



ENHANCING REGIONAL COOPERATION IN INFRASTRUCTURE DEVELOPMENT INCLUDING THAT RELATED TO DISASTER MANAGEMENT



ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC

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Shaded areas of the map are ESCAP members and associate members.

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ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC

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Foreword

The Asian and Pacific region has carved out a leading position in the world economy and become a centre of growth. For the last seven years, the region's GDP growth rate has consistently and significantly surpassed world growth and its trade with outside world has increased sharply. The region's share of world savings is around 40 per cent; its foreign exchange reserves of \$2.7 trillion represent more than 70 per cent of total world reserves. In a nutshell, the region has reaped considerable benefit from globalization and has grown rapidly.

However, the rapidity of that economic growth, especially in a number of major developing countries, has exerted tremendous and visible pressure on infrastructure, especially transport, ICT, energy and water. Unless these infrastructure sectors are expanded to cater to future demand, the region's economic dynamism cannot be sustained. ESCAP drew the attention of the region's policymakers to this issue, especially the need for massive infrastructure investment, in the study entitled *Implementing the Monterrey Consensus in the Asian and Pacific Region: Achieving Coherence and Consistency*, presented at the sixty-first session of the Commission.

Adequate infrastructure is needed not only for economic growth but also to bring the benefits of a higher economic performance to people living in rural and isolated areas and to enable them to participate in mainstream economic activities, thus contributing to the reduction of poverty. Asian and Pacific countries should keep in mind the crucial importance of infrastructure development in their ability to achieve the Millennium Development Goals and move beyond them. ESCAP highlighted this issue in its report entitled *A Future within Reach: Reshaping Institutions in a Region of Disparities to Meet the Millennium Development Goals in Asia and the Pacific* and suggested the need to find innovative approaches by which countries could generate the financial resources they need in order to be able to invest adequately in infrastructure.

Infrastructure development in this era of globalization should be considered from a holistic point of view. Countries need to consider not only investment in their own infrastructure but also the building and utilization of cross-border infrastructure. Identifying appropriate modalities and options for strengthening the role of regional cooperation in all areas of infrastructure development therefore assumes particular importance for ESCAP.

Against this background, the present study, *Enhancing Regional Cooperation in Infrastructure Development, including that related to Disaster Management*, prepared for the sixty-second session of the Commission (Jakarta, 6-12 April 2006), analyses the role of infrastructure and its socio-economic linkages as well as regional initiatives in creating, maintaining and utilizing infrastructure with a focus on financing such investment. It identifies a number of specific options for strengthening regional cooperation in these areas.

Natural disasters, including floods, earthquakes and storms, regularly strike the region, destroying lives and property, bringing misery to large sections of the population and inflicting heavy economic losses. Damage from the recent tsunami disaster has yet to be fully alleviated and the shock still haunts many survivors. Natural disasters such as the tsunami cannot be prevented but the damage they inflict can be

minimized. Physical infrastructure, including early warning systems, can make a major contribution both to preparedness for disasters and recovery from them. This study also considers the role of, and the win-win situation that can derive from, regional cooperation on this issue.

It is my hope that the study will draw the attention of policymakers, not only to stimulate debate on these important issues but also to suggest a way forward. The status quo is not an option for infrastructure investment and further delay in addressing the issue could cost the region heavily in terms of lost opportunities for growth and development.

A handwritten signature in black ink, appearing to read 'Kim Hak-Su', with a stylized, cursive script.

Kim Hak-Su
Executive Secretary

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This study, *Enhancing regional cooperation in infrastructure development including that related to disaster management*, has been prepared by a team of staff members of the Poverty and Development Division, Environment and Sustainable Development Division, Information, Communication and Space Technology Division and Transport and Tourism Division of ESCAP under the direction of Ravi Ratnayake, Director, Poverty and Development Division and with the work coordinated by Hiren Sarkar, Chief, Development Policy Section, Poverty and Development Division.

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Abbreviations

ABF	Asian Bond Fund
ADB	Asian Development Bank
ALTID	Asian Land Transport Infrastructure Development Project
APEC	Asia-Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
ASEAN+3	ASEAN members plus China, Japan and the Republic of Korea
ECE	Economic Commission for Europe
ECO	Economic Cooperation Organization
EIB	European Investment Bank
EPOC	ESCAP Pacific Operations Centre
ESCAP	Economic and Social Commission for Asia and the Pacific
EU	European Union
FDI	foreign direct investment
GDP	gross domestic product
GNI	gross national income
ICT	information and communication technology
ICDs	inland container depots
IDFC	Infrastructure Development Finance Corporation
IEA	International Energy Agency
IFC	International Finance Cooperation
IMF	International Monetary Fund
IPN	international production network
ITU	International Telecommunication Union
JBIC	Japan Bank for International Cooperation
MDGs	Millennium Development Goals
NMT	non-motorized transport
ODA	official development assistance
OECD	Organization for Economic Co-operation and Development

Abbreviations *(continued)*

PEG	Partnership for Equitable Growth
PPAIF	Pacific Private Infrastructure Advisory Facility
PPI	Private participation in infrastructure
PPP	Public-private partnership
SAARC	South Asian Association for Regional Cooperation
SIDS	small island developing States
TEUs	Ton equivalent units
TOPEX	Typhoon operational experiment
UNDP	United Nations Development Programme
WEC	World Energy Council
WHO	World Health Organization

Executive summary

The crucial role of regional cooperation in meeting the future infrastructure requirements of Asian and Pacific countries cannot be overstated. The need for cooperation in the areas of infrastructure creation, maintenance and utilization is well recognized. On the financing side, research reveals that the region will need to find *at least* \$228 billion per year to pay for the infrastructure it plans to build and maintain between 2006 and 2010. Furthermore, assuming a business-as-usual scenario on the availability of assured finances, a gap as large as \$180 billion per year between requirement and availability is within the realm of possibility. To bridge the gap, Asian and Pacific countries need to find innovative ways to mobilize finances for infrastructure investment urgently and regional cooperation could be a vehicle for identifying and operationalizing the appropriate instruments and institutions. The conclusion in this study is that status quo might not be able to generate sufficient funding to meet the region's infrastructure needs.

For Asian and Pacific countries, the urgency of deciding on a course of action is commensurate with the critical role of infrastructure in people's daily lives and the economic outlook of the region. Adequate infrastructure in the four key sectors of transport, telecommunications, energy and water considered in this study is a prerequisite for opening up access to global trade and investment flows, increasing the competitiveness of production and services and thus sustaining the region's economic growth.

Infrastructure, at the same time, makes growth more inclusive. It unlocks the resources and potential of remote areas and small or landlocked countries and distributes the benefits of growth, enabling the delivery of health, education and other services. Infrastructure is therefore a crucial facilitator of the region's efforts to reduce poverty and achieve the Millennium Development Goals.

More investment in infrastructure is also needed to reduce the impact of natural disasters. Asia and the Pacific, the world's most disaster-prone region, accounts for over 90 per cent of all deaths and nearly half of all economic loss from disasters in the past 15 years. Infrastructure can both reduce the losses resulting from natural disasters and facilitate post-disaster recovery, the study concludes.

With globalization intensifying, the scale and scope of the Asian and Pacific region's infrastructure needs and their effective fulfilment increasingly lie beyond the capacity of individual countries and require regional solutions to complement national efforts. Regional cooperation in both infrastructure development and its financing are required.

Many transportation, information and communication technology, energy and water projects are cross-boundary. ESCAP is well positioned to facilitate regional cooperation in setting up consultative bodies, planning cross-border projects and promoting private sector participation.

In this regard, a brief look at the requirements in individual infrastructure sectors underlines the need to strengthen a number of regional cooperation initiatives. Some major examples where ESCAP has played and will play major roles are the following:

Transport: Exploring options for sharing bilateral and subregional infrastructure, such as sharing dry ports in landlocked countries, promoting improved infrastructure asset management and maintenance, for example by creating road funds, and

promoting better mechanisms for coordinating regional transport infrastructure including the Asian Highway and Trans-Asian Railway, and such issues as tax breaks and designation of special economic zones to promote foreign direct investment. Improving cross-border facilitation through the implementation of pilot projects based on single window or “one stop shops” concepts for cross-border customs, trade and transport facilitation will promote efficient infrastructure usage;

Information and communication technology: There have been several regional initiatives in Asia and the Pacific focused on the increasing use of advanced and sophisticated technology, especially broadband. To support broadband development (the Asia Broadband Program), ESCAP could focus on creating a regional consensus and an enabling policy and regulatory environment, building the required skills base and promoting such applications as e-government, e-business, e-environment, e-learning and e-health;

Energy: Facilitating the establishment of consultative or collaborative mechanisms for planning and coordinating efforts to improve energy security by promoting a trans-Asian energy system, which could include carrying out studies, organizing policy dialogues, negotiations and networks for information exchanges, promoting private sector involvement in APEC with a view to developing a link to the North-East Asian energy initiative and supporting the Partnership for Equitable Growth initiative on the Asian Gas Grid;

Water: A number of innovative regional cooperation initiatives that can be facilitated by ESCAP could include: creating an Asian water infrastructure forum for the development of water infrastructure with a view to ensuring the effective participation of stakeholders, particularly the private sector, in the implementation of the Millennium Development Goals related to water and to ensure sustainable economic growth and development;

Disaster management: A priority would be facilitating the creation of a regional task force on disaster recovery and management to help developing countries in the region to meet rapidly expanding needs for in the aftermath of natural disasters and to promote adequate investment in infrastructure for effective disaster preparedness and prevention are priorities. This regional task force, consisting of key member countries and interested partners would be expected to draw up a regional strategy on disaster recovery and management and recommend a programme of action to be undertaken by ESCAP and collaborating organizations.

Heavy regional demand for infrastructure investment and the large resource gap associated with it, however, necessitates the strengthening of regional cooperation initiatives in the form of greater innovation in the way the region finances its infrastructure development programmes. Asian and Pacific Governments have long identified infrastructure as a priority but have financed it largely from public funds because of its key economic and social role. The private sector held back from infrastructure because of high capital costs, long lead times and slow returns on investment and the vulnerability to fluctuating political and economic circumstances. The growing fiscal stress that Governments are experiencing in this era of globalization is forcing them to look for alternative sources of financing.

Private sector interest in, and incentives for, participating in the building, operation and financing of infrastructure have increased with the liberalization of markets and investment flows. Private investment in the region's infrastructure, however, is not expected to rise much beyond the \$20 billion per year averaged from 2000 to 2003. Meanwhile, lending by the World Bank, the Asian Development Bank and the Japan Bank for International Cooperation, which totaled an average of \$7.4 billion per year from 2000 to 2003, also falls far short of filling the financing gap.

The size of the financing gap, however, also requires a collaborative effort to mobilize new sources of capital. Alternative sources of funding include the region's surplus savings, averaging around \$200 billion per year (2000-2003), which are mostly invested outside the region, and possibly the region's \$2.5 trillion in foreign exchange reserves. Asian and Pacific countries need to cooperate, however, in developing mechanisms for accessing these funds through cross-border financial intermediation.

One option could be expanding the role of the Asian Development Bank and setting up a specialized subsidiary to undertake the mobilization of funds from capital markets and lending for infrastructure projects. Governments of the region that have taken some steps towards creating a regional bond market initiative (the Asian Bond Fund or ABF) could also expand its size and geographic scope to intermediate the region's savings. Setting up subregional development banks or funds by reinvigorating the existing proposals and ideas could be a third option.

A further option is to set up an Asian investment bank, which would be similar to the European Investment Bank, an institution that lends substantially more than the Asian Development Bank. An Asian investment bank could specialize in infrastructure financing, raise funds mainly from capital markets and provide medium-term loans and guarantees for the region's developing countries, typically at below market rates made possible by its expected high credit ratings, for infrastructure projects that fulfil certain criteria. Such an institution could be owned by ESCAP member countries and regional and multilateral development banks. Selected private banks could also be invited to join this endeavour, reflecting the spirit of public-private partnership.

The scale of the region's financing requirements and the large shortfall in funding from existing sources call for prompt action by Governments. The longer the region delays reaching decisions on which financing mechanism to adopt, the greater the cost in lost opportunities for growth, improved living standards and tackling poverty.

I. INTRODUCTION

Infrastructure, consisting especially of transport, ICT, energy and water, has become so intermeshed with modern living that it is difficult to imagine a world without it. Inadequate and poor quality infrastructure not only holds back economic activity but also drastically reduces the quality of life. It is no surprise, then, that the Governments of developing countries have placed infrastructure development very high on their action agenda.

In the Asian and Pacific region, infrastructure development has always been considered a very important public sector activity. There are many reasons. First, Governments recognized the crucial role of infrastructure in fostering economic growth and reducing poverty.¹ Infrastructure development has been, and continues to be, a popular and potent instrument of Governments for improving the welfare of the people. Second, because of its public good and “essential” nature, Governments have attempted to ensure its availability irrespective of market conditions. Third, for a number of economic, social and political reasons, private sector involvement in this important area was slow to develop and uneven, and Governments came forward to compensate.

In recent times, however, globalization has changed traditional views of infrastructure. The emergence of trade as an engine of growth and the importance of infrastructure for trade, both in the production and movement of traded goods, have increased the private sector’s stake in this area and incentives for it to take an active role. Certain types of infrastructure (for example, electricity) have become tradables. Furthermore, the trend towards deregulation and liberalization has facilitated flows of portfolio capital and direct investment and increased the ability of the private sector to become a major player. In Asian and Pacific countries, the private sector has a dual role to play. First, they can take a larger role in building and operating infrastructure projects either on their own or through public-private partnerships. Secondly, they can provide financial resources for both public and private infrastructure investment in their own and other countries. The rates and quantum of private savings in many Asian and Pacific countries are quite well known.

With the advancement of globalization, cross-border issues (such as transboundary roads and railways, water infrastructure on rivers that cross frontiers and cross-border capital and investment flows) have taken on much

Infrastructure development has always been considered a very important public sector activity

But the private sector is increasingly taking a major role

¹ Ifzal Ali and Ernesto M. Pernia, “Infrastructure and poverty reduction – what is the connection?” ERD Policy Brief Series No. 13 (Manila, Asian Development Bank, 2003); and Stephen Jones, “Contribution of infrastructure to growth and poverty reduction”, presentation made at the Workshop on Infrastructure in East Asia and the Pacific: The Way Forward, held in Bali, Indonesia, from 27 to 29 June 2004 (both available online at www.adb.org).

greater importance. As individual countries lack the resources to tackle these issues alone, regional cooperation has assumed a primary role in infrastructure development. In Asia and the Pacific, regional cooperation in infrastructure has two strands or tracks. First, different levels of infrastructure development have opened up what a recent ESCAP study clearly demonstrates to be an “infrastructure divide.”² The same study finds a strong correlation between a country’s per capita income and the state of its infrastructure and observes that regional cooperation agreements and initiatives in infrastructure development could create a win-win situation by helping to bridge the divide. Secondly, a number of studies³ have concluded that future demand for infrastructure investment will be enormous. However, the potential of regional cooperation in addressing the resource requirement has not been adequately explored. This area needs to be studied in some detail.

Cross-border issues in infrastructure development can be handled effectively through a two-track regional cooperation strategy

Against that background, the present study analyses infrastructure development and the role of regional cooperation. It attempts to add value to the existing literature on the subject by proposing a comprehensive two-track strategy that includes, first, regional cooperation in building and maintaining infrastructure and, second, cooperation in mobilizing the required finance.⁴

The study raises several questions. What are the salient features of infrastructure development in the Asian and Pacific region? What are the constraints holding back future infrastructure development in the region? What are the region’s future infrastructure needs? What resources are needed to meet these needs? What are the traditional sources of funds? What resources are assured? Will there be a gap between the demand for and supply of resources? If yes, how wide will the gap be? What are the options for bridging the gap? Can regional cooperation be used to operationalize the options? How can regional cooperation be strengthened?

To answer such questions, the study analyses a number of regional cooperation initiatives for strengthening the creation and utilization of infrastructure assets and suggests innovative future initiatives, including some in the area of infrastructure financing. Last but not least, the study draws the attention of policymakers to natural disasters, which have affected development negatively in a large number of Asian and Pacific countries. It suggests that infrastructure development through regional cooperation can help to control damages caused by natural disasters and to expedite post-disaster recovery.

Infrastructure development has many dimensions.⁵ For example, providing incentives for private sector participation in road construction by charging toll fees is an easily acceptable proposition, but in the water

² ESCAP, *Meeting the Challenges in an Era of Globalization by Strengthening Regional Development Cooperation* (United Nations publication, Sales No. E.04.II.F.24).

³ Asian Development Bank, Japan Bank for International Cooperation and World Bank, *Connecting East Asia: A New Framework for Infrastructure* (Washington, D.C., World Bank, 2005).

⁴ Such a two-track approach will also help strengthen physical and non-physical networks and reduce various types of transaction costs.

⁵ The benefits of road construction, for example, will increase if a village being linked to an urban hub is provided with electricity.

infrastructure sector, charging fees to supply drinking water raises many non-economic considerations. Such differences in sectoral strategies need to be recognized and analysed. The diverse infrastructural needs and priorities of the countries of the region also raise a multiplicity of issues. Some of the key issues are identifying and implementing specific infrastructure projects, mobilizing the financial resources they need and providing an enabling policy and institutional environment that facilitates infrastructure investment and utilization of assets.

Taking account of the multidimensional nature of infrastructure development in the region, the study is divided into nine chapters. Chapter II discusses broad issues related to infrastructure development and briefly presents the arguments for narrowing the focus of the study to four types of infrastructural assets, namely transport, ICT, energy and water. It discusses linkages between infrastructure, economic growth and achieving the MDGs; the relationship between infrastructure and disaster management; financing of infrastructure investment and the role of regional cooperation in promoting infrastructure development in general and infrastructure investment in particular.

Chapter III deals with the development of transport infrastructure. It reviews the experiences of Asian and Pacific countries in using transport development for national and regional development. It also outlines a vision of desirable transport infrastructure in the future and considers the obstacles, including how to finance investment in transport infrastructure, that need to be addressed to realize the vision. The chapter also identifies potential initiatives in regional cooperation and integration in transport.

Chapter IV examines the current state of ICT infrastructure in the region and the salient issues and challenges. Regional broadband initiatives are an area of particular discussion but the chapter also identifies future ICT infrastructure needs and costs. It develops a proposal for regional cooperation on the Asia Broadband Program and highlights important policy considerations.

Chapter V briefly covers energy infrastructure needs, including electrical power stations, transmission lines, oil and gas pipelines, storage and end-use of energy along with future investment needs. A number of key examples of energy cooperation are highlighted.

Chapter VI briefly discusses the current status of various types of water infrastructure; infrastructure for managing and storing water resources (dams and reservoirs), drinking water supply and sanitation, wastewater treatment, industrial and irrigation water supply and transboundary water infrastructure. It also considers future water infrastructure development needs and the possible role of regional cooperation as a way to meet those needs.

Chapter VII addresses the role of infrastructure in mitigating the impact of natural disasters and in facilitating post-disaster recovery. After a brief review of regional experiences in developing infrastructure to manage the effects of natural disasters, the chapter identifies priorities for enhanced regional cooperation in infrastructure development and outlines possible regional cooperation initiatives which ESCAP could facilitate.

*Regional cooperation
in infrastructure
development is the
binding theme of the
study*

***Enhancing financial
cooperation for
infrastructure
investment is a priority
for the region***

Issues and options for enhancing regional cooperation in financing infrastructure are discussed in chapter VIII. After a detailed discussion of estimates of the resources needed to fund future infrastructure investment, the chapter analyses the existing sources of funding to ascertain the dimension of the financing gap and considers options for addressing the gap. The options include expanding the role of existing financial institutions and setting up new institutions specialized in infrastructure financing. Chapter IX concludes by synthesizing the key messages of the study and highlights the issue of resource mobilization for infrastructure investment as a priority action for the Asian and Pacific region.

