al., eds. 2009. *Trade and Poverty Reduction in the Asia-Pacific Region*. Australia: Cambridge University Press.

The key challenges are to pursue a policy environment that builds on the potential of infrastructure to enhance growth, and ensure that this growth is inclusive. The corresponding regional challenge is to encourage cooperation among countries to bridge the development gaps between nations.

### 3. The Role of Regional Cooperation in Overall Policy Environment

Regional cooperation can have a strong impact when it provides a structure and program for coordinating soft infrastructure; particularly the rules, regulations, and institutions related to trade. A significant effort by the member countries of ASEAN toward establishing the ASEAN Economic Community involves building compatible and consistently applied trade rules. This effort in Southeast Asia mirrors wider efforts in other parts of Asia to lower tariffs and generally encourage trade, especially in Central Asia through CAREC and in South Asia through SAARC.

<sup>26</sup> These issues are treated in Hulten (1996), Datt and Ravallion (2002) Pinstrup-Andersen and Shimokawa (2006), Calderón and Servén (2005), and Levine and Renelt (1991).

Bilateral and multilateral trade agreements have had success in lowering formal tariff rates and otherwise lowering trade costs. However, electricity trade in South Asia has been hampered by the sheer challenge of harmonizing institutional and technical issues (ADB, 2011c). Similarly Bhattacharyay (2011, p. 16) notes that a lack of harmonization of customs operations, as well as other policies that discourage cross-border movement, has limited cross-border trade and travel along inland waterways in South Asia.

The GMS has encouraged soft infrastructure development as a complement to its huge hard infrastructure investment program. One example is the GMS Cross-Border Transport Agreement (CBTA), a transport facilitation agreement to encourage cross-border movement in mainland Southeast Asia and southern PRC. An early goal was to facilitate the transit of trucks through third countries for trade in goods. Easing border delays and costs was a powerful stimulus for trade between the PRC and Thailand through the Lao PDR. This ongoing effort focuses on limiting national restrictions on international truck traffic and providing for reciprocal recognition of licensing and insurance. Key efforts involve ensuring that (i) cargo does not have to be unloaded and then reloaded onto different trucks, (ii) inspection systems are transparent and are the minimum needed to ensure compliance with national standards, and (iii) pilot programs at given border crossings can be scaled up across the region.

The complexity and scale of the challenge is evident in the nearly two dozen separately negotiated implementing agreements (annexes or protocols) in the CBTA that govern a wide variety of issues. These typically need to be ratified, passed into national law, or drawn up in national regulations. Furthermore, the new laws and regulations are meaningless until the administrative capacity is developed to implement them.

The CBTA provides a potential template for other parts of Asia, particularly Central Asia with CAREC and South Asia with SAARC. Crossing facilities in the border areas of these regions are sometimes overcrowded and poorly maintained and administered, compounding the problem of costly land transport. Policy reforms coordinated among the neighboring countries could considerably reduce the real costs of trade. In particular, the complex border-crossing requirements currently in place and weak administrative capacity provide openings for corruption. This discourages formal trade and encourages traders to turn to informal routes and trade.

Ongoing regional cooperation programs face significant challenges to ensure that the less developed and poorer member states are able to gain the capacity to meet the standards adopted by the group. This aspect of the development divide is particularly apparent in ASEAN. Singapore, for example, is at the forefront with port and air travel facilities that meet and help define international best practices, while member states such as Cambodia and the Lao PDR will struggle to adopt and implement similar standards. Process is made easier if the rules and procedures themselves are standardized, allowing for dissemination across a regional grouping.



The challenges are specific to each country; however, at a minimum each country must move from paper-based records and procedures to digital, computer-based systems (UNESCAP, 2009). Equally important is the need to ensure that there is effective and appropriate national and regional coordination of programs. At the national level, many countries have difficulties in ensuring effective interagency cooperation. This is particularly important in advancing trade reforms that often require the cooperation of a variety of line ministries or agencies, including finance, customs, health, planning, and transport.

#### **4. The Role of Logistics Industries in Realizing Connectivity Potential**

The logistics industry, made up of firms that handle the movement of goods from seller to buyer, is crucial for ensuring that the trade in goods materializes once hard and soft infrastructure are in place. A country needs firms that can operate locally, regionally, and internationally in an efficient and profitable manner.

Arnold (2009) cautions that different goods have different sensitivities to trade costs and the need for logistics services. The smaller, lighter, and more valuable a good, the higher the transport or trade costs it can bear. Thus electronic subcomponents for computers and cut flowers are shipped by air, but coal is transported by sea. Some commodities, including most agricultural products, have shelf lives that limit the time available to move the goods to their final markets. Other goods are time sensitive because they are needed in production processes or fulfill seasonal demands.

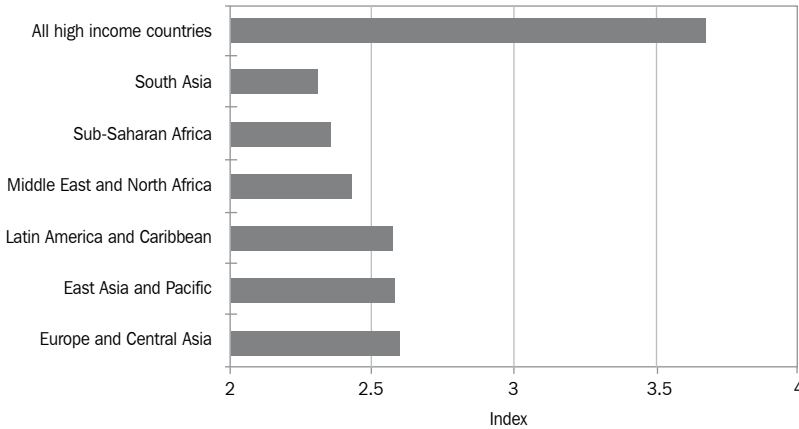
Adding to the complexity, multimodal operations are essential to broad participation in international trade. This is especially true with the increasingly prevalent and important distributed production networks pioneered by Japanese enterprises and expanded by other multinational firms. These are complex production organizations in which intermediate processing is sited in different countries, based on small but important cost advantages. Development in East and Southeast Asia has come to rely on such networks.

The intermediate goods produced by these networks need to be moved from production site to production site without trade and transport costs erasing location-specific advantages. “Just-in-time” inventories and other cost-saving business processes associated with these lengthening supply chains are crucially dependent on the logistics industry. To make this process work, infrastructure investment can help establish centers for cluster-based production where firms can benefit from and feed into economies of agglomeration.

Logistics firms need to be efficient. In Figure 11, an index reflecting a wide variety of measures is used to compare the economic efficiency of the logistics industry in different regions of the world. The figure shows the clear difference between relatively costly South Asia and the more trade-friendly East Asia. It also emphasizes the scope of the problem confronting developing countries: The data for high income countries

shows that their logistics industries are considerably more efficient than those found in any of the other regions listed, all of which are dominated by poor developing countries. There is undoubtedly some mixed causality in this picture: richer countries can afford better logistics systems; however, it is powerfully suggestive that for development to proceed, a country must improve its logistics services.

Figure 11 International Logistics Performance Index



Note: International logistics performance index mainly reflects infrastructure, customs, international shipments, logistics competence, tracking and tracing, domestic logistics costs, and timeliness.

Source: Arvis et al 2007.

In Asia, Hong Kong, China; Japan; the Republic of Korea; Malaysia; Singapore; and Taipei, China all have firms that meet or indeed define world logistics standards. Efficient, competitive pricing and services are found in air and marine ports in these economies. Multimodal transfers work smoothly to move goods between air, land, and sea. These industries have emerged as a result of public–private investments in hard infrastructure and policies that enable these facilities to be used efficiently. Low-income developing countries face considerable challenges to compete with the established industries in these economies.

Logistics services determine much of countries' overall transport or trade costs. Examining South Asia, De (2009b) found that inland transport costs account for about 88% of overall trade transport costs in South Asia. In this huge region, inland transport costs are very high, except in Sri Lanka. Although they vary across goods and countries, overall the high costs lower international competitiveness and discourage trade development and poverty reduction.

The impact of lowering transport logistics costs can be considerable. A multi-country study by Carruthers and Bajpai (2003) concludes that a 20% reduction in logistics costs would increase the trade-to-GDP ratio by more than 10%–20% in countries as diverse as Cambodia, the PRC, the Lao PDR, Mongolia, and Papua New Guinea.

Policies to encourage the logistics industries need to take many forms. Policies that encourage trade will also spur the growth of logistics enterprises; and regulations affecting transport vehicle registration, insurance, and safety all affect logistics operations. Competition policy is important as the logistics industry needs to be grounded in competitive markets to be able to spur trade and growth. Noncompetitive logistics services will mean high trade costs and lower growth prospects. Policies that restrict carriage to national firms—common in trucking and coastal sea transport—are examples of barriers that restrict competition.