II. REGIONAL COOPERATION IN INFRASTRUCTURE DEVELOPMENT AND FINANCING

A. INTRODUCTION

Infrastructure is a broad concept linked to every facet of the economy and human life. Accordingly, the list of associated issues is long. For any purposeful analysis of issues in infrastructure development to lead to an action-oriented way forward, it is necessary to narrow down the definition of infrastructure and associated issues. The aim of this chapter is to clarify certain concepts and elaborate certain key issues.

The term infrastructure has been used since 1927 to refer collectively to the roads, bridges, rail lines and similar public works that are required for an industrial economy to function. Transportation, communication, sewage, water and electric systems are all a part of infrastructure. These systems tend to be high-cost investments. In general, infrastructure is location-specific and cannot be moved from place to place. However, the term infrastructure is also used to refer to the basic architecture of any system; mechanical, social, political or cultural. The expanded definition of infrastructure includes transport (e.g. roads, railways, ports and airports), public utilities (e.g. electricity and water supply), public services (e.g. fire service, flood protection, police), national services (e.g. the defence, monetary and postal systems and the legal and regulatory system) along with “soft infrastructure,” which denotes institutions that maintain the health and cultural standards of the population (e.g. public education, health and social welfare).¹ There has been further broadening of the meaning of the word. The term is often used very abstractly. For instance, software engineering tools are sometimes described as part of infrastructure. In economics, the term “infrastructural capital” at times includes skilled manpower. Before attempting to put forward the arguments for narrowing down the coverage of infrastructure areas for this study, certain other clarifications are needed.

Two other terms are usually associated with infrastructure. The first is infrastructure services, such as transport, energy and water. A second is the stock of infrastructure assets which produce the flow of services. Although service flows are proportional to the stock of assets, the extent of proportionality can vary according to space, time and infrastructure type. One aspect of infrastructure development is to build new assets and maintain existing assets; another is the delivery of infrastructure services. The major requirements for the first are financial resources and technical capabilities. The service delivery process, on the other hand, is more complex. It involves the

The term infrastructure is very broad; transport, communication, sewage, water, energy as well as health, education, social welfare, law and order could be included. For any meaningful analysis the definition needs to be narrowed down

The stock of infrastructural assets needs to be developed and maintained to expand the flow of infrastructure services

¹ Definition and background provided by the Answers Corporation (www.answers.com).

interaction of multiple actors: consumers, service providers, government, communities and NGOs, as well as an enabling economic environment and a host of institutions, including those related to rules and regulations, law and order, and governance.

This chapter attempts to bring together some of the major issues in the Asian and Pacific region. What is the link between infrastructure and the economic and social performance of the countries of the region? What are the links between infrastructure and economic growth? How important is infrastructure development for poverty reduction and achieving the MDGs? What kind of infrastructure is needed for disaster management given the realization that natural disasters pose an increasingly serious obstacle to achieving the MDGs? What funds are needed to finance the region's future infrastructure development? How can the required finances be mobilized? How can regional cooperation help in this endeavour? How can existing regional cooperation initiatives promoting infrastructure development be strengthened and new ones formulated?

Financing the development of infrastructural assets is an important issue; regional cooperation can help

Before proceeding further, one concept needs to be clarified. As already pointed out in the introduction, this study will deal mainly with infrastructure assets (such as electricity-generating plants) and not infrastructure services (such as the flow of electricity). It will be assumed that increased provision of infrastructure assets will lead to increased flow of services² as, in most cases, the availability of the former is a necessary condition for the latter. Policymakers and thinkers alike recognize the nexus between the process of economic development³ and an adequate stock of infrastructure assets. Accordingly, infrastructure (asset) development and identifying and implementing appropriate policies for it figure prominently in the agendas of all Governments.

The study focuses on development in four infrastructure areas: transport, information and communication technology, energy and water

This chapter discusses issues associated with the role of regional cooperation in infrastructure development. In view of the broad definition of infrastructure discussed above, this study will focus on transport, information and communication technology, energy and water, which are essential for the production of nearly all goods and services. However, in these discussions, especially on linkages of infrastructure with the rest of the economy, the terms assets and services will be used interchangeably.

B. INFRASTRUCTURE AND ECONOMIC GROWTH

Transport, telecommunications, energy and water have become part and parcel of human existence. It is difficult to imagine a modern world without them. These are central to the household life and economic production. A lack of such infrastructure facilities is considered to be a major structural weakness which holds back economic growth and development. It is often said that infrastructure can be considered, if not the engine, then the "wheels" of economic growth. This is one part of the infrastructure story. The other part is that infrastructure helps to spread the benefits of growth, which makes the development process more inclusive.

² World Bank, *World Development Report 1994: Infrastructure for Development* (New York, Oxford University Press, 1994) discusses the service delivery issues in detail.

³ Edgardo B. Espiritu, "Infrastructure and development", *Manila Times*, 11 May 2005 (available online at www.manilatimes.net).

Infrastructure has strong supply- and demand-side economic linkages. As already pointed out, these four infrastructure sectors are used in the production of nearly all goods and services and hence are called “universal intermediate.” The availability of these “inputs” is essential in order to ensure supply.

In much the same way, infrastructure caters directly to demand. Households and governments consume infrastructure services, such as transport, communication, energy and water, to satisfy basic needs for survival in modern times. When events such as natural disasters destroy infrastructure, their opportunity cost becomes painfully evident. Major infrastructure failures quickly and drastically reduce the quality of life of communities. The impact of infrastructure consumption on productivity can be significant. For instance, providing faster motorized transport services (which require good paved roads) allows people to cut down significantly on their time in commuting to work or bringing their produce to the market, which can increase their labour productivity.

The availability of infrastructure has a very perceptible impact on other areas of demand, such as foreign trade and investment. The role of transport in economic development is usually discussed in relation to its contribution to the development of domestic trade. Globalization has changed this perception. The ability of a country, and particularly the more isolated communities within a country, to participate in trade depends on the quality of the transport and communication infrastructure that allows them access to the world trading system. If liberalization of trade can open new markets, appropriate transport infrastructure, timely delivery and the quality of services provided are essential elements in determining the competitiveness of products for global markets. Transport services (for example, shipping) have become a tradable service.⁴ Furthermore, the competition in certain high-value export markets is especially dependent on high quality infrastructure. For example, developing countries wishing to participate in global production networks should create a good-quality transport and telecommunication infrastructure. In fact, studies have shown that improving trade efficiency can do much more to spur economic growth than tariff reform⁵ and improving infrastructure is a major factor in improving efficiency of trade.

A large volume of research studies also makes it clear that the availability of good quality physical infrastructure improves the climate for foreign direct investment (FDI) by reducing the “cost of total investment” incurred by foreign investors and thus raising the rate of return.⁶ Thus, both the quantity and quality of physical infrastructure is often an important consideration for multinational enterprises in choosing where to locate their FDI. Following this logic, it is almost certain that infrastructure development will also “crowd in” domestic private investment.

Infrastructure is used in the production of goods and services as well as directly to satisfy consumer demand

The availability of infrastructure is crucial for enabling countries to participate in international trade and the quality of infrastructure is an important determinant of trade competitiveness

The availability of infrastructure attracts FDI

⁴ ESCAP, *Development through globalization and partnership in the twenty-first century: An Asia-Pacific perspective for integrating developing countries and economies in transition into the international trading system on a fair and equitable basis* (ST/ESCAP/2054).

⁵ D. Brooks, David Roland-Holst and F. Zhai, “Growth, trade and integration: long-term scenarios of developing Asia” (Manila, Asian Development Bank, 2005).

⁶ Nagesh Kumar, “Broader economic integration in Asia: trends, potential and a possible roadmap”, theme paper for the Third High-Level Conference on Building a New Asia: Towards an Asian Economic Community, jointly organized by Shanxi University of Finance and Economics and the Research and Information System for Developing Countries (RIS), Taiyuan, China, 15-16 September 2005.

From both supply- and demand-side considerations, infrastructure development is positively and strongly correlated with economic growth. Empirical research using cross section-time series pooled data from over a hundred countries and spanning 40 years has also shown that growth is affected positively by the stock of infrastructure assets.⁷ However, the importance of infrastructure goes far beyond its impact on growth.

C. INFRASTRUCTURE AND POVERTY REDUCTION

Economic growth brings economic development, but the “inclusiveness” of development is an important issue for policymakers. Are the benefits of economic growth shared by all so as to contribute to the reduction of poverty? This is not guaranteed. Economic growth is a necessary condition for poverty reduction but not a sufficient one. Infrastructure, however, plays a dual role. It supports higher economic growth and also strengthens the sharing of the benefits of growth. The latter takes place in more than one way.

Availability of infrastructure ensures delivery of a number of basic needs: water for drinking; power for cooking, heating and lighting; telephones to interact with others who are at a distance; and transport, which allows mobility. Providing access to these basic services is an important aspect of poverty reduction.

Infrastructure helps poverty reduction in a number of ways: strengthening economic growth, which increases employment opportunities, and improving public health and education

Infrastructure plays an equally prominent role in increasing employment and incomes for the poor. For example, roads and railways increase access to employment, health and education for the poor, who normally live in places away from economic hubs and social facilities. Better access to communication aids the poor in migrating to find work or markets for their produce and to engage with wider communities. There are good reasons why infrastructure development may have a disproportionately positive impact on the income and welfare of the poor. Empirical research shows that infrastructure development, especially transport development in general and road development in particular, can be highly effective in combating poverty⁸ (see box II.1). The Asian Development Bank has emphasized this line of thinking (see box II.2).

D. INFRASTRUCTURE INVESTMENT AND ITS FINANCING

It is amply clear from the above discussions that the development of infrastructure needs to be sustained to support both future economic growth, poverty reduction in general, and achieving the MDGs in particular. Many researchers have discussed the importance of infrastructure development in achieving the MDGs.⁹ Overall findings show that infrastructure projects

⁷ César Caldeón and Luis Servén, “The effects of infrastructure development on growth and income distribution”, Central Bank of Chile, Working Paper No. 270, September 2004 (available online at www.bcentral.cl).

⁸ Ibid.

⁹ Antonio Estache, “Emerging infrastructure policy issues in developing countries: a survey of the recent economic literature”, World Bank Policy Research Working Paper No. 3442, November 2004 (available online at www.worldbank.org).

Box II.1. Road development and poverty reduction: the case of the Lao People's Democratic Republic^a

Most poor people in the developing world, including Asian and Pacific countries, reside in rural areas characterized by low levels of public infrastructure, especially roads. Inadequate access to roads increases transport costs, prevents poor people from using local markets to sell their produce and buy goods and lessens opportunities for off-farm employment. Access to education and health facilities is also constrained when it is difficult to reach them. These problems are particularly acute in the Lao People's Democratic Republic, where inadequate roads are a severe problem for rural people. Over the past decade, efforts by the Government have led to improvements in rural roads. The impact was significant. A study shows that, between 1997 and 2003, the incidence of rural poverty in the Lao People's Democratic Republic declined by 9.5 per cent. An analysis of the relationship between the poverty incidence and road development suggests that about 13 per cent of this decline in rural poverty can be attributed to improved road access alone.

Between 1997 and 2003, improvement in road access took the form of providing wet weather access to areas which already had dry season access. The study suggests that this strategy paid off significantly in reducing poverty and that further investment in providing this form of road is highly desirable.

The study suggests that there is a high return from providing dry weather access to the country's most isolated households – those which have no road access at all. These constitute 31.6 per cent of all rural households, which are being left behind by the development of the market economy. By providing them with dry season road access, the incidence of rural poverty could be reduced permanently from the current 33 per cent to 29.7 per cent and providing all rural households with all-weather road access would reduce it further to 26 per cent.

^a Peter Warr, "Road development and poverty reduction: the case of Lao PDR", Asian Development Bank Institute Research Paper No. 64, 21 April 2005 (available online at www.adbi.org).

deliver high economic and social returns (see box II.3). Economic returns on investment projects average over 30 to 40 per cent for telecommunications and more than 200 per cent for roads. These returns are much higher in low-income countries than in middle-income countries.

Is there an "adequate" level of infrastructure development which the countries of the Asian and Pacific region would like to achieve? What is the demand for infrastructure in the region? A rough comparison of access to infrastructure between developed and developing countries shows that potential private consumer demand for infrastructure in Asian and Pacific countries is tremendous. Across the world, about 2.5 billion people cannot access commercial energy, approximately 1.2 billion people do not obtain safe drinking water and about 1.6 billion people cannot use roads. A large majority of these deprived people belong to the Asian and Pacific region. As a result, the gap between developed and developing Asian and Pacific countries in terms of access to basic infrastructure services is very large. In many developing countries in this region, average electricity consumption is 300 kilowatt-hours per person, compared with 9,000 kilowatt-hours (30 times higher) in Europe and North America.¹⁰ Such large gaps exist for all types of

¹⁰ Remarks by Tadao Chino, President of the Asian Development Bank, at the Conference on Infrastructure and Development, Asian Development Bank Institute Annual Conference, Tokyo, 6 December 2004 (see www.adbi.org).

Box II.2. The Asian Development Bank's assistance to China and poverty reduction^a

Pro-poor economic growth is supported by moving lending to the poor interior areas and designing infrastructure projects to spread benefits to the poor. To address the growing income disparities between urban and rural areas and between inland provinces and coastal areas, the Asian Development Bank decided to assist the Government of China in promoting economic growth to reduce poverty in the inland provinces. ADB will shift the focus of its lending operations to the less developed inland provinces where most of the country's poor live. ADB will help to reduce poverty by designing physical infrastructure development to distribute project benefits to poor areas. Selected examples of such projects are given below.

Project	Loan amount (Millions of United States dollars)	Type of poverty intervention to promote increased employment and income
Yaogu-Maoming Railway	67.5	Transportation access in/through poor counties
Qitaihe Thermal Energy	165.0	Access to electricity in a poor area
Henan Power	200.0	Access to electricity by poor villagers
Daxian-Wanxian Railway	100.0	Transportation access in/through poor counties
Jiangxi Expressway	150.0	Transportation access by poor townships
Shenmu-Yan'an Railway	200.0	Transportation access in/through poor counties
Hebei Roads Development	180.0	Transportation access by poor townships
Guizhou-Shuibai Railway	140.0	Transportation access by poor counties
Chengdu-Nanchong Expressway	250.0	Transportation access by poor townships and villages
Yunnan Transmission	100.0	Access to electricity by poor villagers
Southern Yunnan Road Development	250.0	Local feeder roads in poor counties and townships
Shanxi Road Development	250.0	Local feeder roads in poor counties and townships
Chongqing Guizhou Road Project	320.0	Local feeder roads in poor counties and townships
Hefei Xi'an Railway Project	300.0	Transportation access by poor townships
Shaanxi Roads Development	250.0	Transportation access by poor counties and townships
Ganzhou-Longyan Railway Project	200.0	Transportation access in/through poor counties
Guangxi Roads Development	150.0	Transportation access by poor villages
Shenda Grid Rehabilitation and Transformation	100.0	Rural electrification

^a Asian Development Bank, ADB's assistance to China and Poverty Reduction, 35th Annual Meeting of the Board of Governors, Shanghai, 8-12 May 2002, <http://www.adb.org/AnnualMeeting/2002/Media/adb_prc2.html>.

Box II.3. Infrastructure development and achieving the Millennium Development Goals

Asian and Pacific countries have made significant progress towards their MDGs,^a yet many still face substantial problems in fully achieving them. Lack of infrastructure, especially roads, transport, ICT, energy and water, have been found to be one of the main barriers to poverty reduction and ensuring equitable access to basic services. As a result, infrastructure development has a significant role to play in countries achieving their MDGs by stimulating growth, increasing access to resources and services, reducing vulnerability and improving income-earning capacity.

Goal 1 – Eradicate extreme poverty and hunger

In developing countries, the poor are often excluded from the benefits of infrastructure provision. Poor transportation infrastructure is a major obstacle to increasing agricultural productivity and market activities. Transport infrastructure and services facilitate food production by lowering input prices and transaction costs, increasing agricultural production and improving access to markets. Thus, road construction and improved access to transport services could be effective in reducing poverty and hunger.^b

Transport can also help to create opportunities for non-agricultural employment by facilitating poor people's access to locations where there is greater demand for their services. In urban areas, transport is a major source of employment where there are numerous forms of small and non-motorized vehicles. Three-wheeled taxis (motorized) in Sri Lanka generate more than 300,000 direct jobs for youth in the low-income groups.^c In Bangladesh, the rickshaw industry alone was estimated to employ 1.25 million people.^d

Goal 2 – Achieve universal primary education

Availability of infrastructure has substantial implications for access to education.^e A major cause of drop-outs in primary schools is the distance that children have to walk to reach their schools. In Thailand, some parents have removed their children from school because they could not afford the combined costs of education and transportation. Attendance, especially for girls, and performance at school is also affected by lack of appropriate transport services.

Where a paved road exists, a school's participation rate increases for both boys and girls.^f Apart from enabling pupil and teacher access to schools, transport improvements can reduce the amount of time that household members, including children, have to devote to collecting water, fuel and food, which is usually one of the reasons for non-enrolment.

Water and sanitation services affect the schooling of rural children. Lack of such services discourages qualified teachers from working in poor villages. Queues for water almost always consist of women and girls, preventing women from engaging in productive activities and keeping girls from attending schools.^g Studies show that girls' school attendance can be increased through improved sanitation. In Bangladesh, a school sanitation programme has increased the enrolment of girls by 11 per cent every year since it began in 1990.^h

^a The United Nations Millennium Project has estimated that, in 2005, Asia was home to 71 per cent of the total number of people in the world without access to improved sanitation; 58 per cent of those without access to safe water; 56 per cent of the world's undernourished; 54 per cent of those living in slums; and accounted for 43 per cent of the world's child mortality.

^b United Kingdom, Department for International Development, "Transport's role in achieving the Millennium Development Goals" (2002).

^c Ibid.

^d Ibid.

^e ESCAP, ADB and UNDP, *A Future Within Reach: Reshaping Institutions in a Region of Disparities to Meet the Millennium Development Goals in Asia and the Pacific* (United Nations Publication, Sales No. E.05.II.F.27).

^f United Kingdom, Department for International Development, "Transport's role in achieving the Millennium Development Goals" (2002).

^g Erna Wiltoelar, "Where Does the Asia and Pacific Region Stand in Achieving Water-Related Millennium Development Goals?", Jakarta, 23 January 2004.

^h Health, Dignity and Development: What Will it Take? United Nations Millennium Project Task Force on Water and Sanitation, 2005.

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Goal 3 – Promote gender equality and empower women

The “time poverty” caused by poor infrastructure limits women's chances of obtaining an education, engaging in income-generating activities and participating in community affairs. In many cases, women work significantly more hours per day than men. They spend a large amount of time gathering fuel wood and fetching water. Such “time poverty” can be reduced by promoting rural electrification and providing affordable means of transport and access to clean water.

Women's mobility is also constrained by their socially constructed roles. A lack of mobility and access restrict women's choices and their participation in the social and political process. Women's access to ICT and modern means of communication would increase their engagement in civil society and politics. ICT offers access to information and social, economic and empowerment networks. In general, ICT fosters social, economic and spatial integration and mitigates isolation in much the same way as transport.

Goal 4 – Reduce child mortality and Goal 5 – Improve maternal health

Inadequate transport and communication services are the main constraints in achieving key health targets in developing countries. Poor families are often far from medical facilities and without access to affordable transport. WHO reports that some 40 to 60 per cent of the people in poor countries live more than 8 km from a health care facility.ⁱ There is a clear association between levels of infant and child mortality and the distance to health care facilities. A study from Cebu in the Philippines indicates that a 10 per cent increase in distance (from the hospital) is associated with a 2 per cent increase in all three mortality rates.^j

Poor transport infrastructure also affect women's gynecological health in many ways. Around 250,000 women die each year during pregnancy or childbirth across Asia and the Pacific.^k These deaths could be avoided if mothers had routine obstetric checks and access to emergency obstetric care. Surveys in a range of countries confirm that many women would like to deliver in a formal health facility but are unable to do so because of distance and lack of transport.^l The transport sector has a critical role to play in reducing maternal mortality because of the need for urgent evacuations to hospital of women who suffer serious problems in childbirth or other emergencies. Transport also plays a significant part in the distribution of drugs, blood, vaccines, bed nets and other supplies to health facilities.