However, it may not be feasible to achieve a competitive logistics industry in small countries which cannot support more than a limited number of firms. Partly as a result of a lack of economies of scale, relatively rich Brunei Darussalam has a small logistics sector that is not internationally competitive.<sup>27</sup> To address this problem, the country should open borders to allow cross-border service provision and to achieve regionally competitive markets. Competitive industries will require regulatory agencies that can act in the nation's interest and resist "capture" by the industry.

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27 Personal interviews in Brunei Darussalam with logistics sector representatives and David Green, April 2011 [citation]



## CHAPTER 5

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# PUBLIC–PRIVATE PARTNERSHIPS

*Public–private partnership includes a range of possible relationships among public and private entities in the context of infrastructure and other services. The main purpose is to attract private capital investment (often to either supplement public resources or release them for other public needs); increase efficiency and use available resources more effectively; and reform sectors through a reallocation of roles, incentives, and accountability.*

(ADB, 2008b).

### A. Introduction

Providing for infrastructure needs in developing countries is one of the most important and demanding roles of their governments. Infrastructure projects are expensive, especially for poorer developing nations, which have relatively less resources than the richer ones. Moreover, governments do not always possess the necessary project management skills to execute them. Worse still, the operation of complex infrastructure systems, especially utilities, creates a fundamental conflict of interest because the government is both operator and regulator. One possible solution is to involve the private sector in infrastructure provision by adopting public–private partnerships (PPPs).

### B. Public–Private Partnerships in Asia

PPPs are found in a wide range of infrastructure development, including

- utility services: electricity generation, transmission, and distribution; natural gas transmission and distribution; and water and sewerage (storage and flood control, sanitation services, and water treatment); and
- transport: airports; railways and urban mass transit; road systems (rural, urban, and highway); and water transport (ports and inland water systems).
- the private sector can help provide better information and other services to citizens, thereby improving governance (Box 10).

In some cases, the emphasis is on the public sector taking a strong position, so the term “private sector participation” is used. Sometimes the focus of partnership can be in one aspect only, such as meeting the financing requirements, construction, or service operation. The varying forms of partnerships reflect the different allocation of responsibility between the private and public sectors. There are many names for the various partnerships, although their meaning and use are not standardized. The common types of PPPs are:

- **Build–design–operate.** The private sector designs, constructs, and tests the facility; then operates it, while the public sector retains the ownership.
- **Build–operate–transfer or build–transfer–operate.** The private sector designs, constructs, and tests the facility, sometimes operating it or transferring it to the public sector for operation after some time.
- **Build–own–operate.** The private sector builds and retains ownership of a facility, in addition to operating the project.
- **Operation and maintenance.** Private sector operates and maintains a facility owned by the government.

**Box 10 An Information System that Improves Governance:  
The Philippines Civil Registry System**

De Vera and Gabriel<sup>a</sup> describe a public–private partnership initiated by the Government of the Philippines to provide people with vital documentary information needed to allow them to participate in a modern formal society. The project improved the capacity of the National Statistics Office to provide ready access for people to civil registration data, including records of births, marriages, and deaths. The earlier paper-based systems were slow to access and subject to illegal manipulation, a source of corruption. To address the problems, in 2000 the government initiated a \$65 million public–private partnership project under a build–transfer–operate structure. Ten years on, over 135 million documents have been introduced into the system in digital form and nearly 97% of all requests for documents are handled through the computer database. The project has reduced the waiting time for citizens and improved governance.

a De Vera, M.J. and D.A. Gabriel. 2011. The Public–Private Partnership Case of the Civil Registry System of the Philippine National Statistics Office. Discussion paper presented at the conference on Infrastructure for Inclusive Growth and Poverty Reduction. Manila. 14–15.

Source: Summarized by the author.

In addition, there are various types of service contract where the private sector supports some aspects of operation or maintenance of a public sector facility, as well as management contracts, in which the private sector contributes to the management of the facility. The potential for involving the private sector is expected to lower operating costs and raise service reliability and quality. These are the important reasons for entering into PPPs.

Asia has a good record of PPP implementation. There have been more than 1,500 PPP projects in infrastructure in East and South Asia in less than 2 decades (Table 4). Most of them have been in the PRC and India, countries with rapidly growing economies and relatively capable government agencies. In a relatively small country like Sri Lanka, there have also been 22 private sector participation initiatives and in Nepal there have been 8 partnerships. In South Asia, most PPPs are in telecommunications and energy,

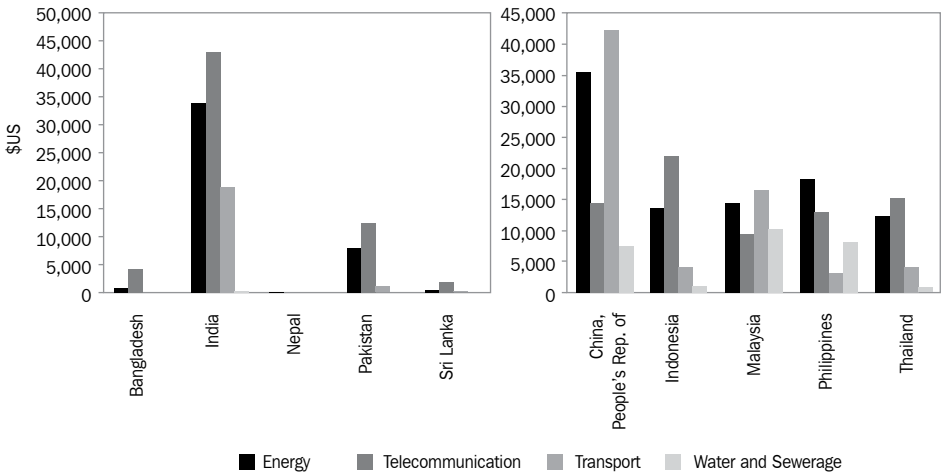
although India has also involved the private sector in public transport (Figure 12). In Southeast Asia, PPPs are important for telecommunications, energy, and transport; while in the PRC and Malaysia, PPPs are most evident in transport (Figure 12).

Table 4 Private Participation in Infrastructure, East and South Asia

Country	Total Investment, US\$ million	Number of Projects	Population, million	Income Category
Bangladesh	5,367	23.0	149.0	Low income
India	96,130	306.0	1,131.9	Low income
Nepal	404	8.0	27.8	Low income
Pakistan	21,715	47.0	169.3	Low income
Sri Lanka	2,640	22.0	20.1	Lower Middle Income
China, People's Rep. of	99,969	805.0	1,318.0	Lower Middle Income
Indonesia	40,676	87.0	231.6	Lower Middle Income
Malaysia	50,204	96.0	27.2	Lower Middle Income
Philippines	42,243	88.0	88.7	Lower Middle Income
Thailand	31,954	96.0	65.7	Lower Middle Income
Total	391,302	1,578.0		

Source: World Bank. Private Participation in Infrastructure Database; and Population Reference Bureau. 2007. World Population Datasheet.

Figure 12 Infrastructure Projects with Private Participation in Asian Countries, 1990–2007



Source: World Bank and Private Participation in Infrastructure Advisory Facility (PIIAF) Project Database.

### C. Benefits and Costs of Public-Private Partnerships

It is important that PPPs achieve the right balance between risk and reward for both government and private partners. The partnership must be attractive for the private sector, but the public sector should not pay more than is needed to attract private sector resources—financial or managerial. PPP designs include calculations of revenue streams to support operational expenses and defray or pay back capital expenses. Deciding on

these revenue and payment flows can be extremely difficult, involving setting utility rates and providing compensation to the private sector. If the project involves foreign firms operating in high-profile sectors, the political stakes can become very high.

The benefits of a PPP depend upon the nature of its structure and the sector. In general they are as follows:

- Involving private sector financing can ease public sector debt and expenditure burdens. However as the public sector can usually borrow long-term funds at lower costs than the private sector, this must also be taken into account when planning for any given project.
- Private sector financing in PPP can be a catalyst to help domestic financial markets develop. Avoiding the use of public funding reduces the risk of public sector borrowing crowding out private investment. We may see “crowding in” of private sector investment as success in PPPs, both funding and project, provides confidence and institutional arrangements to encourage activity and risk-taking in other sectors.
- Private sector administration can often obtain more specialized, experienced, and skilled personnel. The higher staff costs can be offset by greater administrative efficiencies in planning, implementation, and operation. Quicker project cycles can therefore be beneficial.
- Private sector involvement can lead to better service provision. Managerial skills in a competitive private sector survive market tests and, if brought into infrastructure through PPPs, can lead to lower service provision costs and higher quality given the right policy environment.
- The act of investing in large infrastructure systems, employing people, and buying construction materials can stimulate broader economic activity. However, it may be difficult to use infrastructure spending as a fiscal stimulus during recessionary periods (Box 11).

The wide range of possible positive impacts of PPPs explains their popularity, especially in harnessing private sector resources for development. Financing is often the main reason for PPPs, particularly in developing countries where expensive infrastructure projects can be well beyond the financing capacity of the governments.

The Theun-Hinboun Hydropower Project in the Lao PDR in 1990s is a good example of a PPP in energy development. The project exported 95% of its electricity output to Thailand, earning significant revenues for the Government of the Lao PDR. The total project cost of \$240 million was beyond the government’s capacity. The financing structure developed provided for 46% equity and 54% debt, with 60% of the equity held by the government and 40% held by Nordic and Thai investors. To allow the government to cover its equity portion, ADB, the United Nations Development



Program, and Nordic assistance agencies provided \$66 million in loans and grants. The government also received considerable assistance for capacity building to enable it to negotiate effectively with highly skilled, experienced private sector operators.

**Box 11 Public–Private Partnerships**  
**Complicate the Use of Infrastructure in Fiscal Stimulus Programs**

Economic crises create a sense of urgency about infrastructure programs. It is generally accepted that large infrastructure programs can, independent of the projects, themselves be part of a solution to weak economies. The spending on construction, labor, and materials purchases can be a powerful boost to a recessionary economy. Conducting infrastructure projects during recessions can mean lower costs of construction, allowing limited fiscal resources to stretch further.

As the current global economic crisis materialized in the latter part of the last decade, the collapsing international trade environment encouraged some governments, especially those in East and Southeast Asia, to devise programs of fiscal stimulation, including infrastructure projects. The Philippines and Singapore moved particularly quickly to try to use fiscal resources to combat the economic slowdown.

However, infrastructure projects, especially large public–private partnerships, are highly complex, and cannot easily be started and implemented within the time frame for fiscal stimulus. Moreover, increasing requirements for community consultations, environmental assessments, and good governance institutions all make projects difficult to initiate and implement quickly.

Infrastructure can be a part of fiscal stimulus packages only to the extent that projects can be started or accelerated within a time period of months, not years. They need to be “shovel-ready.” Few countries in Asia have made the necessary investment in planning to be able to jump-start infrastructure projects to meet countercyclical goals.

Source: Summarized by the author.

A key consideration for private sector participants in any PPP is the return to their effort and assumption of risk. Some sectors and projects are easier to structure than others. Toll roads connecting urban areas are easier to implement than rural roads since rural roads often offer low traffic density and therefore revenue collection is more difficult. Rural roads may also yield lower financial returns to investment than toll roads that connect economic centers. Rural roads, however, can have high social returns because they link people, schools, and health facilities. Accordingly, they may require considerable public subsidies to bring partnerships to fruition and this can complicate implementation. Getting the subsidies, process, and results right, including in politically acceptable terms, is very difficult, and this has resulted in a number of PPP failures (Jones, 2006, p. 9).

From the beginning of project planning, there must be clear agreement about the nature of the service, the service conditions, pricing, and likely demand. This is an extremely complex exercise that is further complicated by the dynamic changes in the

national and global economy. There are risks to basic economic assumptions in any PPP. For instance, a PPP to provide an urban road and rail system in Bangkok failed partly because of the market competition from a nearby toll road had not been accommodated in the cost–benefit structure (Tam and Leung, 1997). Bhattacharyay (2011) identifies six categories of risks that must be faced in project design: exchange rate, inflation, commodity price, credit (relating to project financing), demand (traffic), and economic risks (how the economy will perform).

Infrastructure services cannot be accommodated through supply and demand of competitive markets. The characteristics of infrastructure (especially its public goods aspects) mean that optimal service levels will not follow from the choices of private sector firms. Moreover, the need of a government’s role implies that PPPs are designed and implemented as part of a political decision-making process. Therefore, in the best case scenario, a well functioning democratic institution is brought into play, while at the opposite extreme, all issues, even purely technical ones, can be debated in highly politicized environments that creates political risks.

#### **D. Good Governance for the Success of Public–Private Partnerships**

Creating and using appropriate public sector institutions are important. This includes the need for the government to set and enforce standards, such as on safety, service, and price. Market forces cannot be relied upon to make these decisions. Infrastructure is often a natural monopoly, and in any given locality there may only be one service provider. Even in the planning stage, such as tendering for contracts, it is likely that only a handful of firms will have the technical skills and market presence to be able to compete. Therefore, the involvement of the public sector as a regulator is necessary for efficient service provision and pricing.

Sometimes, because of history, the public sector plays the both role service provider and regulator simultaneously. This is likely to result in one or the other tasks not being fulfilled adequately. A degree of separation can be achieved by inviting the private sector to provide some of these needs. Greater involvement of private enterprises, through privatization or operating concession awards, reallocates roles and incentives and is therefore one approach to reform.

It is very important to separate the role of regulator and service provider when seeking to meet social goals. For example, utility service charges often have a “lifeline” pricing element in which fees for low-level usage of a service by low-income groups may be subsidized by richer groups. This fee structure requires careful balancing of broad social goals since the price structure essentially allocates benefits among different consumer groups differently. Such a price scheme cannot escape political scrutiny so that it must be determined in the most appropriate way to reflect a good governance and a firm understanding of technical issues. Jones (2006, p. 16) discusses an example from India in which agricultural users of electricity receive such highly subsidized rates that private service providers are discouraged from entering the sector.

Structuring complex PPP can be complicated by issues relating to the extension of service provision. Often, poor neighborhoods lack electricity, sanitation, and water services and private sector firms sometimes shy away from targeting poor consumers. This is in spite of the fact that poor families often pay much higher unit fees for basic services than richer families, who are connected to well-functioning infrastructure systems.

Efficiently supplied water and electricity services need to be designed to meet needs at affordable prices. This, however, is both technically demanding and politically charged. Being able to make these decisions is a mark of good governance, which is crucial to providing a cost-effective, high quality PPP. Lack of good governance may result in distorted design and construction and increased project cost, thus reducing its overall value. In this context, autonomy, transparency, and accountability are critical for ensuring good governance as a basis for efficient, sustainable, and inclusive infrastructure projects.

Despite the high-profile nature of PPP infrastructure provision, governance is often a challenge. Provision of these services can make or break businesses, tempting them to influence government officials and leading to corrupt practices that reduce the quality of life of large numbers of people. Key measures in PPP are to limit discretionary decision making and to ensure that decision making by public bodies is made in a transparent, rule-based fashion.

The provision of infrastructure services involves public sector funds, prestige, and fiscal credibility. Infrastructure contracts are often one-of-a-kind operations in which government agencies have a little relevant experience. This makes them high-risk exercises. Ensuring that developing Asian countries have the capacity to plan, negotiate, and supervise infrastructure projects is very important. To complicate the issue, Asian governments are increasingly evolving into participatory, democratic institutions that affect their ability to conduct an efficient PPP exercise. While such institutions can provide better consultations to build public trust in the decision-making process, in many instances, decision making on a technical matter becomes embroiled in political disputes. Even when the political process works smoothly, the need to meet best-practice standards involves lengthy, expensive consultations with stakeholders.

The land-use issues central to many infrastructure projects are particularly subject to becoming political issues. Acquiring land or obtaining the rights to use land for roads, railways, pipelines, or transmission lines can be a very difficult exercise with limited alternatives, especially in crowded urban areas. In the absence of public authority or expertise to acquire land at fair prices, projects become vulnerable to speculators and holdouts that can imperil even well-structured projects.

Belford (2011) notes that Indonesia is planning to institute a new legal basis for public authorities to acquire private land, especially for infrastructure projects. The lack of such legal process has hampered infrastructure projects in the past, resulting in delays due to problems with land acquisition (Pranoto, 2011). Similarly, Bangladesh

approved the Land Acquisition Act 2011 to pave the way for implementation of an important urban transport project—the Dhaka Elevated Expressway Project (bdnews24.com, 2011).

Because of the difficulties of planning, building, and operating complex, large infrastructure systems, it is rare to find projects with no experience of setbacks, delays, or changes of plan. In poorer countries, the conditions are even more challenging. Some governments struggle with complex development plans while also needing to undergo widespread political reforms. For instance, the political changes since 2000 in Indonesia have been profound as decentralization has transferred responsibility for many aspects of the economy to local governments. At the same time, central government reforms have resulted in a legislative body that increasingly involves itself in overseeing line ministry operations. These challenges contribute to the problems of implementing ambitious infrastructure plans. In 2005, for example, the government planned to build toll roads with the involvement of the private sector, covering approximately 1,000 kilometers, mostly in Java. However, after nearly 4 years, only about 20% of the planned route had been either completed or well started (*Reuters*, 2009).