The attainment of MDGs 4, 5 and 6 also depends on increased access to clean water and sanitation. More than 3 million deaths are caused each year by waterborne diseases and inadequate sanitation.^m Contaminated water and improper sanitation also harm women's health. Providing clean water supply and sanitation could reduce the incidence of diseases such as diarrhea and dengue fever, the leading killers of children under five years old. ICT could play a critical role in supporting the prevention efforts.

Goal 6 – Combat HIV/AIDS, malaria and other diseases

HIV is spreading at an alarming rate in many parts of Asia. As of 2004, the Asian and Pacific region has over 9 million people living with HIV/AIDS and each year half a million people die of it.ⁿ Malaria and tuberculosis remain a major concern in many developing countries. Infrastructure and services have to be adequate to ensure timely and efficient delivery of key inputs such as impregnated bed nets, drugs, repellents, quinine and medicines, with particular attention to maintenance of the cold chain for certain vaccines. Adequate infrastructure also influences the success of tuberculosis and other immunization and disease control programmes.

ⁱ United Kingdom, Department for International Development, “Transport's role in achieving the Millennium Development Goals” (2002).

^j Ibid.

^k ESCAP, ADB and UNDP, *A Future Within Reach: Reshaping Institutions in a Region of Disparities to Meet the Millennium Development Goals in Asia and the Pacific* (United Nations Publication, Sales No. E.05.II.F.27).

^l United Kingdom, Department for International Development, “Transport's role in achieving the Millennium Development Goals” (2002).

^m Erna Wiltoelar, “Where Does the Asia and Pacific Region Stand in Achieving Water-Related Millennium Development Goals?”, Jakarta, 23 January 2004.

ⁿ ESCAP, ADB and UNDP, *A Future Within Reach: Reshaping Institutions in a Region of Disparities to Meet the Millennium Development Goals in Asia and the Pacific* (United Nations Publication, Sales No. E.05.II.F.27).

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Goal 7 – Ensure environmental sustainability

Finding safe water may be an unattainable dream for 700 million people in the Asia and the Pacific region.⁹ One in three Asians lacks access to safe drinking water, and half the people living in Asia and the Pacific do not have access to adequate sanitation.¹⁰ The need for sanitation and water supply is urgent and immense. Sufficient clean drinking water and adequate water for household, agriculture and economic activities can be instrumental in reducing poverty and hunger. As women are most affected by water insecurity, they should play a central role in the management of water resources.

Appropriate infrastructure can also contribute in many ways to development that is environmentally sustainable, an issue that is already at the forefront in many Asian cities grappling in particular with vehicular air pollution and traffic congestion. More efficient public transport will not only improve the lives of the urban poor by enhancing access to public services and employment but would also help to meet the challenge of reducing vehicle emissions.

Goal 8 – Develop a global partnership for development

MDG 8 concerns the broader framework of international cooperation in support of economic development. The specific objectives agreed include progress in addressing the “special needs” of least developed and landlocked countries. Landlocked countries face problems of high transport costs as well as the inadequacy of transport and communications infrastructure, which makes it difficult to guarantee timely, reliable or flexible delivery of goods. These problems inflate the prices, not only of imported consumer goods but also of fuel, capital goods and intermediate inputs, thereby increasing the cost of domestic agricultural and industrial production and reducing their competitiveness. Adequate infrastructure would give these countries greater access to employment, educational and health facilities, agricultural development, social inclusion and networking.

Conclusion

Infrastructure development will be critical to the Asian and Pacific region’s ability to meet the MDGs. Efficient and inclusive infrastructure would help to reduce the share of the population living on less than \$1/day as the opportunity for people to earn a living is increased when transport, information, electricity and water are readily available. Emerging challenges such as urbanization, decentralization, demographic change and increased regional integration would require a large-scale investment in infrastructure.

⁹ Dr. Bindu N. Lohani, “Advancing Sanitation and Wastewater Management Agenda in Asia and Pacific Region”, Keynote Speech at the Sanitation and Wastewater Management-the Way Forward Workshop, Manila, 19-20 September 2005.

¹⁰ Erna Wiltoelar, “Where Does the Asia and Pacific Region Stand in Achieving Water-Related Millennium Development Goals?”, Jakarta, 23 January 2004.

infrastructure. The gap is an indicator of latent or potential consumer demand which is bound to reveal itself as the growth rate of the region’s economies accelerates. However, a major part of the demand for infrastructure will be for intermediate inputs required for the production of goods and services. In many Asian and Pacific countries, both forms of demand are expected to be formidable. For example, demand for petroleum has been heavy in Japan, the Republic of Korea and India and dizzying in China.¹¹ To meet the demand, the region needs to be prepared to invest heavily in infrastructure in the coming decade. Studies undertaken by the World Bank

In the rapidly growing Asian and Pacific region, demand for infrastructure is expected to be very large in the coming years, necessitating heavy investment in infrastructure assets

¹¹ Jamie Miyazaki, “Beware the petrodragon’s roar”, *Asia Times Online*, 10 June 2004 (www.atimes.com/atimes/china/ff10Ad05.html).

individually and jointly with the Asian Development Bank and Japan Bank for International Cooperation estimate the infrastructure investment needs of developing Asian and Pacific countries at \$228 billion annually between 2006 and 2010.¹² The present study, however, provides some alternative estimates which are higher (see chapter VIII).

1. RESOURCES FOR INFRASTRUCTURE INVESTMENT: THE FINANCING GAP

Without going into the precision of the estimated requirement of \$228 billion per year, it can safely be concluded that the dimension is very large. The challenge is: can funds of this magnitude be mobilized and, if yes, by what means? Historically, infrastructure investment in developing countries has been funded largely through public funds. In the major developing countries of the Asian and Pacific region for which data was available, this amounted to around \$27.2 billion per year from 2000 to 2003.¹³ However, fiscal constraints and concerns of “overheating” will seriously limit the ability of Governments to set aside funds for infrastructure investment. There are also other considerations. Current expenditure often takes priority over long-term capital expenditures on infrastructure development which becomes the first casualty of any fiscal restraint effort.¹⁴ Thus, the current level of infrastructure investment (\$27.2 billion annually) is not expected to increase significantly. Private sector investment in infrastructure in the Asian and Pacific region has amounted to about \$20.6 billion annually from 2000 to 2003 and under normal circumstances is also not expected to change drastically¹⁵ (see box II.4).

There are many reasons why private investment in infrastructure will not increase. Infrastructure subjects private investors to major risks because the investments are often large and their costs can be recouped only over long periods of time. Two additional special features of infrastructure create additional risks. First, the investments are largely sunk; the assets cannot be used elsewhere. Secondly, infrastructure projects often provide services that are considered essential to the population, including the poor, and the pricing of infrastructure services becomes a sensitive issue in which the rate of return that is attractive to private investors is weighed against a rate that is affordable to the general population. These factors make the returns from infrastructure projects vulnerable and uncertain. Therefore, attracting private investment in infrastructure often requires guarantees against such risks which are not forthcoming in a systematic manner from existing institutions. This constraint has been a particular problem in many countries of the Asian and Pacific region after the 1997 economic crisis.

From this analysis, the Asian and Pacific region can expect a huge gap of about \$180 billion annually between demand for infrastructure investment (\$228 billion) and supply (\$47.8 billion from public and private

If investment in infrastructure continues at its current level, the gap between supply and demand could be \$180 billion per year

¹² The estimate of infrastructure investment requirement is taken up in more detail in chapter VIII, on financial cooperation.

¹³ Data compiled by ESCAP on countrywide investment in infrastructure. Data from IMF, *Government Financial Statistics* (various issues) have been used. Some details are given in the annex tables. Infrastructure investment refers to government or as reported in the data source.

¹⁴ World Bank, *World Development Report 1994: Infrastructure for Development* (New York, Oxford University Press, 1994), “Throwing infrastructure overboard” (box 1.3).

¹⁵ ESCAP calculations based on World Bank, “Private participation in infrastructure” database (see annex table II.1).

sources).¹⁶ However, resources provided by multilateral institutions for infrastructure projects have averaged \$7.4 billion per year from 2000 to 2003, including lending by the Asian Development Bank (\$2.6 billion), the World Bank (\$2.8 billion) and the Japan Bank for International Cooperation (\$2.0 billion). Most of these resources were used by Governments to fund public infrastructure investment.

Although estimates of infrastructure investment needs and financing gaps are important, there can be differences in the assumptions on which they are based (see chapter VIII for alternative estimates). Moreover the data will be subjected to significant biases due to such factors as the paucity of available data on infrastructure investment, incomplete coverage and differences in definitions.¹⁷ The precision of the estimated \$180 billion annual financing gap is not of primary importance; the figure is only indicative. The crucial point is that the financing gap is formidable. The main aim of discussing these numbers, therefore, is to draw the attention of policymakers to the magnitude of the effort needed to mobilize resources.

E. FUNDING THE FINANCING GAP

What are the funding sources that can be drawn upon to bridge the gap? The most important source for Governments of the Asian and Pacific region is borrowing (including concessional loans and grants) from existing multilateral organizations such as the Asian Development Bank, the World Bank and the Japan Bank for International Cooperation. However, as mentioned before, total funding received by the developing countries for infrastructure investment from these three organizations amounted to \$7.4 billion per year from 2000 to 2003.¹⁸ This represents less than 5 per cent of the gap. At this stage, the pertinent question is: are resources (savings) available in the region (both developing and developed countries) that can finance the needed level of investment? The savings investment gap of the region shows that there is ample room for optimism. From 2000 to 2003, many countries recorded a large surplus, notably Japan (\$53.5 billion), the Russian Federation (\$44.2 billion) and China (\$32.6 billion) (annex table II.3). These surpluses far exceed the moderate deficits observed in such countries as Turkey (\$5.5 billion), India (\$3.6 billion) and Australia (\$3.5 billion) (annex table II.4).

The region's overall savings surplus turns out to average around \$200 (\$197.5 to be exact) billion annually from 2000 to 2003.¹⁹ This included total surplus savings of \$51.7 billion in the region's developed countries (Japan and New Zealand) and \$145.8 billion in its developing countries. Among the latter, the largest surplus was recorded by South-East Asia (\$57.1 billion), followed by East and North-East Asia (\$56.3 billion), North and Central Asia (\$44.2 billion) and the Pacific islands (\$0.89 billion). South and South-West Asia, however, show a small deficit of \$11.9 billion.

The Asian and Pacific region's surplus savings (savings minus investment) amounted to \$200p billion annually from 2000 to 2003. In principle, these funds could be used to bridge the \$180 billion annual gap in infrastructure financing

¹⁶ However, alternative estimates of infrastructure investment which are larger than the annual \$228 billion result in financing gaps that are correspondingly larger (see chapter VIII for details).

¹⁷ For a more detailed discussion, see chapter VIII.

¹⁸ ESCAP calculations. Some details are given in annex table II.2.

¹⁹ ESCAP calculations. Some detail tables are given in annex tables II.5). An alternative estimate (http://www.newasiaforum.org/ris-policy_briefs.htm) of available funding which can be used for regional projects is \$150 billion per year.

Effective and systematic cross-border intermediation of these surplus savings, against the background of the region's more than \$2.5 trillion in foreign exchange reserves (end June 2005), might be an option for filling the gap.²⁰

The following quotation shows the way forward:

"If we can attract sufficient investment, including in infrastructure, 20 or 30 years from now, the Asia-Pacific region could become the economic engine room for the whole world. Across the region there are significant differences between nations. But one very simple fact applies to all of us: whatever the shape of our nations, whatever the size of our economies, we cannot drive sustainable economic growth without the right infrastructure in place. Equally, we will not be able to deliver the necessary level and quality of infrastructure until the region's governments are able to form stable and balanced relationships with the private sector and attract ongoing private sector investment."²¹

Public-private partnerships mobilizing regional resources to fund investment, especially in infrastructure, are within the reach of Governments in the Asian and Pacific region. So far, however there has been no cross-border intermediation of regional savings that systematically accesses the private capital markets of Asian and Pacific countries to finance development, including infrastructure. The challenge is to devise an appropriate modality which will both mobilize private funds and induce the private sector to invest in infrastructure.²²

Cross-border intermediation of the regional savings by systematically accessing private capital markets could be one way of addressing the gap in financing infrastructure investment

F. INFRASTRUCTURE AND DISASTER MANAGEMENT

The aim of governments everywhere is to keep the damage to "critical infrastructure" during natural disasters to a minimum. The term "critical infrastructure" defines the systems, facilities and networks which support the health, safety and economic well-being of the population, during and after natural disasters. These usually include energy and utilities (electricity, gas), transportation (road, railways, and water), communications, food, water and health services and essential government services.²³ Mitigation activities before disasters strike should aim, in particular, at protecting these critical infrastructures so that relief and reconstruction activities afterwards can be carried out efficiently.

However, natural catastrophes destroy essential infrastructure. Asia accounts for half of the world's natural catastrophes and 70 per cent of all floods and much of the damage inflicted by floods is to infrastructure. By some estimates, infrastructure losses account for 65 per cent of all flood

²⁰ The foreign exchange reserves of 15 major countries and areas in Asia and the Pacific (covering 99 per cent of the total reserves of the region) for the year 2004 are given in annex table II.6.

²¹ Opening address by the Honorable John Brumby, MP, Treasurer, Minister for Innovation, and Minister for State and Regional Development, Government of Victoria, Australia, at the Asia-Pacific Infrastructure Forum, held in Melbourne, Australia, from 1 to 3 December 2004 (see www.infrastructureforum.com.au).

²² Such a modality could also provide various guarantees which the private sector needs before it will invest in infrastructure.

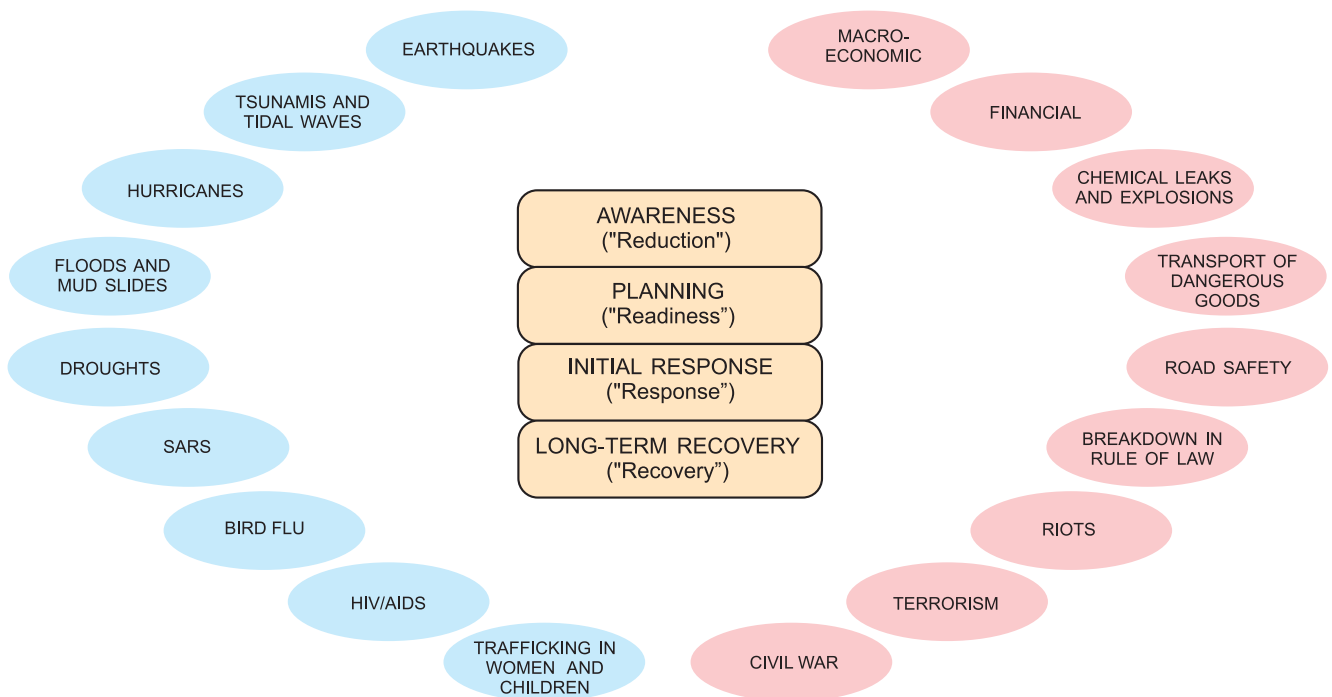
²³ Canada, Public Safety and Emergency Preparedness Canada, "About critical infrastructure" (www.psepc-sppcc.gc.ca), accessed 7 July 2005.

losses.²⁴ The cost of infrastructure losses can be compared with the World Bank's worldwide lending: the direct damage to infrastructure in Asia alone is equivalent to approximately 50 per cent of the World Bank's total lending.

Three factors are important in dealing with natural disasters. Firstly, physical infrastructure development can prevent damage from natural disasters. For example, drinking water systems can be very effective for flood management. Secondly, as mentioned above, care has to be taken to keep damage to critical infrastructure to a minimum. Thirdly, reconstruction and rehabilitation activities in the post-disaster period need to be carried out efficiently. A range of institutional initiatives play an important part in achieving these aims. This can include combined efforts by all sectors to plan ahead for disasters, build capacity and strengthen institutional arrangements, including legislation that covers land-use regulations, building codes and environmental protection. Other initiatives that contribute to efficient management of natural disasters include drawing up an integrated disaster risk management plan which covers risk assessment, early warning systems, training and public awareness programmes, as well as emergency response management, recovery resources and strengthening community-based organizations. A generic approach to crisis and risk management is given in figure II.1. As location is a key factor determining levels of risk, land-use plans and mapping are useful tools for identifying the most suitable usage of land in vulnerable areas (for example, determining the location of buildings, roads, power plants and fuel storage depots).

Natural disasters cannot be prevented but the adverse impacts of these events can be kept to a minimum by preparing an integrated disaster risk management plan, including early warning systems

Figure II.1. Crisis and risk management: the generic approach of ESCAP



²⁴ Paul K. Freeman, "Infrastructure, natural disasters and poverty" in *Proceedings of the EuroConference on Global Change and Catastrophic Risk Management: Flood Risks in Europe*, International Institute for Applied Systems Analysis, Laxenburg, Austria, 6-9 June 1999 (available online at www.iiasa.ac.at).

Promoting regional cooperation between countries within the Asian and Pacific region is crucial for the success of these initiatives on the ground.²⁵ In this regard, the experiences of other regions, especially North America, South America and the Caribbean, are of considerable benefit to the Asian and Pacific region.

G. REGIONAL COOPERATION IN INFRASTRUCTURE DEVELOPMENT AND FINANCING: A TWO-TRACK APPROACH

The role of regional cooperation in infrastructure development has been increasingly discussed in recent years and offers considerable potential for fulfilling the infrastructure dream of this region.

Regional cooperation in infrastructure development in the Asian and Pacific region has taken a two-track approach, including cooperation in implementing cross-border initiatives and cooperation in development financing

In the Asian and Pacific region, regional cooperation in developing infrastructure has followed a two-track approach: on the one hand, there has been cooperation in building cross-border infrastructure that exploits shared resources (such as energy and water), harmonizing cross-border rules and regulations and learning from good institutional practices and policies. On the other hand, there has been cooperation in financing infrastructure development.

Regional cooperation delivers the most benefits when it is geared to promoting long-term growth and development. For this reason, even if trade liberalization is usually at the core of such initiatives, they increasingly cover related activities, such as transport, energy, communications and other infrastructure development. In addition to promoting infrastructure development at the national level, Asian and Pacific countries also need to cooperate to create regional infrastructure, such as the Asian Highway and Trans-Asian Railway Network, where cooperation promoted by ESCAP has played and will play an important role.