In some cases, failures or alleged failures in infrastructure and PPP themselves become political issues. The Philippines experienced a very difficult build–operate–transfer project involving the construction of a new airport terminal in the capital, Manila. Delays, cost overruns, and disputes between the government and the contractor were all exposed to the public spotlight that could discourage other PPPs. The case highlights the need for processes and institutions that can resolve problems and differences between stakeholders in a timely and responsible manner without risking the project itself. Paderanga (2011, p. 38) cites that the “failure of the judicial system in settling issues and debt resolution” is a key factor in hindering the greater use of PPPs in the Philippines.

Globally, PPPs have proven to be a potentially valuable modality for infrastructure provision. However, empirical evidence shows that they can also be problematic that result in a failure.<sup>28</sup> The following factors contribute to PPP failure:

- **Political risks.** Failure to be able to agree on, commit to, and implement a program considered equitable to both parties puts a PPP at risk. Infrastructure development with project cycles of more than a decade requires comparable political consistency and commitment—something that is difficult in the context of evolving democratic institutions in much of developing Asia.
- **Unforeseen economic conditions.** Project planning needs to correctly assume crucial economic variables, such as exchange rates, interest rates, service fees, and labor and other input costs. If economic conditions change in an unexpected

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<sup>28</sup> Jones (2006) notes that there had been “high hopes” in the 1990s for the private sector to assume a major role in infrastructure provision in developing countries; however these expectations have largely not been realized due to the many difficulties facing PPPs. See his discussion of the reasons for this, mirroring many noted in this book.

way, the plan's viability could be in jeopardy. The initial plan to apportion risks and returns must be seen as equitable, otherwise there will be risks that one side or the other will try to renegotiate or renege. The current considerable uncertainty about the future growth in any economy further complicates project planning. All projects involve risks that can be minimized, but they can never be entirely avoided.

- **Lack of capacity.** Low capacity on the part of government agencies or the private sector can result in complex projects, and time-dependent processes may fail to materialize. Land acquisition, procurement, and environmental impact assessments all require particular technical skills that may be lacking. In some cases, dedicated PPP agencies can help develop this capacity, but they need resources to conduct studies, including feasibility studies, to understand as much as possible about the opportunities and risks of a project.
- **An uncertain or unreliable legal system.** A weak legal system can discourage the private sector from entering into PPP arrangements. Private investors require confidence, and only unbiased, impartial, noncorrupt institutions can provide them with some protection and assurance in the event of disagreements with other stakeholders, including the government, and ensure contracts are enforced.
- **Access to financing.** Access to financing consistent with international norms is important to ensuring that expensive systems yield benefits commensurate with the risks. The current period of international financial uncertainty, however, carries with it unprecedented challenges; and while interest rates are at historically low levels, concurrently lenders are reluctant to lock-in funds for a long-term financing in this uncertain situation.
- **Lack of continuous dialogue.** Continuous dialogue between the government and the private sector is necessary to better understand the willingness of the private sector to participate in infrastructure investment programs. Good communication can also ensure that the public sector can take steps to address implementation problems as they emerge.

## E. The Role for International Financial Institutions

The huge financing needs, importance of developing government capacity, and need to bring international best practices to PPP provide scope for international financial institutions to support developing countries in their infrastructure development and facilitate private sector involvement. International financial institutions can also support the development of regional infrastructure.

In Asia, ADB and the World Bank have established programs to support PPP in national and regional infrastructure projects. During 1990–2011, ADB lent \$58.6 billion from market-linked funds and \$11.8 billion from the Asian Development Fund in support of PPP-related projects.

The ADB has been particularly active in a host of regional initiatives in Asia, helping organize the first meetings and providing continuing assistance for CAREC and the GMS. In the GMS, ADB has helped coordinate over \$12 billion in infrastructure investments that have cross-border impact. Many of these projects have private sector participation, including the Laotian Theun-Hinboun Hydropower Project (p. 68).

## CHAPTER 6

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# CONCLUSIONS AND POLICY IMPLICATIONS

Asian countries face tremendous challenges in providing for infrastructure needs and maintaining growth momentum. About 0.8 billion people still lack basic electricity, 1.8 billion are not connected to basic sanitation services and 0.6 billion do not have access to safe water. ADB studies suggest that meeting the requirements for infrastructure development to maintain the current growth level until 2020 requires a total investment of \$8 trillion. This is a huge amount. Maintaining the investment and growth level will help determine whether the 21st century will be the Asian century, in which living standards in the region is to rise to equal Europe's current standard by 2050.

The provision of hard and soft infrastructure demands active public sector involvement. This is because infrastructure has public good characteristics, such as huge financing requirements and large externalities. The private sector cannot be expected to provide infrastructure needed by the economy, and the governments need to take the responsibility for planning and ensuring that infrastructure needs are met by working in collaboration with the private sector through public–private partnerships (PPPs).

Empirical studies help understand the complex relationship between infrastructure and economic performance, which is measured in terms of economic growth and poverty reduction. This book develops a framework to show how soft infrastructure and PPP can support the development and functioning of infrastructure that in turn support inclusive growth and reduce poverty. Infrastructure development achieves this by (i) creating additional jobs and economic activities, (ii) reducing production costs through improvements in transport and connectivity, (iii) expanding overall production capacity, (iv) connecting markets and other economic facilities, and (v) improving access to key facilities. Therefore, good infrastructure development will support inclusive growth and reduce poverty.

The rapid growth of the PRC economy is a good example of understanding how infrastructure investments improve growth inclusiveness and reduce poverty. Infrastructure development in the PRC has reduced trade and transport costs, encouraging growth and helping shift labor from agriculture to urban areas.

Transport infrastructure is generally considered the important component of infrastructure development. Roads, railways, airports, and water transport systems provide facilities to improve national and international trade. This has contributed to the success of the development strategies in East and Southeast Asia. Improvements in regional transport systems are also essential to connect the 12 landlocked Asian countries with their neighbors and global markets.

It is important to note that the differing development stages and economic structures among countries may result in inconclusive findings from the studies on the relationships between infrastructure, growth, and poverty reduction. However, the empirical work suggests that infrastructure investments have the greatest impact in the presence of other, supportive actions. For instance, rural roads, irrigation systems, and electrification programs have the greatest impact on promoting growth and reducing poverty when strong education and/or health programs are also present.

### **A. Soft Infrastructure, the Crucial Policy Environment**

Soft infrastructure is an integral part of infrastructure development. The proper functioning of hard infrastructure, such as roads and railways, electricity, telecommunications, and water, requires less visible soft infrastructure in the form of government policies, regulations, and institutions. Accordingly, good governance is necessary to ensure that the policy environment created supports the optimal functioning of the hard infrastructure system. For example, the regulations governing the development and operation of infrastructure must be clear, consistent, fairly applied, and reflect international best practices.

Empirical studies show that some soft infrastructure, such as documentary requirements, operational efficiency, and operational fees, can be as important an influence on trade as tariffs or freight charges. Therefore, customs, immigration, quarantine, and security policies must be part of a trade-encouraging policy environment to ensure that trade will support growth and reduce poverty.

Environmental policies are also part of soft infrastructure. Transport and energy infrastructure, for instance, can produce negative externalities, such as air and water pollution and greenhouse gases that contribute to a global warming. These externalities must be considered in evaluating the costs and benefits of infrastructure development.

A trade-encouraging policy environment is also important for the logistics industry. A competitive logistics industry that minimizes trade costs is a prerequisite for firms to be able to compete internationally.

National infrastructure development also needs to be seen in the context of regional and global economies. Regional cooperation initiatives such as the Greater Mekong Subregion (GMS) Economic Cooperation Program help participating countries to establish consistent policies that encourage cross-border trade. The GMS has streamlined transit procedures to reduce the costs of truck-borne trade in mainland Southeast Asia. From a country perspective, regional infrastructure programs also provide support for the relatively poorer countries to build their capacity to administer complex, demanding tasks and policies.

### **B. Public–Private Partnerships, the Key to Enhance Infrastructure Development**

Various forms of PPP have been used in a wide range of infrastructure projects in Asia, particularly for transport, energy, and water supply. Involving the private sector in



infrastructure development and provision can scale up the level of services and leverage a country's fiscal resources to allow scarce funds to be channeled to other pressing needs. PPPs can also bring in private sector skills and expertise to augment the services that can be provided from a given investment or infrastructure facility.

However, in structuring the PPPs, the rewards and risks must be divided equitably between the public and private sectors. In many instances this can be contentious, especially in Asia where democratic institutions are still evolving. Public acquisition of land for infrastructure projects can also create a stumbling block to successful PPP. Similarly, the determination of service charges calls for difficult decisions. This underscores the need to have a transparent legal system to help resolve project disputes fairly. For PPPs to succeed, the decisions must be made and upheld in an atmosphere of good governance.

PPPs involve a large number of inherent risks, including uncertainty over future exchange rates, inflation, and commodity prices. If these variables change unexpectedly, there may be serious consequences for the economic viability of a project.

For PPPs to succeed over the long term and play a substantial role in fulfilling country's infrastructure needs, governments must accept and take on a number of important roles, including that of regulator to enforce safety and technical service standards. This can be politically and technically demanding, especially when the task is to ensure that the private sector service provider meets social goals.

PPPs have the potential to play an important role in helping developing Asian countries meet their infrastructure needs. To enable this to happen, countries need to have the administrative capacity and policy environment to support their design and operation. These are areas in which international financial institutions can provide support and financing.



# APPENDIX

## **Appendix 1: Conference on Infrastructure for Inclusive Growth and Poverty Reduction in Asia, ADB Headquarters, Manila, 14–15 April 2011**

### **A. Key Points in the Papers and Presentations**

#### **1. Opening Remarks (Juzhong Zhuang)**

The opening remarks set the stage for the workshop, by emphasizing that:

- infrastructure is crucial to ensuring inclusive growth and poverty reduction;
- economic growth does not happen without investment in electricity, roads, sanitation, telecommunications, and water supply; and
- infrastructure facilitates trade in goods, services, and factors of production, and Infrastructure investment can therefore enhance business productivity, encouraging inclusive growth.

There are great needs for investment in infrastructure in developing Asia, perhaps \$8 trillion over the next 10 years. The Asian Development Bank (ADB) supports infrastructure investment by its developing member countries in Asia, conceivably lending \$8 billion annually in the near term.

#### **2. Infrastructure for Inclusive Growth and Poverty Reduction: An ADB Perspective (Douglas H. Brooks)**

Infrastructure has characteristics that distinguish it from other goods and services, necessitating a strong role for the public sector to ensure adequate investment and provision of services:

- **Public goods and externalities.** Typically the private sector will not provide adequate levels of goods and services; therefore public sector intervention is needed.
- **Bulky investment and long time horizon for investment.** In developing countries, firms typically cannot access funds required for large infrastructure systems.
- **Infra–industry nexus.** Infrastructure, especially in small developing countries, can radically alter the potential for local business investment, sometimes providing the keys to virtuous circles of public and private investment encouraging enterprise investment and general development.

Infrastructure can have a very positive role to play in inclusive growth and is also a tool in achieving social and environmental objectives.

### 3. Key challenges and the Role of ADB in Infrastructure (Gil-Hong Kim)

The presentation covered the following four areas:

- **ADB's Strategy 2020.** The strategy focuses on (i) inclusive growth, (ii) ensuring that growth is environmentally sustainable, and (iii) encouraging regional integration. Infrastructure is a core element of this strategy.
- **Developing member countries' infrastructure challenges.** The tremendous need for infrastructure (lack of access to electricity and commercial energy sources, and the need to provide sanitation and safe water and affordable transport) was detailed. As part of this discussion, the importance of improving efficiency in service provision was noted. Strengthening regional connectivity is an essential part of this story, as regional trade in energy and regional transport systems can help enhance growth. Financing these needs will be a challenge. For instance, ADB staff estimates suggest that energy infrastructure investment could run \$7.0–\$9.7 trillion over 2005–2030.
- **ADB's Sustainable Infrastructure Strategy.** The strategy treats each sector according to its particular requirements, however, across sectors there is the need to ensure (i) the appropriate policy dialogue, (ii) innovative development financing, and (iii) that capacity development is pursued.
- **ADB's Operational Mechanisms.** ADB seek to help Asian developing countries meet infrastructure needs through ensuring best practices are understood, disseminated, and built into project structures.

### 4. Infrastructure and Growth in Developing Asia (Stéphane Straub and Akiko Terada-Hagiwara with the discussions provided by Gilbert Llanto and Ghulam Samad)

The paper starts by recognizing that infrastructure provides both for final consumption and for intermediate inputs for production by firms. Both are important, with the paper citing estimates that household or final consumer usage could account for between one-third and half of total infrastructure service provision and enterprises consuming the remaining, major portion. Infrastructure is pictured as having an impact both through a direct channel of influence, especially through the availability of services (water, electricity), and an indirect channel, through technological change and by affecting the productivity of other factor inputs.

The authors apply a dual modeling approach, using cross-country regression analysis and growth accounting to analyze the link between infrastructure and growth and productivity. Infrastructure is assumed to affect productivity. It is easy to see, for example, how a lack of infrastructure lowers the productive impact of investment.

To set the stage for the modeling exercise, the authors examine “stylized facts” concerning infrastructure in developing Asia. First, using a measure of the quality of infrastructure, broadly, better infrastructure is found in countries in Asia and other parts of the world with higher gross domestic product (GDP) per capita. The measures of infrastructure quality used are surveys from the World Economic Forum, which are based on the perceptions of infrastructure service users, covering such sectors as electricity, roads, and telecommunications and internet connections.

Using these measures, there have been significant increases in the availability of infrastructure generally across developing Asia. However, the authors judge that infrastructure investment in the region has been too little to significantly bridge the development gap to countries of the Organisation of Economic Co-operation and Development, and may not be sufficient to positively affect productivity.

As one aspect to the future demand for infrastructure in developing Asia, growing urbanization will be a challenge to countries to meet the demand for services. Urban areas need carefully planned infrastructure programs: ill-designed infrastructure systems impose serious environmental, economic, and social costs in the future. The needs of growing urban areas should not, however, suggest that rural areas be neglected. Rural areas are typically ill-served by infrastructure services, especially roads.

The model assumes that changes in infrastructure can affect the economy in a number of fashions. Very importantly, investment in infrastructure can raise the productivity of general business investment. Examples include road transport or electricity provision that encourages private investment in unrelated industries.

The paper provides a summary of some of the literature. Earlier empirical studies work with a variety of econometric structures, with varying estimates of the impact of infrastructure on growth and productivity. Some of the problems identified include failing to handle possible reverse causality (infrastructure improves income standards, but richer countries can afford more infrastructure) and the use of monetary measures of infrastructure services rather than physical service indices.

The authors distinguish between macro studies in growth accounting frameworks and micro studies that work with sector data and sometimes link specific types of infrastructure to growth. These models should recognize the spatial nature of an economy and the impact that infrastructure systems can have on production and investment decisions.

The empirical analysis looks at per capita GDP as explained by a broad list of infrastructure indicators:

- telecommunications measures including telephone lines and internet coverage,
- energy—electricity generating capacity,
- transport—paved roads, and
- water—the share of population with a service.

The data set covers 102 developing or emerging countries, including 17 in Asia. In some exercises, specific policy environment effects are examined, testing to see if institutional arrangements or governance can have an impact in the nature of the relationship between infrastructure and growth. Llanto notes that the ability to distinguish between different forms of infrastructure and their impact on the economy would help policy makers in what is essentially a “political decision.” Indeed, carrying the authors’ efforts to a lower level of discrimination, it might be interesting to test what kind infrastructure, within sectors, has the greatest impact on growth. For instance how do rural roads compare with urban roads in a country’s economy?

The first set of exercises are cross-country regression estimations which suggest that for most infrastructure measures, increasing infrastructure stock raises GDP per capita growth rates, but institutional factors have little net impact. It was noted that data problems might have been too severe to see relationships. Samad suggests that there is need to detail the institutional environment in which the economy operates. For instance, the prevalence of state-owned enterprises may be a significant barrier to providing the “fiscal space” for governments to properly support infrastructure investment.

The second set of exercises looks at total factor productivity (TFP) within a growth accounting framework. The results suggest that there is little evidence that infrastructure investment affects TFP. Only in a small number of countries, including the People’s Republic of China (PRC) and the Republic of Korea, for telecommunications and electricity, do the authors find that the TFP can be enhanced by infrastructure investments.

### **5. Infrastructure, Growth and Poverty in Bangladesh (Selim Raihan with discussion provided by Gilbert Llanto)**

This paper focuses on the relationship between pro-poor growth and infrastructure in Bangladesh, noting that different countries may have different relationships. Three analyses are presented:

- an examination of whether household consumption of fuel affects its poverty status using a logit model using data from the Household Income and Expenditure Survey in Bangladesh;
- an investigation of the economy-wide impacts of infrastructure investment through input–output analysis using the Bangladesh 2007 Social Accounting Matrix (SAM); and
- a computable general equilibrium (CGE) analysis to examine the reduction in transport margins on resource allocation, output and consumption, and poverty and income distribution.

**Findings from the logit model analysis.** The logit analysis shows that the fuel consumption has a positive and significant impact on poverty reduction. A one unit increase in fuel consumption per person increases the probability of households to be nonpoor by 5.6%.

**Findings from the social accounting matrix multiplier model.** The SAM multiplier model uses input–output data for Bangladesh for 2007 covering 109 accounts or subsectors. The SAM model captures patterns of expenditures and production, depicting the interdependency of spending and income flows. It distinguishes between exogenous influences (policies including public spending) and endogenous or derived results. This model emphasizes the short-run impact of changes in expenditures, not structural impacts.