Regional cooperation is also important for infrastructure financing. One major option available to Governments for financing infrastructure investment is to secure loans from multilateral institutions, particularly the Asian Development Bank, the World Bank and the Japan Bank for International Cooperation. However, it is important to remember that the Asian Development Bank was established through a regional cooperation initiative by ESCAP (then known as the Economic Commission for Asia and the Far East or ECAFE) in 1966.²⁶

Since then, Asian and Pacific countries have experienced considerable positive changes. East and South-East Asian countries have recorded enviable economic and social progress. China has not only achieved a very high economic growth rate but has also become a major player in the world economy. India has shown considerable resilience. The role of the private

²⁵ Neil Britton, "Managing Hazards from an Asia-Pacific Perspective", a paper prepared for the 1st Annual Symposium of the Canadian Risk and Hazards (Knowledge and Practice) Network: Reducing Risk through Partnerships, Winnipeg, Manitoba, Canada, 18-20 November 2004 (see www.crhnet.ca); and Y. Murosaki and K. Koshiyama, "Disaster risk assessment and management – urban planning for disaster reduction", Working Group 2, Urban Planning for Disaster Reduction, 3rd EqTAP Workshop, Manila, 28-30 November 2000.

²⁶ ESCAP, *Meeting the Challenges in an Era of Globalization by Strengthening Regional Development Cooperation* (United Nations publication, Sales No. E.04.II.F.24), p.29.

sector (domestic and foreign) in both savings and investment has vastly expanded in all developing countries. The three developed countries of the region, namely Australia, Japan and New Zealand, have been able to maintain their status. Indeed, Japan remains the second largest economy in the world. As a result of these extraordinary economic performances, massive resources (domestic savings and foreign exchange reserves) are available within the region. In addition to the three developed countries that already possess advanced capital markets, many developing Asian and Pacific countries have made efforts to develop their stock and bond markets. Domestic capital markets are gaining significant importance as mechanisms of financial intermediation.²⁷ Conditions may be conducive to undertaking cross-border intermediation of available regional resources to fund infrastructure. There have also been some encouraging steps towards enhancing intermediation through regional cooperation. The Asian Bond Fund (ABF 1 and 2) and the Asian Development Bank's Asian Infrastructure Fund are two such examples.²⁸ There have also been other proposals for pooling savings.²⁹ However, regional cooperation has not been put to systematic use as a way to access savings through capital markets. The European Investment Bank may be a useful case study in order to evaluate the feasibility of adopting a similar mechanism for mobilizing resources primarily from capital markets and for lending to countries for development, especially in infrastructure, and at the same time promoting private sector participation in this area by providing direct loans and guarantees.

This chapter discussed the major issues in infrastructure development, including the role of regional cooperation. These issues, however, need to be analysed from a sectoral perspective. It would be especially interesting to ascertain how regional cooperation has been used in creating, strengthening and facilitating cross-border initiatives in the four infrastructure sectors that this study considers and in infrastructure development for disaster management. These will be discussed in the next five chapters, and options for cooperation in addressing the gap in infrastructure financing will be taken up in chapter VIII.

Could the lessons in financial cooperation provided by the European Investment Bank be adopted in the Asian and Pacific region?

²⁷ ESCAP, *Implementing the Monterrey Consensus in the Asian and Pacific Region: Achieving Coherence and Consistency* (United Nations publication, Sales No. E.05.II.F.8), p. 18.

²⁸ Ibid.

²⁹ Such as the Northeast Asian development bank and the SAARC infrastructure fund, which are discussed in more detail in chapter VIII.

Annex tables

Annex table II.1. Investments in infrastructure (1995-2004)

(Millions of United States dollars)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Private	25 369.0	38 996.0	47 009.0	15 822.0	16 350.0	28 466.0	18 390.0	18 416.0	17 252.0	..
Public	38 762.7	40 121.2	41 975.3	37 130.8	40 948.1	35 841.5	24 036.5	29 076.7	20 103.3	4 336.7
Total	64 131.7	79 117.2	88 984.3	52 952.8	57 298.1	64 307.5	42 426.5	47 492.7	37 355.3	4 336.7

Source: IMF, Government Finance Statistics August 2005 CD-ROM, International Financial Statistics August 2005 CD-ROM; World Bank, World Bank Annual Report (various years), World Development Indicators 2005 CD-ROM, Private Participation in Infrastructure Database, <<http://ppi.worldbank.org/>>, accessed on 2 September 2005.

Note: (..) data is not available.

Annex table II.2. Total resources available for infrastructure investments from international lending organizations (1995-2004)

(Millions of United States dollars)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
World Bank	4 118.1	3 741.5	3 351.0	2 866.5	2 095.1	2 947.0	3 410.2	2 320.3	2 623.6	2 560.4
ADB	..	2 683.2	1 601.4	1 936.7	1 652.0	2 485.8	2 088.4	2 630.5	3 334.4	2 822.7
JBIC	..	..	..	7 278.0	1 906.0	1 890.0	1 938.0	1 533.0	2 524.0	..
Total	4 118.1	6 424.7	4 952.4	12 081.2	5 653.1	7 322.8	7 436.6	6 483.8	8 482.0	5 383.1

Sources: ADB, *ADB Annual Report* (various years), *ADB at a Glance*, JBIC, *Annual Report 2000, 2001, 2002, 2003, 2004*.

Note: Energy refers to fuel, energy and electricity, transportation consists of railways and roads, water includes water supply and sanitation. Public expenditure in infrastructure is calculated as the sum of government outlays on fuel and energy, transportation and communication.

Note: (..) data is not available.

Annex table II.3. Gap between savings and capital formation in major Asian and Pacific economies: countries and areas showing surplus

	2000-2003	
	Average (current \$ million)	Percentage of total surplus
Japan	53 506	24.28
Russian Federation	44 185	20.05
China	32 605	14.80
Singapore	20 423	9.27
Malaysia	18 339	8.32
Republic of Korea	12 501	5.67
Indonesia	12 226	5.55
Hong Kong, China	9 636	4.37
Thailand	9 064	4.11
Macao, China	2 355	1.07
Iran (Islamic Republic of)	2 307	1.05
New Zealand	1 110	0.50
Kazakhstan	860	0.39
Turkmenistan	441	0.20
Papua New Guinea	351	0.16
Uzbekistan	323	0.15
Maldives	122	0.06
Fiji	20	0.01
Total	220 373	100.00

Source: World Bank, *World Development Indicators 2005* CD-ROM (Washington D.C., World Bank, 2005).

Annex table II.4. Gap between savings and capital formation in major Asian and Pacific economies: countries showing deficit

	2000-2003	
	Average (current \$ million)	Percentage of total deficit
Turkey	-5 512	23.30
India	-3 607	15.25
Australia	-3 471	14.67
Bangladesh	-2 661	11.25
Viet Nam	-1 563	6.61
Sri Lanka	-1 262	5.34
Afghanistan	-1 177	4.98
Philippines	-796	3.37
Nepal	-576	2.44
Georgia	-495	2.09
Azerbaijan	-481	2.04
Armenia	-467	1.98
Cambodia	-381	1.61
Pakistan	-314	1.33
Timor-Leste	-262	1.11
Mongolia	-209	0.89
Tajikistan	-136	0.57
Bhutan	-133	0.56
Tonga	-61	0.26
Kyrgyzstan	-56	0.24
Lao People's Democratic Republic	-35	0.15
Total	-23 655	100.00

Source: World Bank, *World Development Indicators 2005* CD-ROM (Washington D.C., World Bank, 2005).

Annex table II.5. Gap between savings and capital formation in the Asian and Pacific region, by developing economies major subregions and developed economies

(Millions of United States dollars)

	2000-2003 Average	2000-2003 GDP	2000-2003 Percentage of total	2000-2003 Percentage of GDP
South and South-West Asia	-11 897	958 011	-6.02	-1.24
South-East Asia	57 146	561 837	28.93	10.17
East and North-East Asia	56 299	1 883 184	28.50	2.99
North and Central Asia	44 173	74 120	22.36	59.60
Pacific	89	437 412	0.05	0.02
Developed	51 735	4 792 410	26.19	1.08
ESCAP region total	197 546	8 706 975		2.27

Source: United Nations, *UN Common Database* and World Bank, *World Development Indicators 2005* CD-ROM (Washington D.C., World Bank, 2005).

Annex table II.6. Foreign exchange reserves in selected countries and areas of the Asian and Pacific region*(Millions of United States dollars)*

	2004	Percentage of total
Total (Asian and Pacific countries)	2 393 103.59	
Japan	824 264.00	34.44
China	609 932.00	25.49
Republic of Korea	198 175.00	8.28
India	125 164.00	5.23
Hong Kong, China	123 540.00	5.16
Russian Federation	120 805.00	5.05
Singapore	111 498.00	4.66
Malaysia	65 409.00	2.73
Thailand	48 497.50	2.03
Turkey	35 480.00	1.48
Indonesia	34 724.10	1.45
Australia	33 901.30	1.42
Philippines	12 979.50	0.54
Pakistan	9 554.02	0.40
Kazakhstan	8 471.87	0.35
Total (selected countries)	2 362 395.29	98.72

Source: International Monetary Fund, *International Financial Statistics December 2005* CD-ROM (Washington, DC, 2005).

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III. TRANSPORT INFRASTRUCTURE¹

A. INTRODUCTION

Transport is so essential in both developing and developed countries that it is often taken for granted. Macroeconomic facts about transport are indeed impressive. The value added by transport and storage accounts for 3 to 8 per cent of the GDP of countries in Asia and the Pacific, according to ESCAP secretariat estimates.² Employment in transport, storage and communications ranges between 2.5 and 11.5 per cent of total paid employment. Demand for freight and passenger transport, particularly by road, has typically grown 1.5 to 2 times faster than GDP in most developing and transition countries. Public investment in transport typically accounts for 2.0 to 2.5 per cent of GDP³ and may rise as high as 4 per cent or more in countries modernizing or building new transport infrastructure.⁴ Logistics costs are typically more than 20 per cent of sales, of which transport costs alone can be as much as 13 per cent.⁵

Demand for freight and passenger transport has grown 1.5 to 2 times faster than GDP

Landlocked countries face logistics costs that are, on average, 50 per cent higher than those of countries with access to the sea. Consequently, many Governments have assigned transport an important role as a key to economic development and integration into the world economy.

The logistic costs of landlocked countries are 50 per cent higher than those of countries with access to the sea

¹ For the purpose of this study, *transport infrastructure* refers to “hardware”, including roads, railways, bridges, tunnels, ports (for maritime and inland water transport), airports, urban transport infrastructure (mass transit systems), dry ports and inland container depots (intermodal infrastructure). It also includes signage and traffic management systems. It does not include mobile equipment, except for trains. “Software” issues are discussed in the study only to the extent that they create an environment conducive to investment in infrastructure, make more efficient the utilization of existing infrastructure (for example, repairs and maintenance) or facilitate the movement of goods, vehicles and people, thereby supporting trade, growth and mobility objectives. In other words, they have a direct bearing on type or volume of investments for “hardware”.

² ESCAP, *Statistical Abstract of Transport 2005* (www.unescap.org/ttdw/statabs/index2.asp)

³ World Bank, *Transport Sector Overview* (<http://www.worldbank.org/transport/whysimp.htm>)

⁴ Viet Nam government expenditure on transport amounted to 4.9 per cent of GDP in 2003 (see Asian Development Bank, Japan Bank for International Cooperation and World Bank, *Connecting East Asia: A New Framework for Infrastructure* (Washington D.C., World Bank, 2005)). Total private and public expenditure on transportation reached 4 per cent in China and Thailand and 6 per cent in Viet Nam in 2003.

⁵ ESCAP, *Statistical Abstract of Transport 2005* (www.unescap.org/ttdw/statabs/index2.asp)

This chapter provides a general picture of current trends and possible future developments in transport infrastructure and related regional cooperation in Asia and the Pacific. Section B describes the experience of countries that have successfully leveraged transport infrastructure development for their overall national development. It outlines a vision for a future Asian transport system in 2015 and 2030 and summarizes the deficiencies that need to be addressed in order to achieve it. Section C provides an overview of investment requirements for transport infrastructure in the region. Section D provides a brief overview of regional and subregional cooperation in transport to bridge infrastructure gaps. Section E concludes by identifying potential regional cooperation initiatives in transport.

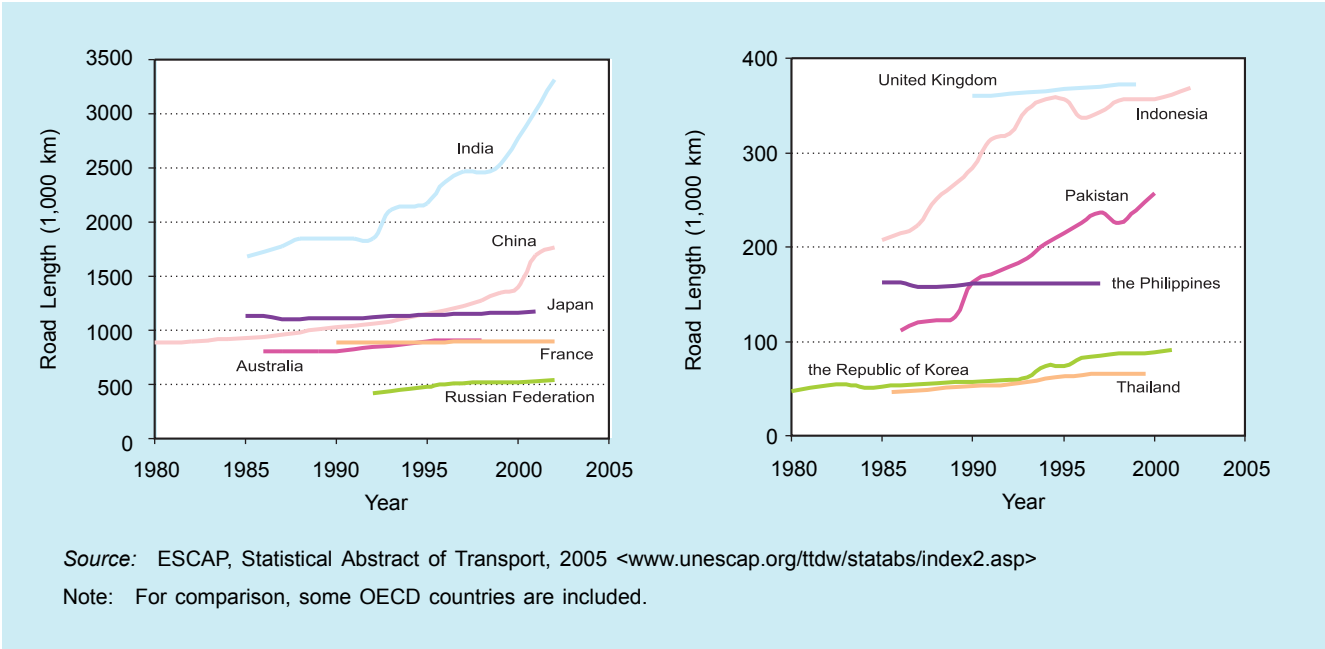
B. REPLICATING SUCCESSFUL TRANSPORT INFRASTRUCTURE DEVELOPMENT THROUGHOUT ASIA

1. EXAMPLES OF SUCCESSFUL TRANSPORT INFRASTRUCTURE DEVELOPMENT

Many East and South-East Asian countries have substantially expanded their transport infrastructure; yet, in most Asian countries transport densities and effective network access levels are still much lower than in Europe or North America

Some Asian countries, particularly in East and South-East Asia, have been very successful in instrumentalizing transport for their overall national economic development. In fact, many East and South-East Asian countries have substantially expanded their transport infrastructure. Some countries have doubled road network length over the past two decades (figure III.1); some invested in road widening schemes which significantly increased capacity through increased total lane length. Yet, in most Asian countries, transport densities and effective network access levels are still much lower than in Europe or North America, implying a potential for further large transport infrastructure development.

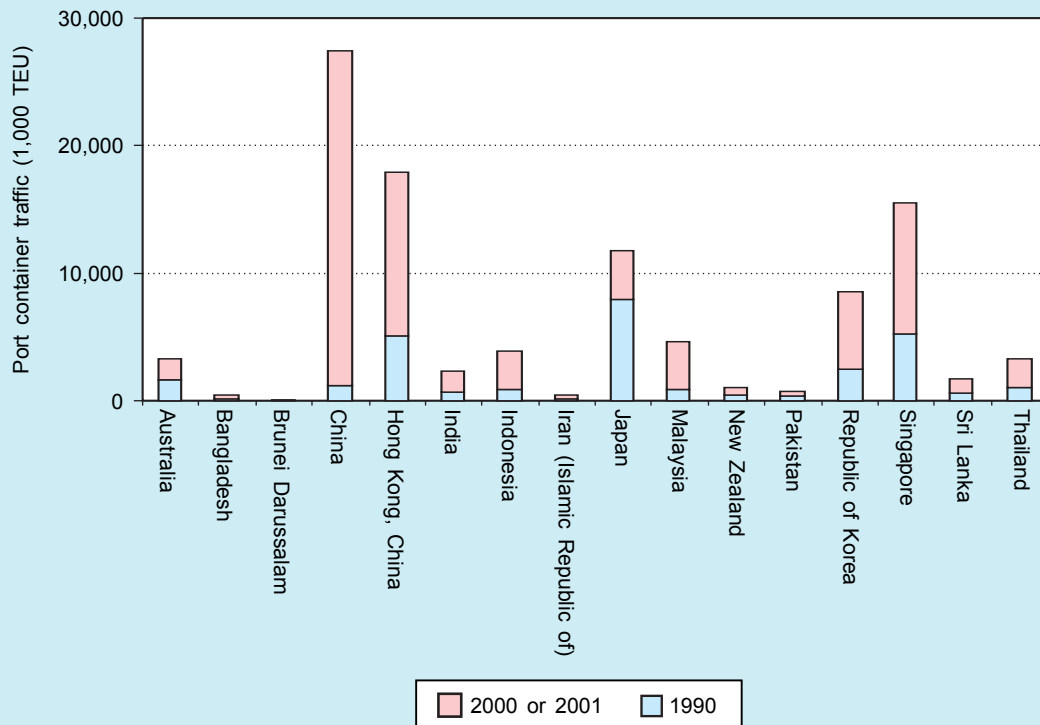
Figure III.1. Road length in selected ESCAP member countries (1980-2003)



Seaport and airport infrastructures have grown even faster. Port container traffic in the ESCAP region tripled in the 1990s. Today, Asian countries account for 26 per cent of world gross product but 62 per cent of world container throughput. In the 1990s, port container traffic increased 23-fold in China, 5-fold in Malaysia and 4-fold in the Republic of Korea, Indonesia, Bangladesh and India (figure III.2), much faster than in most of the rest of the world.

Today, Asian countries account for 26 per cent of world gross product but 62 per cent of world container throughput

Figure III.2. Port container traffic in select ESCAP members and associate members (1990 and 2000/2001)



Source: ESCAP Statistical Abstract of Transport, 2005 <www.unescap.org/ttdw/statabs/index2.asp>.

Aircraft departures in the region doubled between 1990 and 2000 and have tripled since 1980. In some emerging Asian economies, departures grew even faster, albeit from a low base. Between 1980 and 2000, departures increased 11-fold in China, 6-fold in the Republic of Korea and 4-fold in the Islamic Republic of Iran.

Intercity railway infrastructure has attracted comparatively less investment in Asian countries in recent years. Almost all the increase in Asian railway length occurred in China, with some expansion in Indonesia. India has undertaken a major gauge conversion programme, while the Republic of Korea, Turkey, Malaysia and Japan made significant investments in electrification.⁶

Intercity railway infrastructure has attracted comparatively less investment than roads in Asian countries

⁶ ESCAP, *Review of Developments in Transport in Asia and the Pacific* (ST/ESCAP/2392), 2005 (<http://www.unescap.org/ttdw/PubsDetail.asp?IDNO=178>).

a. Transport, globalization and regionalization

Transport infrastructure development in East and South-East Asia has played a key part in the phenomenal growth of world trade. The infrastructure backbone for international trade has been the container shipping network and increasingly the airfreight network. World container port traffic, which expanded by 9.2 per cent to 266 million TEUs in 2003, is dominated by Asian countries. They accounted for 46 per cent of container ship operations, 62 per cent of container port throughput, and 83 per cent of container ship building. Twelve major South and East Asian exporters together account for half of the world's containerized exports.