The simulation models the impact of infrastructure investment by assuming increases in spending in sectors such as construction and utilities by 20%. This results in a GDP increase of 8%. The construction sector enjoys the greatest benefits, followed by linked sectors such as cement, forestry, steel, and utilities.

**Findings from the computable general equilibrium model.** A CGE model is used that measures the impact of lowered “transport margins” (by 25%) and the impact on other sectors is noted. There are a variety of results:

- **Price effects:** The fall of transport margins or transport costs lowers domestic prices generally. These changes then influence the general allocation of resources, incomes, and consumption expenditures.
- **Welfare effects:** Households experience a fall in real prices, stemming from lowered transport costs, as a rise in real income. This leads to a rise in real consumption and welfare. There is a particular impact on the rural sector, which is sensitive to trading and transport costs.
- **Macroeconomic effects:** Due to the fall in transport margins, the positive growth of the economy, and the fall of general price index, there is a rise of national welfare by 0.39%. Real GDP increases by 0.57%, imports by 0.95%, and exports by 0.83%.
- **Poverty effects:** The incidence of poverty falls by 1.24%. The poorer household groups are likely to experience higher gains than nonpoor families.

Llanto notes that these modeling efforts are potentially quite useful to policy makers. However, these developing countries would then need to maintain the rather detailed and costly data sets required to use these models.

## **6. Operationalizing Inclusive Economic Growth (Kyeongae Choe with discussion provided by Gilbert Llanto)**

The author uses anecdotes about Dharavi, India to show that infrastructure affects growth when it changes the potential for business activities or business costs. Dharavi is a center of labor-intensive businesses that require some minimum of infrastructure services and benefit from economies of agglomeration. In the main text, it was suggested that Dharavi is a good example of how infrastructure can stimulate income earning activities, but that uneven policies and infrastructure provision can result in a poor quality of life. For example, one cannot have decent housing without the provision of safe water and sanitation.

The author advocates cluster-based economic development, which focuses on business competitiveness, both in geographical area terms and with respect to the sector of work. The analysis is particularly appropriate to urban centers—agglomeration concepts form a background.

A seven-step process is sketched that provides an analytic framework for identifying a business cluster for development: (i) profile national economic strategy, (ii) assess city competitiveness, (iii) multisector industry competitiveness analysis, (iv) industry geographic information system mapping and industry cluster structure analysis, (v) gap analysis in competitiveness, (vi) project design and infrastructure feasibility studies, and (vii) executing a project for cluster development.

An example of the use of this method was sketched in a pilot cluster-based economic development study of the natural rubber or latex industry in Sri Lanka. Especially, the cost of doing business is an input in understanding local competitiveness. The author uses “bubble” analysis (contrasting different sectors as they are growing or declining; small or large in national economy) to reveal present competitiveness. Value-chain analysis is used to understand backward and forward linkages based on core business activities and mapping exercises showing location and changes over time of present businesses.

Llanto raises the issue that this methodology should not be seen as providing governments the go-ahead to “pick-winners”: to move back to the kind of industrial policy seen in previous decades where the government decided what firms had access to constrained resources such as foreign exchange or subsidized loans. Rather, the tools should be used for “creating the market environment for winners to emerge”.

## **7. Estimating the Social Return to Transport Infrastructure: A Price-Difference Approach Applied to a Quasi-Experiment (Z. Li with discussion provided by Dante Canlas)**

This paper examines the social return to transport infrastructure using the case study of infrastructure investment in railways in western PRC, between Urumqi and Lanzhou. Very broadly, investment is shown to lower costs and increase social welfare.



The paper estimates the impacts of an infrastructure investment on the trade costs of goods, then calculates the social welfare gain using these estimates. The paper uses a microeconomic analysis of regional markets separated spatially. The economic impact of this distance is shown to be affected by key infrastructure investments. Canlas notes that this paper fits well with the more general public finance literature.

Trade along the route studied is heavily asymmetric, with heavy raw materials moving east, and lower volumes of finished goods moving west. Crucial to the results is that there is considerable traffic congestion in one direction (moving east) that influences regional business costs and prices. Investment that reduces congestion can have positive economic influences.

Survey information on the market prices of more than 50 goods in the PRC between 1992 and 2001 provided the initial estimate of the regional differences in business costs and the potential gain from easing trade costs, i.e., altering the economic costs of distances between the urban centers. These differences were associated through regression analysis with possible determinants including the action of improving the infrastructure rail linkage between the two cities. Canlas remarks that, in some situations, this process might obviate the necessity to calculate shadow prices.

The paper found that interregional price differences were reduced by around 30% due to the investment in railway infrastructure. The welfare gain attributable to the reduced transport price and the increased freight volume implies a sizable return to investment of 10%–50%, depending on assumptions concerning transport and maintenance costs and inflation rates. Welfare gains would be on the order of \$300–\$400 million annually. Canlas notes that generally 10% is a very acceptable social rate of return for public investments.

## **8. Public Infrastructure and Economic Growth: A Dynamic General Equilibrium Analysis with Heterogeneous Agents (Yazid Dissou and Selma Didic with discussion provided by Dante Canlas)**

An inter-temporal CGE model is used to model aggregate and sector growth and the welfare implications of investment in infrastructure. Data on Benin are used to examine the issues with the model. Benin is a small, open economy in which infrastructure can help enhance growth prospects.

The authors argue that the impacts of infrastructure on production are not simple, rather they are complex and “multiple linkages” can be expected. The inter-temporal nature of the model is considered important as some households and firms have decision-making freedom. Moreover, the agents do not make their decisions in a similar fashion: heterogeneous agents are structural features. Canlas notes that the model used by Dissou and Didic shows that forward-looking households and enterprises are associated with higher rates of growth than when it is assumed that people are myopic with respect to the future consequences of present decision making. Canlas also raises general issues about the nonuniformity among the economic agents used in the model,

particularly that this should allow for explicitly modeling the impact of inequality on growth. The model is nonlinear and numerical solutions are used with some parameters assumed from other work, such as for the public capital-output elasticity.

Some simulations are done with a permanent increase in public infrastructure to GDP ratio of 10%, financed by indirect tax increases. The results include a suggestion that infrastructure can crowd out private investment. Sectoral impacts differ, partly in the impact of the tax increase relative to the increase in economic activity. Similar exercises with a permanent increase in public infrastructure to GDP ratio of 10% financed by foreign direct assistance show significantly better results.

### **9. Strengthening Policy, Regulation, and Institutions for Effective Transport Infrastructure Development in Asia (Biswa Nath Bhattacharyay with discussion provided by Ernesto M. Pernia)**

The paper examines (i) how to improve the effectiveness of transport soft infrastructure, and (ii) how developing Asian countries can collaborate with each other and with developed Asian economies. Soft infrastructure refers to policies, regulations, and institutions. Soft infrastructure also relates to mechanisms for infrastructure financing such as the use of public-private partnerships (PPP). The paper focuses on transport infrastructure in selected East and Southeast Asia countries. The author makes the case that both hard and soft infrastructure are needed for developing Asian economies.

Connectivity infrastructure is seen as a key factor in the rapid growth of these countries over past decades, supporting cross-border trade. While transport connectivity is vital, it is also crucial to encourage cross-border infrastructure that can facilitate trade in energy and the movement of information and communication. In discussion, Pernia noted that the paper “provides a vision of how infrastructure should be developed at three levels: national, subregional, and regional—i.e., “Pan-Asia connectivity.” The paper refers to the Association of Southeast Asian Nations (ASEAN) Master Plan as an instructive element in regional planning. The Pan-Asian Transport Master Plan is another example, focusing on the development of highways, railways, and intermodal transport terminals.

The author argues that transport infrastructure can be a key element in regional cooperation and that it has a strong impact on inclusive growth and reducing poverty. The importance of connectivity infrastructure to isolated regions and landlocked countries is noted. Beyond issues of growth, the lack of connectivity, especially in isolated areas, can be politically destabilizing. What is important is to move toward “seamless, sustainable transport connectivity.”

Bhattacharyay provides estimates for national requirements for infrastructure investment for 32 developing Asian countries of \$2.9 trillion for 2010–2020. In discussion, Pernia suggested that the paper may underestimate infrastructure needs as many areas “still lack the basic infrastructure requirements that precisely constrain inclusive growth and poverty reduction.” Pernia identifies these needs as including

“farm-to-market roads and rural–urban links” and irrigation systems that would improve the performance of rural areas.

Clearly a challenge is to identify priority infrastructure needs and fund the massive costs. There is a need to look beyond traditional financing mechanisms. Involving the private sector through public–private partnerships is one part of an overall solution.

A high level of intra- and intergovernment coordination must be achieved to ensure the appropriate type and level of infrastructure investment. At the regional level there are many agencies to help coordinate planning.

Soft infrastructure requires a variety of institutions and policies. The impact of soft infrastructure reflects the nature of governance in a country. Better governance, for example, improves network impacts. The paper examines the relationship between measures of governance (World Governance Indicators from the World Bank Institute) and physical infrastructure measures (across transport, telecommunications, and electricity). Regression results suggest that better governance has a strong, positive impact on the availability of infrastructure, particularly whether governments were considered to be acting effectively.

Designing and implementing appropriate regulatory policies will be a challenge, particularly to ensure that national institutions are consistent with international practices. Pernia notes the need for effective community consultations, illustrating his point with a description of how consultation over an airport investment in the Philippines resulted in a more appropriately structured project. Bhattacharyay concludes that harmonizing regional policies can enhance the impact of a good policy environment on national and regional infrastructure.

Transport is noted as a sector that has direct impact on environmental problems including carbon dioxide emissions. Technology has the potential to change the impact of transport on the environment and other aspects of the relationship between transport and the broader economy.

### **10. The Public–Private Partnership Case of the Civil Registry System of the Philippine National Statistics Office (M.J. De Vera and D.A. Gabriel with discussion provided by Ernesto M. Pernia)**

This paper is a case study of the Philippine National Statistics Office’s (NSO) provision of a civil registration system through a PPP project: the Civil Registry System Information Technology Project (CRS-ITP). The CRS-ITP is a \$65 million PPP project with a build–operate–transfer structure. The project is a partnership between the NSO and Unisys Public Sector Services , spanning more than a decade.

The project arose from the need to develop an information technology solution for the country’s civil registry system, providing better documentation services to citizens, for instance, of birth, death, and marriage. The previous, paper-based system

was slow and appeared to encourage corruption. At the core of the project was the need to improve the response of the NSO to requests for documents.

In the Philippines, PPP projects stem from the build–operate–transfer laws in the 1990s, bringing the private sector into infrastructure provision, which until then had been handled by the government. Unisys Public Sector Services was the only bidder and produced the system to maintain and provide documentary records.

The project appears successful, with requests for information—transactions—increasing from under 1 million in the last quarter of 2001 to nearly 10 million in the first 10 months of 2010. At the end of that period, 135.3 million documents had been uploaded into the system, comprising 95.9 million birth certificates, 21.4 million marriage certificates, and 17.9 million death certificates. Most importantly, before the project, responding to requests required on average 7–10 working days. In October 2010, two-thirds of all requests are handled within 30 minutes, and 90% were responded to within 2 hours.

In discussion, Pernia urged that this successful computerization of records within the NSO should be extended to cover NSO surveys and censuses, and across the government to include such services as the provision of passports.

## **B. Country Case Studies**

### **1. Bangladesh (Sk. Md. Abdul Ahad)**

With a per capita income of \$684 and a literacy rate of 55% in 2011 estimates, the government’s development strategy for the country focuses on poverty alleviation. It is understood that poverty reduction requires a widespread attack on long-running stubborn issues, especially to meet the target of reducing the incidence of poverty from the current level of 45% to 15% by 2021. Within this strategy, other challenges must also be addressed, including the threat that global warming and rising sea levels poses to this low-lying, coastal, storm-plagued country. Infrastructure is a necessary component of this effort, as Bangladesh suffers from a lack of adequate service provision across a wide range of sectors from electricity to inland waterway structures and roads. Public–private partnerships (PPPs) are a key tactic for erasing infrastructure deficiencies, especially considering the limited resources not only for building new infrastructure but also for maintaining the existing stock. Fairly detailed administrative procedures are in place in the country to ensure that PPPs can be successfully designed and implemented, and there is supporting legislation in many possible project areas. The continued inefficient dominance of state-owned enterprises in some sectors, for instance in railways, has hindered productivity growth generally. The country provides considerable support for foreign direct investment in the form of tax incentives, especially in support of export processing zones.

## **2. The People's Republic of China (Gong Zheng)**

One important issue with respect to infrastructure in the People's Republic of China (PRC) is the need to improve service provision to poor communities. This includes better access to electricity, housing, irrigation, roads, safe water, and local infrastructure. It is important to provide these services in close coordination with the local community. In particular, villages need to have the capacity to plan and participate in government decision making for their people. The process must give priority to poor and vulnerable communities. Partly as a result of this kind of efforts, the proportion of rural households that do not have access to safe water has fallen from 15.5% in 2002 to 5.8% in 2009.

## **3. Indonesia (Enoh Suharto Pranoto)**

Indonesia's archipelagic nature, with more than 17,000 islands, is one complication to providing the necessary infrastructure to support rapid, poverty-reducing growth. As a strategy, the government has targeted the development of six national economic corridors which will focus infrastructure investments and economic policy in support of the growth of business centers. The recent significant economic growth needs to be underpinned by investment to address "increasingly significant infrastructure shortages and bottlenecks...(Pranoto, 2011)" especially in power and transport. Traffic congestion is a particular problem in major urban centers on the main island and economic center, Java. Compounding the challenge, road transport infrastructure will have to cope with the ongoing, rapid increase in private vehicle ownership. While urban needs are very evident, the government also sees the need to improve rural living conditions and agricultural productivity through infrastructure investment, particularly in support of food security. This will require considerable effort to improve irrigation systems. Overall, the government's growth targets will require approximately \$213 billion in infrastructure investment over 2010–2014. Less than one-third of this sum can be financed from public sector budgets, the remainder needs to come from the private sector. The author identifies two particular problems in successfully meeting infrastructure goals: (i) a lack of technical skills on the part of government agencies, and (ii) a limited ability of private enterprises to borrow or issue long-term debt to finance infrastructure. In addition the government must address issues related to land acquisition, which have posed challenges to past projects.

## **4. Pakistan (S.M. Younus Jafri)**

One of the larger Asian developing countries, Pakistan faces severe problems in supporting poverty-reducing economic growth due to infrastructure weaknesses. Political problems, security issues, natural disasters, and chronically weak revenue efforts have hampered the economy generally, but also inhibit efficient provision of new and existing infrastructure. In the energy sector, power shortages are particularly crippling for private enterprises, and surveys show that this problem has discouraged investment in capacity. Similarly, exporters report that high costs for transport, reflecting inefficiency in infrastructure service provision including the prevalence of corruption, have hindered trade. "The poor performance of the [transport] sector is estimated to

cost the economy 4%–6% of gross domestic product each year (Jafri, 2011).” Urban infrastructure systems are overburdened and face increasing challenges due to the continued migration of people from rural to urban centers. The government particularly sees the need to encourage the development of the logistics industry. In water, there has been a decline in the availability of clean water, hampering agriculture and reducing the quality of life for households. The limited fiscal space has prompted a search for ways to bring in private sector financing. It is likely that less than half of the needed infrastructure financing can come from government resources.

### **5. Sri Lanka (Hewa Wasalage Gunadasa)**

An economy located on one island, Sri Lanka has infrastructure needs that are very different from other Asian countries. Testifying to the importance of maritime shipping, port infrastructure projects account for more than one-quarter of ongoing infrastructure investment projects. Rapid economic growth in the past few years has reduced the incidence of poverty from more than 15% in 2007 to less than 8% in 2010. To continue this trend, there is a need to support growth, but also to make it more inclusive. Not all areas of the country have experienced the same results and some aspects of non-income poverty have worsened, including the incidence of malnutrition. Insufficient infrastructure, amid a deteriorating environmental resource base, is only one of the many challenges facing the government. Infrastructure is seen as one tool to rebalance economic performance across the country and within different groups. Partly to this end, more than 28% of the present infrastructure spending is on irrigation projects. A “peace dividend” flowing from the end of the long-running civil war is allowing for public financing of development projects.

### **6. Viet Nam (Tran Thi Tuyet Mai)**

A mainland Southeast Asian country, Viet Nam has exhibited rapid growth as it develops market-based economic institutions. Meeting infrastructure needs has been a serious challenge and is one of the limiting factors to growth. Infrastructure is one tool to encourage economic growth. It is also seen as necessary to meet social goals, including providing safe water, and to address environment concerns by improving waste treatment (most urban areas lack sewage treatment facilities). Improving transport is particularly important, as transport networks are neither complete nor efficient. There is a lack of highways and high-speed rail systems. Airports need modernization. Inland waterways offer a means for encouraging balanced regional development, but lack planning and investment to realize this potential. The government sees the importance of insuring affordable and efficient transport connectivity with international markets, both by improving the performance of the ports but also in road transport connecting to neighboring countries. Overall estimates suggest that there is a need for \$15 billion in infrastructure investment annually, against a public sector financing ability of about half of this. Foreign investment has provided some of the needed investment in the past, through 44 projects totaling \$7 billion. These have been concentrated in ports, power, and water supply. The government is encouraging future PPPs through targeted policies.