Transport development has been a major factor driving the internationalization of production. The impressive growth of shipping in Asia is in large part due to the formation of regional production networks (RPN),⁷ whereby countries specialize in the production of particular components which are shipped from one country to another until final product assembly, a process that is often referred to as "regionalization".⁸

The most important factor contributing to massive productivity and cost savings in transport was the advent of the marine container

The most important factor contributing to massive productivity and cost savings in transport was the advent of the marine container and the container ship. Container ship sizes have increased more than five-fold since the 1970s and, to keep these ships moving, operators have introduced various route networks, including mainline-feeder (hub-and-spoke) and pendulum services. These route structures, combined with increased ship speed and reduced time in port, have reduced transit times, increased service frequency and improved service reliability.

Large investments have been made in seaports to achieve the significant productivity gains from containers and changes in shipping technology. Access provided by these seaports to international and domestic markets has been enhanced by development of industrial estates and special economic zones and attracted FDI from corporations engaged in RPNs. As a result, coastal areas of East and South-East Asia have derived most of the economic benefits, experiencing faster growth that has in turn exacerbated spatial concentration and inequalities in national economies.

By 2025, 58 per cent of the world's population is expected to live in cities

Spatial concentration of economic activities, particularly in large urban clusters, has been a key feature of rapid development in Asia and increases the importance of international transport agreements. Large urban clusters have taken the role that special economic zones played in the past three decades. Bangalore, for example, with some 100,000 workers (or 0.01 per cent of population) accounts for 25 per cent of India's software exports and 3 per cent of India's total exports. A related observation is that by 2025, 58 per cent of the world's population is expected to live in cities: an increase of almost 11 percentage points from 2000. This implies an increase of 1.7 billion in the urban population with their concomitant demand for urban transport infrastructure. Of equal importance is the converse of this observation, namely that 42 per cent (or approximately the same numbers as today) will be living in rural areas with their concomitant demand for access to health, educational and economic opportunities.

⁷ Similar to those in other world regions, such as in Europe.

⁸ John Moon and Richard A. Roehrl, "Infrastructure networks to extend regional production networks to inland sites in Asia: strategies, programmes and activities", *Proceedings of the High-level Conference on Asia's Economic Cooperation and Integration*, Manila, June 2004.

International production networks (IPNs) have been of overwhelming importance for the rapid development of East and South-East Asian countries. In fact, three features of these countries have been (i) very little export diversification;⁹ (ii) strong sectoral concentration of exports; and (iii) an increasing share of intra-industry trade since 1985 (table III.1). East and South-East Asian trade is dominated by just 30 of over 800 four-digit SITC products (mainly electronic products and other components of manufactures) that in 2001 accounted for just over one half of this exchange.¹⁰ Bulk transport continues to be more important for South Asia and even more so for Central Asia. However, future potential for containerized trade in manufactures is large in these subregions. In addition, bulk transport continues to be more important in domestic transport than in international trade.

East and South-East Asian trade is dominated by just 30 of over 800 four-digit SITC products

Table III.1. Intra-industry trade ratios for East and South-East Asian trade, a simple proxy of participation in international production networks*

	1985 (Percentage)	2001 (Percentage)	Level of integration with IPNs
Lao People's Democratic Republic	0	3	
Cambodia	0	6	
Brunei Darussalam	8	8	
Mongolia	..	14	
Viet Nam	3	21	
Hong Kong, China	42	33	
China	32	37	
Philippines	38	48	
Republic of Korea	27	50	
Indonesia	22	51	
Thailand	47	69	
Malaysia	59	74	
Singapore	64	75	
Average of above	26	38	

Source: Francis Ng and Alexander Yeats, "Major trade trends in East Asia", World Bank Policy Research Working Paper No. 3084 (Washington D.C., World Bank, June 2003).

Notes:

* Intra-industry trade ratios are the shares of trade within one industry as a percentage of total trade.

b. Access and personal mobility

Passenger transport is equally important for the region's economies. During the rapid catch-up phase of economic growth, the investments of countries of the region have focused on providing international connectivity at the land-sea interface, exacerbating subnational disparities. More recently, their focus has typically included providing access for rural areas and small towns.

⁹ There is surprisingly little overlap in the top product lines of quite similar countries. See Robin Burgess and Anthony J. Venables, "Toward a microeconomics of growth", World Bank Policy Research Working Paper No. 3257, April 2004 (available online at www.worldbank.org).

¹⁰ Francis Ng and Alexander Yeats, "Major trade trends in East Asia: what are their implications for regional cooperation and growth?", World Bank Policy Research Working Paper No. 3084, June 2003 (available online at www.worldbank.org).

Access

The region has made substantial progress in providing universal access to the transport system. As of 2002, more than 90 per cent of rural people in China, and 70 per cent in the Lao People's Democratic Republic, as well as 43 per cent of all Thai rural villages were within 2 kilometres of an all-weather road. India's rural road programme means that half of all villages and towns are now connected by all-weather roads, up from 39 per cent in 1995.¹¹ India now has almost half as many kilometres of road as the United States.

Mobility

Personal mobility increased sharply in all of the region's faster growing economies

Personal mobility has also increased sharply in all of the region's faster growing economies. Investment in roads has not been able to keep up with the region's rapid pace of motorization, leading to extremely high vehicle densities (vehicles per kilometre of road) in countries such as China, Thailand, Malaysia and Indonesia. Yet, even in ESCAP member countries with a high prevalence of traffic jams, higher personal mobility levels have helped to increase national competitiveness and economic efficiency. Equally important have been improved urban mass-transit schemes.

2. A DESIRABLE VISION OF THE FUTURE TRANSPORT SYSTEM

It is clear that major advances have been made over the past few decades in the provision of transport services in the region. There are, however, indications that further improvements are required to sustain development and to ensure a more equitable distribution of the benefits of globalization. Consequently, questions such as the following need to be asked: what would a desirable future transport system look like? How would the transport system develop in such a desirable future scenario from now to 2030, and what would it take to achieve it? In particular, how can the rest of the region develop transport infrastructure and services that would facilitate the emulation of the spectacularly successful economic development of the newly industrialized countries over the past 25 years?

a. Regional production networks extended to inland sites in Asia

ESCAP supports a phased approach to extending international production networks to hinterlands and landlocked countries an integrated intermodal international transport system

By becoming important nodes in regional production networks, coastal regions of Asia and the Pacific have been the main beneficiaries of the current phase of globalization. ESCAP supports a phased approach to extending international production networks to hinterlands and landlocked countries in Asia through, among others, the development of an integrated intermodal international transport system. The model for such a transport development process starts with unimodal transport links and nodes of international importance. It moves on to integrate the modes into an intermodal network. In parallel, the model envisions developing and connecting nodes that support the increased efficiency of the system, adding value and creating employment in areas that are in danger of being marginalized by globalization. Such nodes may incorporate functions ranging from inland container depots and value added logistics services through to special

¹¹ Yoginder K. Alagh, "Panchayati Raj and Planning in India: Participatory institutions and rural roads" in ESCAP, *Transport and Communications Bulletin for Asia and the Pacific*, No. 69 (United Nations publication, Sales No. E.00.II.F.23), pp. 1-27.

economic zones. ESCAP is also focusing on developing international transport corridors. Work to date has largely concentrated on the Trans-Asian Railway Network and the Asian Highway, which link countries of the region as well as Asia with Europe.

A desirable vision of the Asian land transport system would see an extension of IPNs to hinterlands and landlocked countries. This process would ideally include a re-emergence of railways. As population densities in East, South-East and South Asia are considerably higher than in North America, and more in line with those in Japan and Europe, there are, for example, signs in China and India that railways might play an increasing role in Asia to complement and substitute for road transport in the backbone network functions. This would also have substantial environmental and safety benefits.

It appears that strategic investment in transport infrastructure at the regional level could lead to rapid growth in Asian countries that are now at risk of being marginalized. The timeline for this process will vary from country to country, but an ambitious scenario would see all ESCAP member countries participating significantly in international production networks by 2030. The process of engaging inland areas would not come at the expense of coastal development and ports. On the contrary, ESCAP container forecasts foresee a huge expansion of container shipping and berth development.

b. Increased average personal mobility levels

Personal mobility as measured by vehicle ownership will increase but large disparities in mobility levels would remain in the region. By 2030, vehicle ownership could reach the level that the Republic of Korea achieved in 2002 with 270 motor vehicles¹² per 1,000 people. An IMF study suggests that China will reach this level by 2030, but Asian developing countries, excluding China, would reach half this rate. By then, Asia is likely to account for three quarters of all motor vehicles in developing countries, with 571 million motor vehicles, up from 81 million in 2002. Personal mobility could also be enhanced by large investments in conventional and high-speed railway systems in the region, particularly in China, as well as significant improvements in urban transport systems (including integration of subsystems).

c. Cost savings due to a more efficient transport system

More efficient transport can potentially achieve very large cost savings for Asian and Pacific countries. A study by Micco and Perez¹³ suggests that upgrading the efficiency of ports could significantly decrease shipping costs (on an order equivalent to the level of many trade tariffs today). A similar study on Asian and Pacific aviation services¹⁴ foresees Asia's share of worldwide international scheduled passenger traffic reaching almost 50 per cent by 2010 and competitive aviation services bringing cost savings to users of \$22 billion per year by 2010. Large cost savings are also possible in the

A desirable vision of the Asian land transport system would see an extension of IPNs to hinterlands and landlocked countries. This process would ideally include a re-emergence of railways

Large cost savings are also possible in the region from improved domestic logistics. It has been estimated that India loses about 20 per cent of total agricultural output and 40 per cent of fruits and vegetables on the journey from farm to consumer as a result of weaknesses in transport and logistics services

¹² Motor cars seating fewer than eight persons, trucks, buses and tractors.

¹³ Alejandro Micco and Natalia Perez, "Maritime transport costs and port efficiency" (New York, Inter-American Development Bank, 2001) (www.iadb.org/res/seminars_events.htm).

¹⁴ Findlay, Hufbauer, and Jaggi, 1996, p. 23; as quoted in T.R. Lakshmanan, "The evolution of transport arrangements" (Paris, OECD, 2005).

region from improved domestic logistics. It has been estimated that India loses about 20 per cent of total agricultural output and 40 per cent of fruits and vegetables on the journey from farm to consumer¹⁵ as a result of weaknesses in transport and logistics services.¹⁶

Fatal accidents per vehicle in the region are roughly double the world average

Significant reductions in greenhouse gases produced by transport appear to be achievable at relatively low cost

Inland container depots need to be developed as a more efficient way to connect inland areas to the coastal production networks

d. Safe, reliable and environmentally friendly transport systems

Transport systems will also need to address the negative impacts arising from higher personal mobility and freight traffic. Fatal accidents per vehicle in the region are roughly double the world average of 0.10 per cent per vehicle. Significant road safety measures in ESCAP member countries could cut the fatality rate to 0.16 per cent per vehicle by 2015 and to the current world average by 2030, which could save 400,000 lives annually. It has been proposed that a Declaration be submitted for the consideration of the Ministerial Conference on Transport, to be held in November 2006, setting out clear, time-bound goals that will help to achieve this goal.

A desirable vision of the future foresees significant reductions in greenhouse gases (GHGs) produced by transport, such as nitrogen oxides and carbon monoxide emissions,¹⁷ by setting standards, and without assuming a major shift in energy fuels. Such reductions are feasible and appear to be achievable at relatively low cost. These could be partially financed through the Clean Development Mechanism (CDM) under the Kyoto Protocol on Climate Change.¹⁸

Transport-related energy use throughout the ESCAP region will remain highest among light-duty vehicles and road freight transport, World Energy Council estimates show (figure III.3). One way that energy use (that is gasoline, diesel) can be reduced (in total and in terms of its non-renewable fuel portion) is through the promotion of alternative forms of transport, such as intercity railways and urban mass-transit systems.

3. DEFICIENCIES AND GAPS IN TRANSPORT INFRASTRUCTURE DEVELOPMENT

The objectives outlined above still leave a significant number of gaps and deficiencies that need to be addressed by transport policymakers.

a. Connectivity of hinterlands and landlocked countries

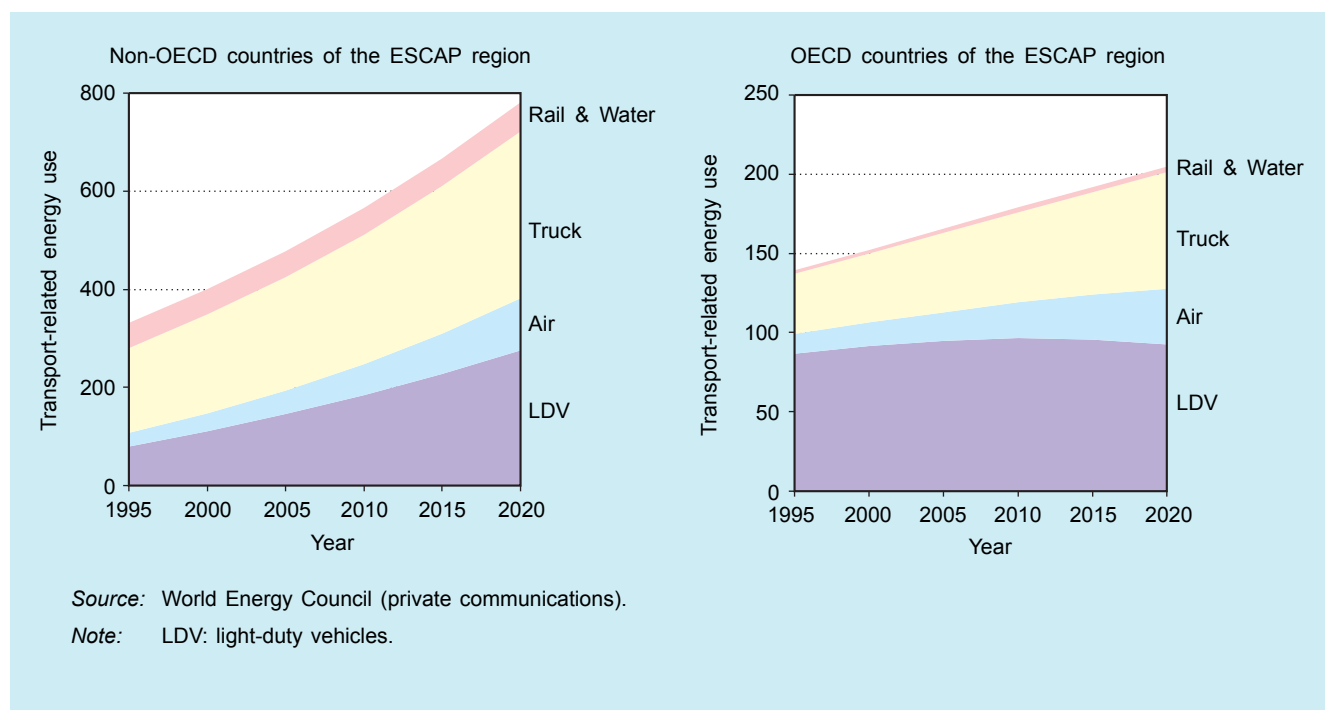
The land transport networks of most ESCAP member countries with maritime coastlines are oriented towards their major seaports. On the whole, internal land transport linkages are not as developed, contributing to the concentration of development in coastal areas. Most general cargo (80 per cent in terms of value, 50 per cent in terms of weight) moves in containers. Therefore, in order to take advantage of this technology, inland container

¹⁵ "A survey of India's economy: grim reapers", *The Economist*, 2 June 2001, p. 14.

¹⁶ Note that these losses are not included in the logistics costs in terms of the definitions used in the estimate presented on page 1.

¹⁷ Cofala, Amann and Mechler (2005), *Scenarios of World Anthropogenic Emissions of Air Pollutants and Methane up to 2030*, International Institute for Applied Systems Analysis (http://www.iiasa.ac.at/rains/global_emiss/global_emiss.html).

¹⁸ Intergovernmental Panel on Climate Change IPCC, *Third Assessment Report* (Cambridge University Press, 2001).

Figure III.3. Energy use in the transport sector*(Millions of tons of oil equivalents)*

depots (ICDs) need to be developed in a few countries as a more efficient way to connect inland areas to the coastal production networks. Further, ICD development will require large-scale investments in the medium-term future.

As large urban clusters have become the major nodes in international production systems, many ESCAP member countries also need to tackle issues arising in urban transport.

b. Quality and efficiency of the infrastructure network system

Intermodal transport, the process of organizing and moving people and goods across different types of transport, is not well developed in many Asian and Pacific countries. Often, there is a lack of comprehensive policies melding together transport and other networks, including networks for financial payments, banking, information and communication, tracking systems, networks of freight forwarders, multimodal transport operators, customs, security and immigration. Many aspects need to be integrated in order to achieve efficient intermodal transport, which include addressing border-crossing issues, change of railway gauge consistency and ICD development.

There is a lack of comprehensive policies melding together transport and other networks

The Asian Highway forms a backbone network of about 140,000 kilometres in Asia, but the quality of the Highway varies considerably within and between its 32 member States. In South Asia, roughly 17 per cent or 24,000 kilometres of the Asian Highway network requires upgrading, and 12 per cent does not reach the minimum standard specified in the Intergovernmental Agreement on the Asian Highway Network. In North, Central and South-West Asia, approximately 14 per cent of the network is below the minimum standard. In the ASEAN region, 11 per cent or 2,600 kilometres,

remains below the minimum standard. Of the total 23,594 kilometres of the Asian Highway in the members of ASEAN, over 4,000 kilometres are currently being maintained or rehabilitated and 2,300 kilometres are being upgraded. Similarly, the Trans-Asian Railway has 13 so-called “missing links” totalling 7,060 kilometres.

In some Asian and Pacific countries, there is considerable room for increased port efficiency, which could lead to large cost savings. As many countries have reduced tariff and non-tariff barriers to trade, to promote their integration into the global economy, the relative importance of transport costs has increased. In order to assist integration into the world trading system and competitiveness, countries need to tackle transport costs,¹⁹ by improving access to hinterlands and landlocked countries, increasing port efficiency and liberalizing airline services.

Transport is crucial to tackling the region's poverty

c. The role of transport in tackling rural and urban poverty

Transport is crucial to tackling the region's poverty. Distance is a key factor depriving the rural poor of access to basic services, such as health and education, and to economic opportunities. WHO estimates that 40 to 60 per cent of people in poor countries live more than 8 kilometres away from a health-care facility. As a result, the simplest day-to-day tasks become difficult and the rural poor are left particularly vulnerable to economic crises and natural disasters.

Transportation is also central to tackling urban poverty. The urban poor tend to live in informal settlements, often out of reach of public transport networks. Available motorized transport is often too expensive. Many urban poor depend entirely on non-motorized transport, such as bicycles or walking, but investment in the infrastructure on which such transport relies is often neglected in favour of private motorized transport, particularly cars.²⁰

Maintenance is a major issue for all transport modes

d. Infrastructure asset management

Maintenance is a major issue for all transport modes, but particularly the maintenance of roads and bridges. This includes preventative maintenance, such as sealing cracks in road pavements, grading shoulders and cleaning drains to minimize the incidence of wash-aways, as well as planned rehabilitation. Regular road maintenance offers major benefits yet is so neglected in some developing countries that every additional dollar spent on maintenance and rehabilitation saves twice as much in reconstruction costs and reduced wear and tear on vehicles.

Safety standards are low in most subsectors of Asia-Pacific transport modes with the economic cost of road accidents estimated to be in the range of 1 to 3 per cent of the GDP of ESCAP member countries

e. Environmental stress, traffic congestion and traffic accidents

Safety standards are low in most subsectors of Asian and Pacific transport modes. Issues related to the transport of dangerous goods, road safety, maritime transport safety (for example, ferry loading, oil spills from ballast flushing in ports), and even aspects of railway safety and air transport safety remain unresolved in some ESCAP member countries. In 2003, an

¹⁹ Alejandro Micco and Natalia Perez, “Maritime Transport Costs and Port Efficiency” (New York, Inter-American Development Bank, 2001) (www.iadb.org/res/seminars_events.htm).