## 7. Thailand (Kriengsak Rabilwongse)

Infrastructure needs and plans for Thailand must be seen in the context of broader, global economic currents. Thailand faces the continual need to maintain and improve competitiveness, including widening participation in global as well as regional marketplaces. Increasingly it will be important to face environmental issues such as global warming by reducing carbon dioxide emissions, but also to improve energy security by encouraging renewable energy sources. Currently, national infrastructure planning comes under the umbrella of the 11th National Economics and Social Plan for 2011–2016. The country's road system is relatively well developed with more than 98% paved. Road connectivity is seen as helping Thailand to be part of the larger ASEAN Highway and in the context of Greater Mekong Subregion programming. Similarly rail development is seen as part of the Singapore–Kunming Rail Link. Thailand's reliance upon international trade as an engine of growth puts a premium on ports development, allowing the country to be a gateway for the region. Tying these sectors together, it is important to encourage multimodal systems. Mass transit systems will also be important to ensure the quality of life in urban centers, particularly Bangkok, but also to maintain these areas as efficient sites for businesses. Soft infrastructure plays a large role in infrastructure planning particularly to:

- develop policies that can reduce logistics costs,
- improve “borderless” trade—facilitating the movement of cargo between countries with minimum delays for customs and related inspections and processing, and
- provide support for PPPs to ease national financing requirements.

### **Appendix 2: The Economics of Infrastructure in a Globalized World: Issues, Lessons and Future Challenges**

Infrastructure supports economic growth through economies of scale and lower transport and trade costs. It is crucial to providing for and sustaining inclusive economic growth. This section paraphrases and summarizes a report by Timo Henckel on a conference on infrastructure held in Sydney, Australia on 18–19 March 2010, sponsored by the Asian Development Bank, Australian National University, The Brookings Institution, the Lowy Institute for International Policy, and Worley Parsons. Quotations are from that paper.

To better understand the potential for infrastructure investment in different countries, the Sydney conference focused on six themes: the returns to infrastructure, the role of the private sector, the evaluation and delivery of infrastructure in practice, the nature of network industries, pricing and regulation, political economy considerations of infrastructure provision, and infrastructure in developing countries.

## **A. The Returns to Infrastructure Development**

Infrastructure “raises productivity and reduces the cost of private production,” particularly improving the prospects for the poor. However understanding the impact of a particular investment in a given situation is a challenge. Early econometric work suggested very high returns to public investment; however, there were serious methodological issues. More recent work, such as that by Calderón, Moral-Benito, and Servén (2009), suggests that the output elasticity of infrastructure is between 0.07–0.10. These estimates are said to be similar across countries, even at different levels of development.

Infrastructure has a strong impact on the broader economy through lowering transport costs, and thereby encouraging trade and employment. Studies in the PRC and India show that trade costs have been a significant barrier to growth, and that infrastructure can measurably enhance trade along both sea and land transport routes.

One challenge in providing adequate infrastructure is that governments must forecast both changing demand and changing market conditions. As the potential for trade changes, governments need to have the right infrastructure in place, but this is clearly difficult. Recognizing the regional component of development needs is one solution: often “economic growth occurs within regional clusters; countries do well when their neighbors do well and vice versa.” Growth “spillovers” are legitimate targets for regional cooperation, enhancing any given country’s returns to infrastructure investment.

## **B. The Role of the Private Sector**

Henckel and McKibbin remind us that historically there have been different levels of private sector involvement in infrastructure. Since the 1980s, there has been widespread interest in relying more on private enterprise in infrastructure provision. This is not to deny a role for the public sector. Infrastructure has a number of characteristics that suggest that private markets do not optimally provide these services. Infrastructure involves possible natural monopolies (especially because of strong economies of scale). Natural monopolies call for regulation and here there is evidence that governments have not been able to accomplish this responsibility efficiently. Similarly, historical involvement of the public sector in infrastructure provision has sometimes meant that inefficient public sector enterprises weigh upon economies. Redressing this through, for instance, privatization can be difficult as entrenched systems are hard to change.

PPPs represent a range of alternatives to providing scope for private sector involvement in infrastructure provision. “They have increased sevenfold in developing countries from 1990–1992 to 2006–2008 ...” While there are many different structures, across the spectrum, potential benefits “include bundling of building, maintenance and operations, easier implementation of efficient user fees, relief of public budgets, and fewer politically motivated white elephants.” These must be balanced against possible “high contracting costs, inefficient competitive arrangements leading to bilateral monopolies, exploitation of soft budget constraints, and problems resulting from



asymmetric information between the contract partners.” Involving the private sector does not alleviate public responsibilities; rather they are heightened in some dimensions.

One example of the trade-offs is the impact of PPPs on public budgets. Using PPPs that involve private sector financing can reduce immediate funding responsibilities, but revenues need to be found to repay the private sector investor: “Overall budgetary benefits must ultimately come from efficiency gains ... .”

Getting PPPs to work, as in so much of development, rests on the quality of governance. This is particularly important in situations where unexpected developments necessitate recontracting or renegotiating PPP arrangements.

PPPs involve a division of responsibilities, revenues, and costs, but also of risks. There are tremendous difficulties involved in apportioning these appropriately. One great difficulty is that the private and the public sectors have access to different information. This makes bargaining asymmetric and may affect the overall costs and benefits of a project.

### **C. Evaluation and Delivery of Infrastructure in Practice**

Given the importance of infrastructure to the economic future of countries, it is imperative that planning is done in a serious and rigorous manner—the history of infrastructure projects has many examples of useless or unproductive investments. Two evaluation methods are generally available: computable general equilibrium (CGE) models and cost–benefit analysis (CBA). CBA tools are generally better known and are somewhat simpler in terms of results. CGE models, however, can sometimes pinpoint the broader impacts of a particular project across sectors and groups. “The solution in many cases is to employ CGE models and CBA jointly.”

### **D. Network Industries, Pricing, and Regulation**

Infrastructure systems have characteristics that lead them to be viewed as natural monopolies (large fixed costs that are barriers to entry, network externalities, economies of scale, and public goods characteristics). This puts a premium on good governance by the public sector, particularly to find the appropriate regulatory institutions—institutions that provide the incentives that will bring maximum service provision at minimum cost.

Getting regulation right is extraordinarily difficult. For every regulatory approach there are downsides. For instance, regulating the rate of return, limiting “profits to ‘reasonable’ levels,” may discourage research and development by the regulated firm. In technologically slow-changing industries this may have few costs, but it could be very damaging in sectors that face fast-paced technological changes.

Similarly, price regulation must trade-off meeting current demand with the impact of today’s price on tomorrow’s demand. In developing countries where there are often supply constraints and in the presence of large network externalities, it is a very difficult exercise, one that needs to be accomplished in the presence of huge uncertainties.

### **E. Political Economy Considerations of Infrastructure Provision**

Given the importance of public decision making in the process of planning, building, and operating infrastructure systems, it should be no surprise that political considerations are sometimes paramount. This can mean that systems reflect the revealed needs for the economy, it can also mean “rent-seeking and lobbying pressure often proves too strong to resist, leading to inefficient political logrolling, pork barreling, and corruption.”

One approach to improving governance in infrastructure would be to better maintain data on “how governments evaluate and decide on infrastructure projects.” Understanding the decision making in projects, “compulsory independent auditing” and the dissemination of evaluation results might result in strengthening the political process.

### **F. Infrastructure in Developing Countries**

“Basic infrastructure helps alleviate poverty directly and provides the poor with the environment in which they can grow their way out of poverty.” Infrastructure is a key driver of the development process. Unfortunately, there is a huge disparity between the infrastructure found in developed economies and poor countries: “... the stock of infrastructure capital in advanced countries [is] much greater than in developing countries (by a factor of up to 50)... .”

The report cites ADB estimates that developing Asia needs to invest about \$750 billion each year for infrastructure in the current decade. Private sector financing will be a key as to whether this level is seen. The report suggests that, statistically, there does not appear to be large differences between infrastructure provision with and without private sector participation. However, given the right policy environment, there are many benefits to having the private sector support infrastructure provision.

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## Infrastructure for Supporting Inclusive Growth and Poverty Reduction in Asia


This publication summarizes the papers and presentations in Workshops on Economics of Infrastructure in a Globalized World, funded by the Asian Development Bank through a regional technical assistance project. The discussions at the conferences focused on three themes: (i) the role of infrastructure in supporting inclusive growth and poverty reduction; (ii) the need for appropriate soft infrastructure, including the policy environment and regulatory institutions; and (iii) the potential for public and private partnerships in infrastructure provision. Each theme elaborates the premise that extensive, efficient infrastructure services are essential drivers of economic growth and sustainable poverty reduction.

### About the Asian Development Bank

ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to two-thirds of the world's poor: 1.8 billion people who live on less than \$2 a day, with 903 million struggling on less than \$1.25 a day. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

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