²⁰ World Bank, *Cities on the Move: A World Bank Urban Transport Strategy Review* (Washington D.C., World Bank, 2002).

estimated 430,000 people were killed and more than 2 million injured in accidents on the roads of Asia and the Pacific.²¹ The economic cost of road accidents is estimated to be in the range of 1 to 3 per cent of the GDP of ESCAP member countries. Although the region has only 20 per cent of the world's registered motor vehicles, it accounts for about half of global traffic fatalities²² and the number could rise to two thirds by 2020, the ESCAP secretariat estimates.

Various approaches to tackling safety are possible but infrastructure interventions are one of the key elements. These include addressing issues of road design and conducting "road safety audits." Railway safety can be enhanced by such measures as improving level crossings.

C. TRANSPORT INFRASTRUCTURE INVESTMENT REQUIREMENTS

This section provides indicative answers to the question of the order of magnitude of the anticipated investment "requirements"²³ in the ESCAP region for the period until 2015.

1. CURRENT EXPENDITURE ON TRANSPORT INFRASTRUCTURE

Current investment and maintenance expenditure on transport infrastructure in the ESCAP region²⁴ is estimated to be at least on the order of \$200 billion per year (see table III.4), which was roughly equal to 1.6 per cent of GDP in 2003.²⁵ Current transport infrastructure investments in many ESCAP member countries are still relatively high, particularly in the East and South-East Asian countries that are participating in international production networks. Indeed, in 2003, investment and maintenance expenditure as a share of GDP reached as high as 6 per cent in Viet Nam and 4 per cent in Thailand and China (see figure III.4).

In 2004, investments in transport in China amounted to a staggering \$88 billion, more than two thirds of which flowed into the road sector (table III.2). In 2004 alone, more than 46,000 kilometres of new highways were put into operation, a total length of 150,000 kilometres of county and rural highways were reconstructed, and almost 2,000 kilometres of new railway lines were constructed. Yet, there are precedents to this massive construction in history, such as the building of the United States interstate highway system. In fact, from 1948 to 1960, between 32,000 and 53,000 kilometres of new highways were built in the United States each year.

In 2004, investments in transport in China amounted to a staggering \$88 billion

²¹ These are conservative estimates; WHO, for example, estimates that these numbers might be twice as high.

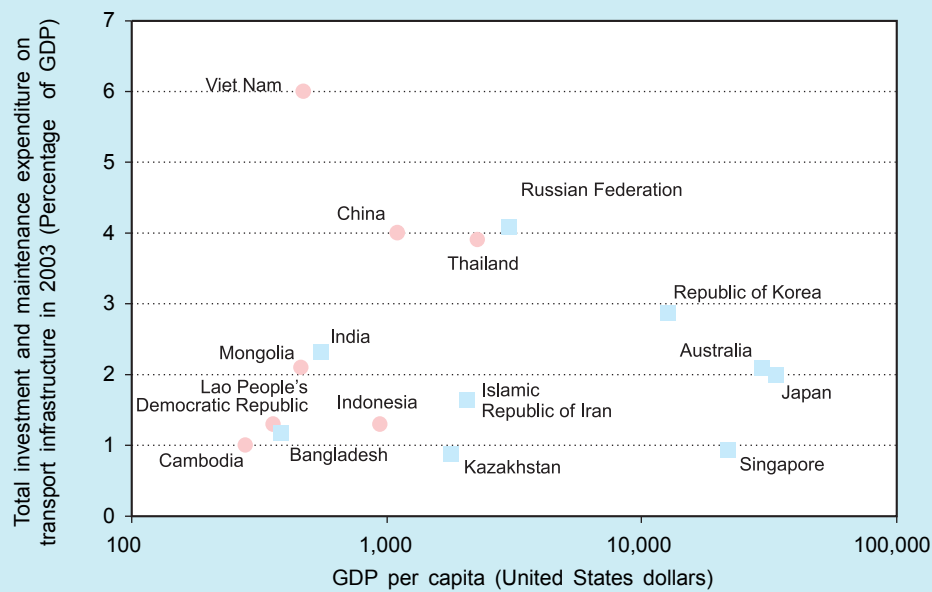
²² ESCAP, *Transport and Communications Bulletin for Asia and the Pacific: Road Safety*, No. 74 (United Nations publication, Sales No. E.05.II.F.17, 2005).

²³ Investment "requirements", "needs" or "wants" depend on assumptions about the uncertain future, such as economic growth and changing policy targets and priorities of Governments. In other words, there are no absolute investment "needs".

²⁴ Excluding the extraterritorial members of the Commission.

²⁵ This is likely to be underestimated; see figure III.4.

Figure III.4. Total investment and maintenance expenditures in transport infrastructure in 2003 as a share of GDP in selected ESCAP member economies



Sources: Asian Development Bank, Japan Bank for International Cooperation and World Bank, *Connecting East Asia: A New Framework for Infrastructure* (Washington, D.C., World Bank, 2005); *India in Figures, 2004*; *Iran Statistical Yearbook 1382*; *Statistical Pocketbook Bangladesh 2003*; *Japan Statistical Yearbook 2005*; *Yearbook of Statistics Singapore, 2005*, and National Statistical Office, Republic of Korea.

Notes: Round circles represent data published in Statistical Appendix of the ADB/JBIC/WB study 2005; squares represent data from statistical yearbooks.

Note that these data do not all follow consistent data definitions. Also, due to data availability, some data are for 2002 or 2004 rather than 2003. As a result, the comparability of these data across countries is limited. For example, the graphed data for Japan, Singapore, the Islamic Republic of Iran, the Republic of Korea and India include only the expenditures of governments, not the private sector.

Table III.2. Investment in the transport sector in urban areas in China, 2004

	Investment (Millions of 2004 United States dollars)	Investment, share of GDP (Percentage)
Transport, storage and post	87 984	5.19
Railway transport	10 500	0.62
Road transport	57 885	3.42
Urban public transport	4 855	0.29
Water transport	6 633	0.39
Air transport	3 380	0.20
Storage	2 319	0.14
Loading, unloading and other transport services	727	0.04
Transport via pipelines	1 328	0.08
Post	357	0.02

Source: China Statistical Yearbook 2005 (China Statistics Press, 2005).

Note: The China Statistical Yearbook was compiled by the National Bureau of Statistics of China.

Table III.3. Examples of new transport infrastructure put into operation in China, 2004

	2004
New trunk railways put into operation [km]	1 433
Double-track railways put into operation [km]	352
Electrified railways put into operation [km]	409
New highways [1 000 km]	46
Reconstructed highways [1 000 km]	150
New berths in major coastal ports (number)	287
New civil airports (number)	7

Source: *China Statistical Yearbook 2005* (China Statistics Press, 2005).

Note: The *China Statistical Yearbook* was compiled by the National Bureau of Statistics of China.

2. ESCAP ESTIMATES OF TRANSPORT INFRASTRUCTURE INVESTMENT REQUIREMENTS

In the theme study for the Commission in 1994,²⁶ the secretariat presented estimates of infrastructure investment requirements to 2000. The secretariat has carried out a similar estimation of transport infrastructure requirements to 2015 for this study using a modified methodology. In essence, the estimates are based on “dynamics-as-usual” assumptions.

a. Overview of results

Consolidated investment and maintenance requirements in transport infrastructure for the ESCAP region are presented in table III.4. They show a rapid increase particularly in South, South-West, East and North-East Asia.

Total annual average requirements are estimated at \$261 billion from 2005 to 2015. This represents an increase to \$292 billion *per year* by 2010-2015, up from the current \$205 billion and the level of \$137 billion per year in the early 1990s. Of this, the developing countries of Asia and the Pacific would require an estimated \$224 billion annually during 2005-2015. However, in terms of GDP, total requirements for the whole region reflect a reduction from 1.8 per cent of GDP in 2003 to 1.4 per cent in 2013, while for the developing countries of the region that will decline from 2.6 per cent of GDP to 1.8 per cent of GDP.²⁷

Roads are expected to continue attracting the largest share of investments, but in selected countries, such as China, upgrading and expansion of railways are also expected to play an important role. Due to the dynamics-as-usual assumptions, requirements for railways are likely to be underestimated. In other words, the “re-emergence” of railways in the form of high-speed passenger trains on routes linking areas with high population densities and dedicated tracks for freight and fast container block-trains may become a policy priority.

Consolidated investment and maintenance requirements in transport infrastructure for the ESCAP region are estimated at \$261 billion per year from 2005 to 2015

²⁶ ESCAP, *Infrastructure Development as a Key to Economic Growth and Regional Economic Cooperation* (ST/ESCAP/1364).

²⁷ Based on the IMF GDP forecasts, as contained in the source mentioned in footnote.

Table III.4. Estimates of average annual investment and maintenance requirements in the transport sector from 2005 to 2015(2004 prices)
(Billions of United States dollars)

		North and Central Asia	South and South-West Asia	South-East Asia	East and North-East Asia	Australia, New Zealand and the Pacific	ESCAP region Total	Developing Asia-Pacific countries
Total	1990-1995	17.0	48.2	15.8	39.9	16.6	137	107
	1995-2000	12.9	49.9	12.1	50.6	11.4	137	112
	2000-2005	18.8	61.8	19.7	88.4	16.2	205	172
	2005-2010	19.7	71.4	22.8	101.1	15.8	231	195
	2010-2015	22.9	86.2	27.4	138.0	18.0	292	253
Roads	1990-1995	13.7	45.6	13.4	33.2	14.7	121	95
	1995-2000	10.0	47.0	10.6	43.5	9.9	121	100
	2000-2005	14.4	57.5	14.2	70.5	13.1	170	145
	2005-2010	14.5	64.8	14.7	78.3	12.2	185	161
	2010-2015	17.5	76.3	17.2	106.7	13.5	231	206
Railways	1990-1995	2.8	1.8	0.5	1.9	0.8	7.8	6.7
	1995-2000	2.6	1.9	0.5	3.2	0.8	9.0	7.9
	2000-2005	2.5	1.9	0.4	2.7	0.8	8.4	4.3
	2005-2010	2.5	2.0	0.5	3.0	0.8	8.8	7.7
	2010-2015	2.5	2.1	0.5	3.5	0.8	9.3	8.2
Airports	1990-1995	0.5	0.8	1.8	4.8	1.0	8.9	5.1
	1995-2000	0.3	0.9	0.9	3.8	0.8	6.7	3.5
	2000-2005	0.9	0.6	0.9	6.5	1.5	10.4	8.0
	2005-2010	1.3	1.1	1.7	8.6	2.0	14.6	8.7
	2010-2015	1.1	1.3	2.0	11.5	2.7	18.5	10.9
Container Ports	1990-1995							
	1995-2000							
	2000-2005	0.002	0.17	0.49	1.15	0.040	1.85	1.71
	2005-2010	0.003	0.24	0.65	1.56	0.049	2.50	2.33
	2010-2015	0.004	0.36	0.92	2.28	0.063	3.62	3.41
Urban mass-transit	1990-1995							
	1995-2000							
	2000-2005	1.0	1.5	3.7	7.5	0.7	14.4	9.9
	2005-2010	1.4	3.3	5.3	9.6	0.9	20.4	15.6
	2010-2015	1.8	6.2	6.8	14.1	1.0	29.8	24.3

Source: ESCAP secretariat.

Notes: ESCAP standardized regional groupings were used, see *ESCAP Review of Developments in Transport* or *ESCAP Economic and Social Survey*. See annex III to this chapter on data sources and methodology.**A doubling of investment requirements in the next 10 years is expected for major coastal container ports**

A doubling of investment requirements in the next 10 years is expected for major coastal container ports. Two thirds of the required new container berths in the world are expected to be built in the ESCAP region, translating into a cumulative capital requirement for terminals alone of roughly \$31 billion until 2015.²⁸

²⁸ Assuming typical costs to develop new infrastructure and procure the handling equipment required to allow the terminal to operate at a satisfactory level of efficiency, see section C.2.b, on data sources and methodology.

Driven by rising living standards, investment requirements for airports and air navigation services may double in the next 10 years to cater for the growth in both passenger and cargo traffic and to accommodate new large aircraft and emerging budget airlines.²⁹ This is despite the fact that more than \$50 billion has been invested over the past decade in the region in eight major new airports alone.³⁰

Investment requirements for mass-transit systems in urban areas of the region are estimated to double over the next decade to almost \$30 billion per year to 2015.

b. Investment “needs”

Still, our results are likely to be underestimates of actual absolute “needs” in terms of politically desired goals. For example, in many countries the necessary regular maintenance needs, particularly of roads and railways, are not being met, leading to higher future liabilities.³¹ Furthermore, the desired vision of an Asian integrated transport system will need balanced investments in the transport backbone as well as the access infrastructures. This will require further investment in secondary access systems.

The ESCAP expert group meetings in 2004 and 2005³² on identifying investment needs and priorities for the development of the Asian Highway network and related intermodal connections identified a shortfall of almost \$18 billion to upgrade and improve about 26,000 kilometres of the Asian Highway in 26 member countries, for which financing from multilateral or bilateral donors and other sources would be required.³³

Furthermore, to close the 13 “missing links” of the Trans-Asian Railway would require about \$13.5 billion to build single track lines (figure III.5). In order to upgrade high priority parts of the Trans-Asian Railway to double-track would cost tens of billions of dollars more. Finally, as inland sites in Asia are increasingly developed through ICDs and efficient intermodal connections, a similar level of investment as for container ports today might be required for the construction of ICDs in the future.

Extensive rural access programmes, such as those of India and more recently of China, are also likely to increase investment “needs” particularly for roads. For example, India is committed to investing \$26 billion to connect all its currently unconnected villages (roughly 50 per cent of the total) to all-weather roads,³⁴ and China plans to build 400,000 kilometres of new rural roads to connect 80 per cent of all villages in China by 2020.

The desired vision of an Asian integrated transport system will need balanced investments in the transport backbone and access infrastructures requiring further investment in secondary access systems

²⁹ This estimate is consistent with the International Civil Aviation Organization's estimate of \$300 billion in cumulative investment needs worldwide from 2000 to 2010.

³⁰ ESCAP, *Transport and Tourism Data for Asia and the Pacific* (<http://www.unescap.org/ttdw/data/index.aspx>).

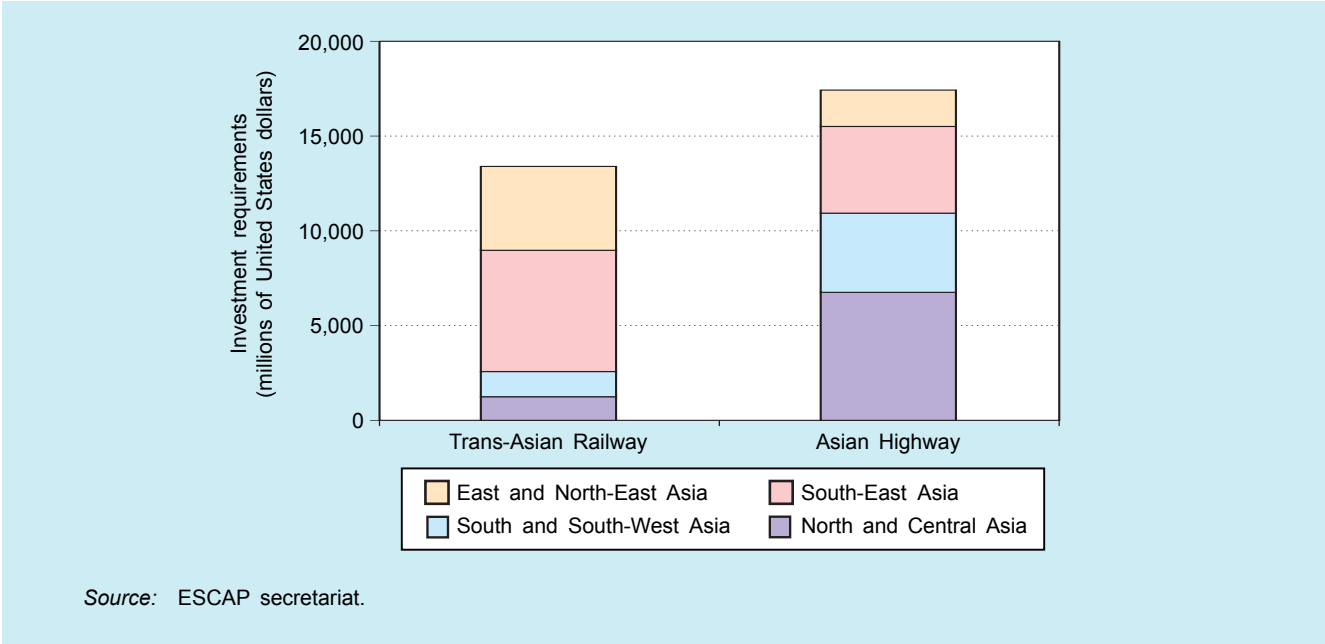
³¹ ESCAP, *Transport and Communications Bulletin for Asia and the Pacific*, No. 75, *Road Funds* (ST/ESCAP/SER.E/75), 2005 (<http://www.unescap.org/ttdw/PubsDetail.asp?IDNO=181>).

³² For SAARC members (with the participation of Afghanistan and the Islamic Republic of Iran) on 21-23 September 2004 in Islamabad; North, Central and South-West Asia on 23-25 January in Tehran; and for South-East Asia (with participation of Mongolia) on 25-26 April 2005 in Bangkok.

³³ This is in addition to current (or committed) investments of \$21 billion in the Asian Highway.

³⁴ Excluding the cost of major bridges; see Pradhan mantra Gram Sadak Rojana project in India (<http://www.pmsgsy.nic.in/pmg216.asp>).

Figure III.5. Identified investment requirement for identified high-priority projects of the Asian Highway and the Trans-Asian Railway



However, to date many Governments and donors have focused mainly on international connectivity, national backbone routes and secondary networks, with the consequence that other access and feeder roads have been neglected.³⁵ This has become a serious issue in some cases, as the efficiency of the road network depends on the state of *all* its links and nodes.

3. SOURCE OF FUNDS

Chapter VIII discusses sources of funds for infrastructure development in detail. While there are important differences between transport subsectors, the largest share of financing for transport has come from and will continue to come from public sector budgets, particularly in the land transport sector. The large transport investment needs in the region identified in this study means that Governments will need to explore all possible funding options, including traditional and innovative public sector financing, loans provided by development banks, official development assistance, and different types of private sector involvement.

Decentralization presents new institutional challenges in terms of coordination and raising of the necessary funds for financing transport infrastructure

There are changing differences among ESCAP members in terms of the role of local governments and various State enterprises in financing transport infrastructure. Decentralization presents new institutional challenges in terms of coordination and the raising of the necessary funds for financing transport infrastructure. In fact, the responsibility for the development of infrastructure has been or is proposed to be delegated to lower levels of government. However, capacity to plan and implement projects is often weak and in many cases the legal basis for raising the level of funds is lacking.

³⁵ Note that developing countries typically channel more than half of their public spending on transport into the roads sector. The World Bank allocates 70 per cent of its transport loan portfolio into the roads sector, despite having changed its policy focus in the 1990s from economic growth to poverty alleviation.

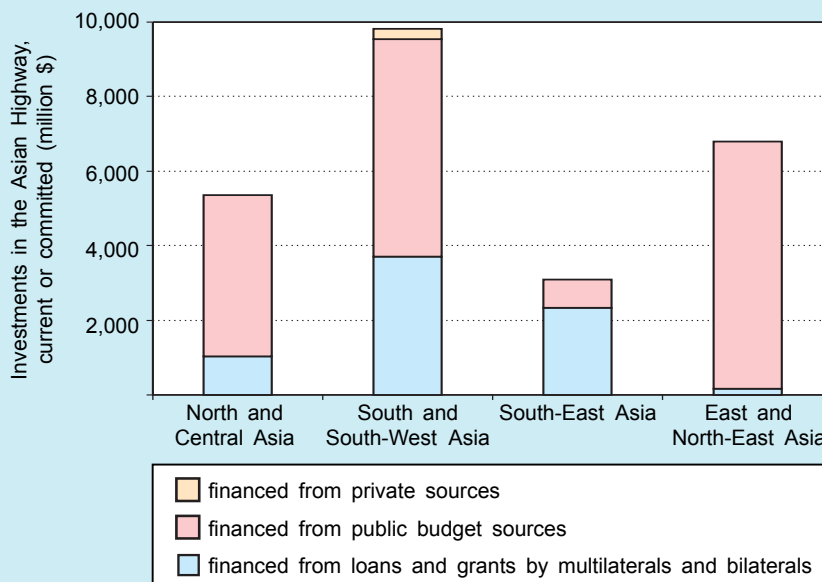
Contributions by the private sector, multilateral or bilateral donors and cross-border financing have been important in certain niches; however, they cover only a small share of the overall total requirements. For example, from 1990 to 2003, PPI flows in the transport sector have concentrated on a few countries and a few sectors.³⁶ In fact, almost all transport private participation in infrastructure (PPI) went to five countries (China, Malaysia, Thailand, the Philippines and Indonesia) and there was no such activity in three quarters of all ESCAP members. From 1990 to 2003, *cumulative* PPI investment in roads (\$25 billion) accounted for half of the region's PPI transport projects. Of 188 road projects in the region, more than half were in China, which invested \$14 billion in such projects. In the same period, cumulative PPI port investments in the region totalled \$13.4 billion, railways \$10.6 billion (mainly urban mass-transit schemes) and airports \$3.5 billion.³⁷ It should be noted that a lack of seed financing for feasibility studies that take project ideas of Governments to a stage where the private sector becomes interested is a general problem and particularly acute in the smaller ESCAP economies.

Contributions by the private sector, multilateral or bilateral donors and cross-border financing have been important in certain niches; however, they cover only a small share of the overall total requirements

Multilateral and bilateral donors play an important role for some least developed countries as well as in the case of transport infrastructure of international importance such as the Asian Highway and the Trans-Asian Railway (figure III.6); yet, they cover only a tiny amount of total regional investment requirements for transport infrastructure.

Figure III.6. Investments in the Asian Highway, current or committed, by types of funds as of 2004/2005

(Millions of United States dollars)



Source: ESCAP secretariat.

³⁶ The figures are only indicative, however, as the World Bank Private Participation in Infrastructure database from which they are drawn does not cover all projects with PPI investment and the actual share of private sector funding in these projects is unknown.

³⁷ ESCAP, *Review of Developments in Transport in Asia and the Pacific* (ST/ESCAP/2392), 2005 (<http://www.unescap.org/ttdw/PubsDetail.asp?IDNO=178>).

Cross-border financing of transport infrastructure has recently received increased attention as a possible way to deliver benefits across national borders. This is particularly the case where there are large disparities in living standards between neighbouring countries. Such financing is of particular interest in the context of transit transport and landlocked countries, as well as in terms of seed financing. One notable example is a \$96 million road project in the Lao People's Democratic Republic, which will link China and Thailand and for which China, Thailand and the Asian Development Bank are providing concessional loans, with maintenance costs being covered by infrastructure usage charges. Other examples of this modality have been reported between China and other neighbouring countries, Afghanistan and its neighbours as well as Myanmar and its neighbours.

D. REGIONAL COOPERATION IN TRANSPORT INFRASTRUCTURE DEVELOPMENT

1. GENERAL TRENDS AND ISSUES

As a step towards deeper regional integration in Asia and the Pacific, international transport-related agreements and programmes have gained increasing importance as a means by which Governments can help economies to participate in international production networks and to mitigate systemic risks.³⁸

The number, magnitude and extent of regional and subregional transport cooperation initiatives and organizations in Asia and the Pacific have increased significantly, creating a complex web of cooperation mechanisms and relationships. There has also been a clear trend towards ever more and often overlapping organizations and programmes with fewer members, particularly in the last 20 years.³⁹ These agreements and programmes take many different legislative and non-legislative forms covering issues related to policy, infrastructure, operations and facilitation.

Most Asian and Pacific Governments recognize the importance of their active participation in the major regional, subregional and bilateral agreements in key sectors related to globalization, such as trade, transport and communications, but some countries have benefited more than others. Countries at the hub of an emerging "hub-and-spoke" system of transport-related agreements have reaped particular benefits, partly due to their geographical location and in part because of their active "transport diplomacy."

The proliferation of bilateral and subregional agreements in the transport sector raises concerns over their consistency with regional and global conventions. ESCAP has promoted openness of agreements and adherence to regional and global standards in order to ensure the efficient operation of the intra- and interregional transport system. One example is in the area of

The proliferation of bilateral and subregional agreements in the transport sector raises concerns over their consistency with regional and global conventions

³⁸ Most risks are simple direct risks. For example, the risk that the income of a certain group of rice farmers will increase/decrease due to regional integration is a direct risk. Direct risks can usually be addressed by appropriate policies on the part of national Governments. *Systemic risks* are risks that are inherent in the "system" as it becomes integrated. These types of risks often can only be addressed by *regional cooperation* among most Governments, not by the policies of a single Government.

³⁹ Smaller groups and groups of a "like mind" can reach a consensus easier, which increases the effective speed of implementation.

cross-border transport facilitation, where ESCAP in its resolution 48/11 of 23 April 1992 recommended that countries in the region consider acceding to a list of key international conventions.

The land transport sector in particular needs policy interventions in order to address the many social, economic and political inter-country challenges. Landlocked countries, such as Tajikistan, Kyrgyzstan, Azerbaijan, Kazakhstan and Uzbekistan, as well as geopolitically important countries, such as the Russian Federation, China, India, Thailand and Turkey, are members of the largest number of agreements and organizations, indicating the level of importance placed by these countries on regional cooperation.

2. REGIONAL INITIATIVES

a. *Early forerunners (1959-1992): Asian Highway and Trans-Asian Railway*

Until the late 1980s, there were only two significant regional land transport cooperation initiatives that had been launched in Asia: namely, the Asian Highway, which started in 1959, and the Trans-Asian Railway, which started in the 1960s, both initiated by ESCAP. These have played a pivotal role in developing regional transport and by providing models for many cooperation initiatives of the past 15 years.

The Asian Highway and the Trans-Asian Railway, both initiated by ESCAP, have played a pivotal role in developing regional transport

b. *Asian Land Transport Infrastructure Development (1992)*

The Asian Land Transport Infrastructure Development Project (ALTID)⁴⁰ launched by ESCAP in 1992 has been at the core of regional cooperation in transport infrastructure development in Asia and the Pacific. Its major contribution was that it drew together the Asian Highway, Trans-Asian Railway and initiatives that facilitate cross-border land transport. ALTID helps countries to identify and formulate routes, set standards, formalize networks and put the networks into operation. Route selection criteria included: capital-to-capital links; connections to main industrial and agricultural centres; connections to major sea- and river ports; connections to major inland container terminals and depots; and connections to major tourist attractions. Furthermore, the number of lines to be included in the networks were to be minimized, and maximum use made of existing infrastructure.

A refined implementation strategy was adopted by the Commission at its fifty-fourth session, in 1998, and includes the following components:⁴¹ (i) facilitation of land transport at border crossings and maritime transport at ports through the promotion of the relevant international conventions and agreements in Asia, particularly those contained in ESCAP resolution 48/11; (ii) completion of the formulation of Asian Highway and Trans-Asian Railway networks covering the whole of Asia as well as completion of the missing links; (iii) formalization of the Asian Highway and Trans-Asian Railway routes/networks. A legal framework in the form of “ESCAP agreements on Asian Highway and Trans-Asian railway routes/networks” should be developed; (iv) improvement of the operational efficiency of the Asian Highway and Trans-Asian Railway routes, including transport logistics; (v) improvement of transport logistics; (vi) Asian Highway and Trans-Asian Railway promotion.

The major contribution of the Asian Land Transport Infrastructure Development Project has been that it drew together the Asian Highway, Trans-Asian Railway and initiatives that formulate cross-border land transport

⁴⁰ Endorsed by the Commission at its forty-eighth session, in 1992, and extended at its fifty-sixth session, in June 2000.

⁴¹ See ESCAP document E/ESCAP/CTC(3)2.

c. The Asian Highway after 1992 and its Intergovernmental Agreement (2005)

The Intergovernmental Agreement on the Asian Highway Network came into force on 4 July 2005

The Asian Highway network now comprises approximately 140,000 kilometres of roads, passing through 32 member States (figure III.7). The Intergovernmental Agreement on the Asian Highway Network was concluded in November 2003 and came into force on 4 July 2005.⁴² The contracting parties have agreed to: (i) adopt the Asian Highway network as a coordinated plan for the development of highway routes of international importance; (ii) bring the network into conformity with the Asian Highway classification and design standards; and (iii) place Asian Highway route signs along the network. Members also established the Working Group on the Asian Highway to review its implementation. The ESCAP secretariat acts as the secretariat for the Agreement. The Agreement plays a catalytic role in developing international highways in the Asian and Pacific region.

Figure III.7. Map of the Asian Highway Network, 2003



Source: ESCAP, <<http://www.unescap.org/ttdw/common/TIS/AH/maps/AHMapApr04.gif>>.

In 2004, ESCAP adopted resolution 60/4 of 28 April 2004 on the Intergovernmental Agreement on the Asian Highway Network, in which it invited (i) all the relevant members of the Commission to become parties to

⁴² As of 6 February 2006, 28 member States had signed the Agreement and 16 had ratified, approved or accepted it.

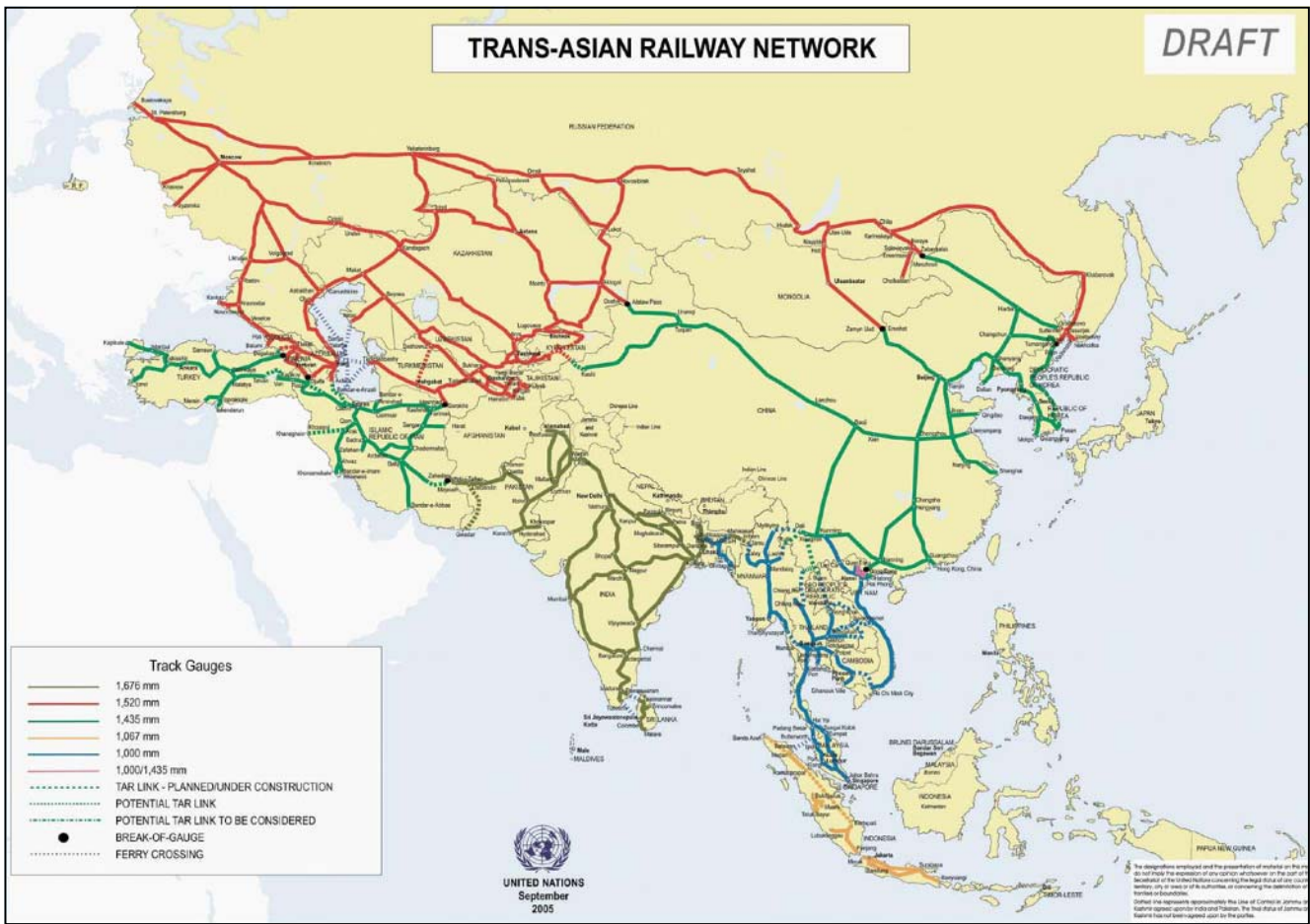
the Agreement; (ii) international and regional financing institutions and multi-lateral and bilateral donors to provide financial and technical support for the development of the Asian Highway network; and (iii) subregional organizations to promote the Agreement and accord priority to the development of the Asian Highway network.

Through a series of subregional meetings with the participation of the World Bank, the Asian Development Bank, the Islamic Development Bank, the Japan Bank for International Cooperation, and related institutions, member countries have identified a list of priority investment projects and prepared project profiles for potential donors, giving highest priority to upgrading the Asian Highway's substandard sections.⁴³

d. The Trans-Asian Railway after 1992

The Trans-Asian Railway Project aims to enhance the efficiency and development of rail transport infrastructure in Asia, thereby promoting international and bilateral trade and regional economic and social development.

Figure III. 8. Map of the Trans-Asian Railway Network, September 2005



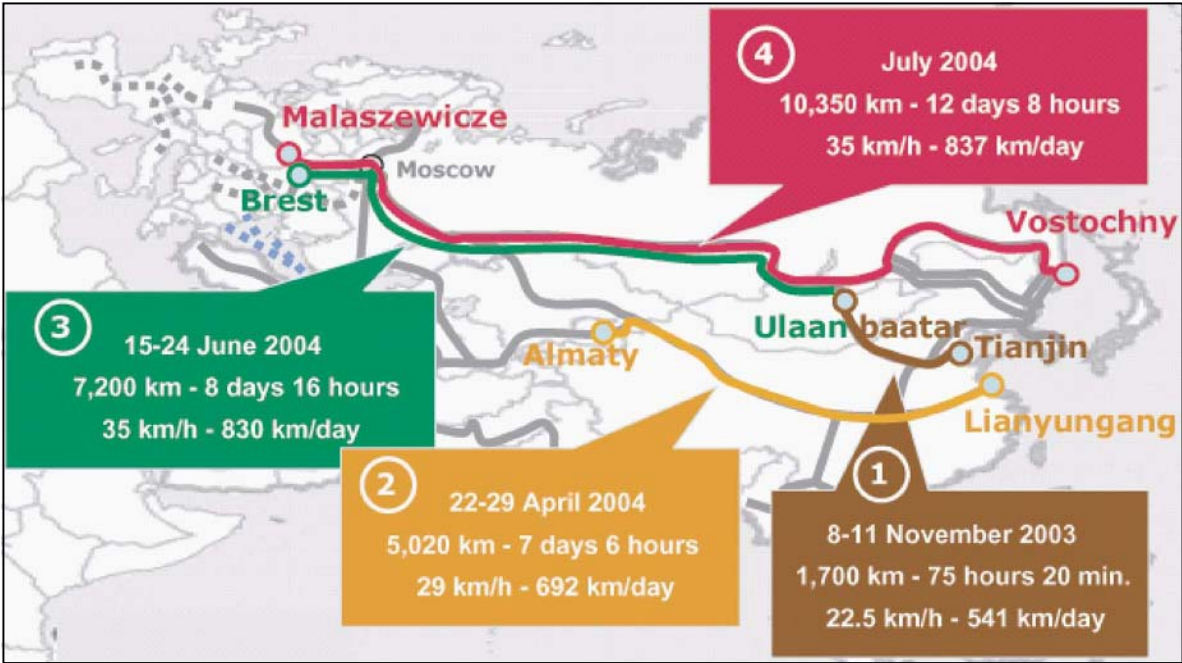
Source: ESCAP, <http://www.unescap.org/ttdw/common/TIS/TAR/images/tarmap_latest.jpg>.

⁴³ See also the second paragraph under section C.2.b.

Given the extent of the territory covered by the Trans-Asian Railway (figure III.8), the differences in standards between railways in the region and the differences in levels of technical development, a step-by-step approach was adopted to developing the network, starting with four major corridors and focusing on break-of-gauge points and missing links.

Demonstration runs of container block-trains were carried out along different routes of the northern corridor of the Trans-Asian Railway between November 2003 and July 2004 (figure III.9). These were followed by more than 200 commercial container block-train runs between 2004 and 2005. A container block-train travelling between Western Europe and North-East Asia covering about 1,000 kilometres per day takes at least seven days less than sea transport.

Figure III.9. ESCAP-promoted demonstration runs of container block-trains along the Trans-Asian Railway Northern Corridor



Source: ESCAP, <<http://www.unescap.org/ttdw/common/TIS/TAR/Container%20Block-trains.asp>>.

Transport officials from across the region finalized the draft of the Intergovernmental Agreement on the Trans-Asian Railway Network at an intergovernmental meeting organized by ESCAP and held in Bangkok from 28 to 30 November 2005. The draft will be submitted for adoption by the Commission at its sixty second session⁴⁴ and for signature at the Ministerial Conference on Transport to be held later in 2006.

⁴⁴ See ESCAP document E/ESCAP/1370.

e. Euro-Asian Transport Linkages since 1997

Trade between Europe and East Asia is increasing rapidly and in 2004, in terms of full containers, amounted to 3.1 million TEUs transported from East Asia to Europe and 7.4 million TEUs in the other direction in 2005.⁴⁵ Almost all of it was transported by sea. ESCAP has promoted a number of initiatives to improve Euro-Asian land linkages and open up the relatively untapped potential of land transport as well as providing access for the landlocked countries of central and transit for concerned countries. These initiatives, which identified priority transport corridors and routes between Asia and Europe, included those proposed by a series of Euro-Asian conferences on transport⁴⁶ held in Saint Petersburg, Russian Federation, since 1998, the OSJD Agreement⁴⁷ of 1997 and a project of United Nations regional commissions entitled "Capacity-building in developing interregional land and land-cum-sea transport linkages"⁴⁸ launched in 2002. Continuation of these efforts will also improve transport links between Central Asia and Europe and between East Asia and Central Asia.

ESCAP has promoted a number of initiatives to improve Euro-Asian land linkages and open up the relatively untapped potential of land transport

3. SUBREGIONAL INITIATIVES

Regional cooperation plays an important role in not only developing inter-country linkages but also in promoting access at the subnational level. The Asian Highway and Trans-Asian Railway networks now provide the main framework for trunk corridors for national, as well as interregional and subregional, movement of goods and people and have improved access both to subregional and national hinterlands.

a. Subregional intergovernmental organizations

Most subregional cooperation in transport infrastructure is promoted under the frameworks of subregional, intergovernmental organizations such as the Association of Southeast Asian Nations⁴⁹ (ASEAN), the Economic Cooperation Organization⁵⁰ (ECO), the Pacific Islands Forum,⁵¹ the South Asian Association for Regional Cooperation⁵² (SAARC), and the Shanghai Cooperation Organization⁵³ (SCO) which cover a multitude of economic

⁴⁵ *Containerization International*, October 2005 (www.ci-online.co.uk).

⁴⁶ Four main Euro-Asian transport corridors were identified in 2000: the Trans-Siberian, TRACECA, Southern, and the North-South Corridors.

⁴⁷ The OSJD "Agreement on organizational and operational aspects of combined transport between Europe and Asia and related installations" identified and formalized a number of Euro-Asian railway corridors/routes with those in Asia constituting a part of the Trans-Asian Railway.

⁴⁸ Both road and railway corridors and routes were identified for transport between Asia, Europe and the Middle East.

⁴⁹ ASEAN was founded in 1967. Its current members are Brunei Darussalam, Cambodia, Indonesia, the Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam ([website: www.aseansec.org](http://www.aseansec.org)).

⁵⁰ ECO was founded in 1985. Its current members are Afghanistan, Azerbaijan, the Islamic Republic of Iran, Kazakhstan, Kyrgyzstan, Pakistan, Tajikistan, Turkey, Turkmenistan and Uzbekistan ([website: www.ecosecretariat.org](http://www.ecosecretariat.org)).

⁵¹ Current members: Australia, Cook Islands, Micronesia (Federated States of), Fiji, Kiribati, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Marshall Islands, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu ([website: www.forumsec.org.fj](http://www.forumsec.org.fj)).

⁵² SAARC was founded in 1985. Its current members are Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka ([website: www.saarc-sec.org](http://www.saarc-sec.org)).

⁵³ SCO was proclaimed in 2001 by China, Kazakhstan, Kyrgyzstan, the Russian Federation, Tajikistan and Uzbekistan ([website: www.sectsc.org](http://www.sectsc.org)).

sectors. The Commonwealth of Independent States⁵⁴ (CIS) consisting of countries which formed part of the former Soviet Union, includes some countries located in Asia, as does the Intergovernmental Commission of the Transport Corridor Europe Caucasus Asia⁵⁵ (IGC-TRACECA). Yet, there are large differences between these subregional organizations. They pursue different levels of integration and different types of cooperation. These organizations have typically set up one or more technical bodies⁵⁶ to deal with transport,⁵⁷ concluding international transport agreements⁵⁸ and adopting long-term visions that include elements of transport infrastructure development (for example, ASEAN 2020 and the ECO Vision 2015).

b. Other arrangements

An increasing number of programmes, projects and initiatives have been started that include elements of subregional cooperation in transport. ESCAP has promoted these initiatives and collaborated on a number key areas

An increasing number of other programmes, projects and initiatives have been started that include elements of subregional cooperation in transport. ESCAP has promoted these initiatives and collaborated on a number of key areas.

ESCAP has been working closely with ADB, supporting its comprehensive subregional cooperation programmes in Asia and the Pacific, all of which include components related to integrated transport. These include the Greater Mekong Subregion (GMS); the South Asia Subregional Economic Cooperation (SASEC); the Central Asia Regional Economic Cooperation (CAREC); the Brunei Darussalam, Indonesia, Malaysia, Philippines-East ASEAN Growth Area (BIMP-EAGA); the Subregional Economic Cooperation in South and Central Asia (SECSCA); and the Pacific Plan for the small island developing States in the Pacific Ocean.

At the request of, and following consultations with the Central Asian republics, the Economic Commission for Europe (ECE) and ESCAP jointly initiated a programme in 1997 focusing specifically on economic issues of concern to those countries. The United Nations Special Programme for the Economies of Central Asia, or SPECA, assists the participating countries in strengthening cooperation for their economic development through more efficient use of resources and facilitation of their integration into Europe and Asia.

ESCAP has also collaborated with the UNDP-supported Tumen River Area Development Programme, a joint project of the five countries in North-East Asia.

In the railway sector, the Organization for Railways Cooperation (OSJD) concluded an agreement on organizational and operational aspects of combined Euro-Asian transport in 1997. This agreement identified a number of Euro-Asian railway corridors and routes.

⁵⁴ The Commonwealth of Independent States was created in 1991. Its current members are Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, the Republic of Moldova, the Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan.

⁵⁵ Current members include Armenia, Azerbaijan, Bulgaria, Georgia, Kazakhstan, Kyrgyzstan, Republic of Moldova, Romania, Tajikistan, Turkey, Ukraine and Uzbekistan (website: <http://igc.traceca-org.org>).

⁵⁶ Examples: 20 transport-related bodies of ASEAN, Transport Coordinating Committee of CIS, and the SAARC Technical Committee on Transport.

⁵⁷ Note that IGC-TRACECA works only on transport issues.

⁵⁸ For example, the ECO Transport Transit Framework Agreement of 1998 and the CIS protocol on international roads in 1998.

ESCAP has concluded a number of memorandums of understanding to formalize its collaboration in promoting subregional and regional cooperation in transport with International Union of Railways (UIC), Organization for Railways Cooperation (OSJD), Asian Development Bank (ADB), International Road Federation (IRF), Korea Transport Institute (KOTI), the Korea Maritime Institute (KMI), Asian Institute of Transport Development (AITD), CPD and others.

Other notable subregional cooperation initiatives include:

- The Brunei Darussalam, Indonesia, Malaysia, Philippines East ASEAN Growth Area (BIMP-EAGA);
- Indonesia, Malaysia, Thailand-Growth Triangle (IMT-GT);
- Indonesia, Malaysia, Singapore-Growth Triangle (IMS-GT);
- ASEAN Mekong Basin Development Cooperation (AMBDC);
- The Ayeyawady-Chao Phraya-Mekong Economic Cooperation Strategy (ACMECS).

4. SMALL ISLAND DEVELOPING STATES IN THE PACIFIC

Distance and isolation have resulted in relatively high transport costs for many small island developing States. The quality and frequency of international shipping and air services are largely beyond their control. Domestic markets are too small to provide economies of scale and the remoteness of many rural and outer-island communities constrains options and increases costs.

The Programme of Action for the Sustainable Development of Small Island Developing States⁵⁹ and its follow-up, the Mauritius Strategy for the Further Implementation of the Programme of Action,⁶⁰ form the basis of much of the regional cooperation in the field of transport and communications in the Pacific, focusing on environmental, infrastructure investment and maintenance issues.

The ESCAP Pacific Operations Centre (EPOC) provided technical assistance and advisory services to Pacific island countries at the request of their respective Governments in various socio-economic areas, including port-related issues.

The Pacific Islands Forum, which represents the Heads of Government of all the independent and self-governing Pacific island countries, Australia and New Zealand, conducted a Pacific Regional Transport Study (2004) and drew up the Forum Principles on Regional Transport Services, which addressed aviation and maritime commercial and regulatory issues.

The ESCAP Pacific Operations Centre (EPOC) provided technical assistance and advisory services to Pacific island countries in various areas including port related issues

⁵⁹ *Report of the Global Conference on the Sustainable Development of Small Island Developing States, Bridgetown, Barbados, 25 April-6 May 1994* (United Nations publication, Sales No. E.94.I.18 and corrigenda), chap. I, resolution 1, annex I.

⁶⁰ *Report of the International Meeting to Review the Implementation of the Programme of Action for the Sustainable Development of Small Island Developing States, Port Louis, Mauritius, 10-14 January 2005* (United Nations publication, Sales No. E.05.II.A.4 and corrigendum), chapter I, resolution 1, annex II.

E. THE WAY FORWARD IN REGIONAL TRANSPORT COOPERATION

To further promote cooperation and an inclusive approach to development of the region's transport sector, the secretariat will continue to work with subregional intergovernmental bodies and development partners

This chapter has illustrated the importance of transport in the economic and social development of the region, the levels of investment required in order that it can continue to effectively support the development process and the priority that member and associate members of ESCAP have placed on regional cooperation in the sector.

To further promote cooperation and an inclusive approach to development of the region's transport sector, the secretariat will continue to work with subregional intergovernmental bodies and development partners including: ECE, ESCWA, ECA, UNCTAD, UNDP, World Bank, Tumen River Area Development Programme (TRADP), the UNDP Silk Road Area Development Programme, Forum Secretariat, Asian Development Bank (ADB), ASEAN, ECO, SAARC, Shanghai Cooperation Organization (SCO), Commonwealth of Independent States (CIS), ICG-TRACECA, Organization for Railways Cooperation (OSJD), International Union of Railways (UIC), International Road Federation (IRF), International Road Transport Union (IRU), International Coordinating Council of Trans-Siberian Transportation (CCTST), the Korea Maritime Institute (KMI), Korea Railroad Research Institute (KRRRI), Korea Transport Institute (KOTI) and Asian Institute of Transport Development (AITD).

While later chapters will consider the general issues of enhancing regional cooperation in infrastructure development, including the sources of funds for such development, the following section considers a number of proposals that are specific to the transport sector.

With respect to the Asian Highway and Trans-Asian Railway, the secretariat will continue to assist member countries in identifying investment requirements and in promoting partnerships with potential donors.

1. STRENGTHENING THE INSTITUTIONAL FRAMEWORK FOR REGIONAL COOPERATION

One mechanism to institutionalize regular (and more frequent) meetings of Asian and Pacific ministers of transport is through the establishment of an institution that would perform functions similar to, although perhaps more limited than, those of the European Conference of Ministers of Transport

In Europe, ECE, the European Union and the European Conference of Ministers of Transport⁶¹ are providing effective mechanism to promote the development of an increasingly efficient and closely integrated transport network. Under the auspices of these organizations, frequent meetings of the highest level policymakers are creating the opportunity to speedily plan, develop and implement strategies responsive to the needs of individual countries and the European region as a whole.

In view of the increasingly rapid development of the transport in the ESCAP region at the national, subregional and regional levels, continuing policy guidance is required at the ministerial level to address emerging issues and promote regional integration. One mechanism to institutionalize regular (and more frequent) meetings of Asian and Pacific ministers of transport is through the establishment of an institution that would perform functions similar to, although perhaps more limited than, those of the European Conference of Ministers of Transport.

⁶¹ See www.cemt.org.

The functions of such an arrangement, which could meet biennially with ESCAP acting as the secretariat,⁶² will be considered at the Ministerial Conference on Transport, to be held in November 2006. The functions could include: (a) identifying and articulating regional transport issues; (b) developing long-term regional policies/strategies; (c) developing and prioritizing regional action plans; (d) reviewing, monitoring, evaluating and coordinating programmes of regional development partners; (e) enhancing the momentum of regional cooperation and integration initiatives in the transport sector; (f) resolving issues that are creating impediments to achieving regional visions and goals; (g) interacting with international financial institutions and bilateral donors; (h) mobilizing resources and promoting public-private partnerships.

Meetings could be held at intervals of two years and could include the convening of sessions of ministers of subregional organizations.

2. DEVELOPING THE REGION'S TRANSPORT NETWORK: INFRASTRUCTURE

In Commission resolution 60/1 of 28 April 2004 (Shanghai Declaration), members and associate members declared that “in the area of managing globalization, we will strive to develop an integrated intermodal transport network in Asia and the Pacific as well as Asia-Europe transport corridors.” In so doing, they recognized the importance of the network concept, including connectivity and interoperability both within and between different transport modes.

Any capacity constrained, inefficient or “missing” links or nodes affect the efficiency of movements from origin to destination along individual routes and over the network as a whole. Consequently, in developing an integrated intermodal transport network there is a need to ensure that all of the constituent elements are contributing to the network's overall efficiency. The Commission's work in developing the Asian Highway and Trans-Asian Railway are both supporting this end and the mechanisms for addressing modal issues are being set in place, though the Working Group on the Asian Highway and the Working Group on the Trans-Asian Railway network. As part of the way forward in the transport sector, activities need to be intensified in: (a) upgrading modal infrastructure links and nodes (including substandard and capacity constrained sections, border crossings and break-of-gauge points); (b) promoting the re-emergence of railways in the intermodal system; (c) addressing infrastructure connectivity issues at modal interchange points (including seaports and dryports); and (d) promoting the improvement of infrastructure asset management and maintenance (in particular, the creation of earmarked road funds for maintenance).

3. DEVELOPING THE REGION'S TRANSPORT NETWORK: LOGISTICS AND FACILITATION

There is a need for initiatives to promote the more efficient use of existing infrastructure. Examples include:

There is a need for initiatives to improve cross-border facilitation, moving towards consistency in transport-related agreements

⁶² The secretariat of the European Conference of Ministers of Transport is located in the secretariat of OECD.

Increasing attention should be given to enhancing the efficiency of unimodal and intermodal routes and corridors between origins and destinations of trading partners

- (a) Improving cross-border facilitation through, among others, the implementation of pilot or demonstration projects based on “single window” or “one-stop shop” concepts for cross-border customs, trade and transport facilitation;
- (b) Moving towards consistency in transport related agreements within the ESCAP region as well as between subregions.

To promote the competitiveness of the region within the globalization process, increasing attention should be given to enhancing the efficiency of unimodal and intermodal routes and corridors between origins and destinations of trading partners.

Annex

Data and methodology

Data on transport infrastructure stocks used for the estimates were taken from the *ESCAP Statistical Abstract of Transport in Asia and the Pacific, 2005^a* as well as *ESCAP's Maritime Policy Planning Model (MPPM)^b* and the *Asian Highway database*. The economic data was drawn from official statistics contained in the United Nations Common database^c and the conservative IMF forecasts.^d

Separate estimates were made for each transport subsector, based on a common dynamics-as-usual assumption. Both investment and maintenance costs are included, except in the case of container ports and urban mass-transit. Mobile equipment (such as railway rolling stock, aircraft, and trucks) is only included in the estimates for railways and urban mass-transit. For most subsectors, the methodologies used are similar to those employed by the 1994 ESCAP theme study^e as well as for the recent ADB/WB/ JBIC study,^f where scenarios are made for infrastructure stocks which are converted into capital costs using average unit costs (see annex table III.1).

Annex table III.1. Unit costs assumed for the ESCAP estimates, in real 2004 prices

Unit costs (United States dollars)		
Roads	\$ 410,000 per kilometre	everywhere except South Asia
	\$ 300,000 per kilometre	in South Asia
Railways	\$ 900,000 per kilometre	everywhere
Ports	\$ 80 million per berth	world class hub port (500,000 TEU per berth)
	\$ 60 million per berth	major port with mainline services (400,000 TEU per berth)
	\$ 60 million per berth	important secondary port (350,000 TEU per berth)
	\$ 40 million per berth	feeder or regional port (250,000 TEU per berth)
	\$ 40 million per berth	minor port using multi-purpose facilities (150,000 TEU per berth)
Airports	\$ 300 per 1 passenger capacity	everywhere
Source: ESCAP secretariat.		

^a ESCAP, Transport and tourism data for Asia and the Pacific (<http://www.unescap.org/ttdw/data/index.aspx>).

^b ESCAP, *Regional Shipping and Port Development Strategies: Container Traffic Forecast*, Monograph Series on Managing Globalization (ST/ESCAP/2398), 2004 (<http://www.unescap.org/ttdw/PubsDetail.asp?IDNO=183>).

^c United Nations, United Nations Common Database (http://unstats.un.org/unsd/cdb/cdb_help/cdb_quick_start.asp).

^d Asian Development Bank, Japan Bank for International Cooperation, World Bank, *Connecting East Asia: A New Framework for Infrastructure* (Washington D.C., World Bank, 2005).

^e ESCAP, *Infrastructure Development as a Key to Economic Growth and Regional Economic Cooperation* (ST/ESCAP/1364), 1994.

^f Asian Development Bank, Japan Bank for International Cooperation, World Bank, *Connecting East Asia: A New Framework for Infrastructure* (Washington D.C., World Bank, 2005).

Future scenarios for road, railway and airport stocks were based on the assumption of continued network growth and upgrading including maintenance costs on the order of 2 per cent of capital stock per year for road and rail and three per cent for airports. Future growth of infrastructure stocks was reduced in some cases where “big-push” development occurred recently. Unit costs for airports are consistent with those implied in International Civil Aviation Organization’s estimates for 2000 to 2010.⁹ Due to the methodology used and the fact that many countries in the region do not invest sufficient amounts in maintenance, the expected increase in investment needs in the future is likely to be underestimated.

Estimates for major container ports were taken from recent results of the ESCAP MPPM model runs for 2002 to 2015^h that forecast individual flows between all major container ports in the world and are strongly correlated with expected economic and trade growth. It should be noted that only capacities of major coastal container ports are taken into account. The estimates do not include smaller container and general cargo berths, liquid and dry bulk ports and inland waterway ports. In the case of the Russian Federation, only ports on the Pacific coast were included. Assumed unit costs (see annex table III.1) include only costs to develop new terminals, including handling equipment. Additional costs of dredging, the provision of breakwaters and the establishment of land transport links and intermodal interchanges would easily double the reported investment requirements for container ports.

Investment requirements for mass-transit infrastructure in urban areas are based on national statistics and the lists of major current or proposed projects as published in the *ESCAP Review of Developments in Transport 2005*,ⁱ *2003*^j and *1996-2001*.^k

Comparison with other estimates

The estimate presented above a comprehensive estimate of transport investment requirements in the ESCAP region for 2005-2015. There are studies by Fay and Yepes (2003)^l and Yepes (2005)^m that present investment and maintenance requirements for roads and railways for the world as a whole for 2005 to 2010. Estimates in the latter study for East and South-East Asia were

⁹ ESCAP, *Review of Developments in Transport in Asia and the Pacific* (ST/ESCAP/2392), 2005 (<http://www.unescap.org/ttdw/PubsDetail.asp?IDNO=178>) and *Transport and Tourism Data for Asia and the Pacific* (<http://www.unescap.org/ttdw/data/index.aspx>).

^h ESCAP, *Regional Shipping and Port Development Strategies: Container Traffic Forecast*, Monograph Series on Managing Globalization (ST/ESCAP/2398), 2004 (www.unescap.org/ttdw/PubsDetail.asp?IDNO=183).

ⁱ ESCAP, *Review of Developments in Transport in Asia and the Pacific* (ST/ESCAP/2392), 2005 (www.unescap.org/ttdw/PubsDetail.asp?IDNO=178).

^j ESCAP, *Review of Developments in Transport in the ESCAP Region* (ST/ESCAP/2307), 2003 (http://ttd_webserver/ttdw/PubsDetail.asp?IDNO=141).

^k ESCAP, *Review of Developments in Transport and Communications in the ESCAP Region, 1996-2001* (ST/ESCAP/2157), 2001 (http://ttd_webserver/ttdw/PubsDetail.asp?IDNO=93).

^l Marianne Fay and Tito Yepes, “Investing in infrastructure: what is needed from 2000 to 2010?”, World Bank Policy Research Working Paper No. 3102, July 2003 (available online at www.worldbank.org).

^m Tito Yepes, “Expenditure on Infrastructure in East Asia Region, 2006-2010”, a background paper for Asian Development Bank, Japan Bank for International Cooperation, World Bank, *Connecting East Asia: A New Framework for Infrastructure* (Washington D.C., World Bank, 2005).

also used in the recent joint study by ADB World Bank and JBIC.ⁿ In absolute terms, the Yepes (2005) estimates are larger than the earlier 2003 estimates. This was due to the use of a different base year that takes into account the recent rapid development in the early twenty-first century.

When expressed *in terms of shares of GDP*, the ESCAP secretariat estimates presented above are roughly in line with those for transport subsectors contained in the Fay and Yepes studies. For example, both foresee annual investment and maintenance needs of roughly 0.1 per cent of GDP for railways and 1 per cent of GDP for roads for the ESCAP region as a whole. In part this is due to the fact that all these studies assume almost identical average unit costs (annex table III.1).

However, the overall *absolute* ESCAP estimate is considerably larger than in the other studies for the following reasons: The ESCAP study (i) comprises more transport subsectors; (ii) uses a more complete dataset, particularly for roads;^o (iii) includes the three developed countries of the region;^p (iv) uses a newer base year (2003/2004) and takes into account the renewed dynamism of Asia after the Asian financial crisis; (v) does not include old data for 1960 to 1980 which reflected a transition in the development paradigm to one dominated by IPNs since the 1980s; and (vi) does not include a statistical relationship with GDP per capita, thereby allowing for continued, higher infrastructure investments already at a lower GDP per capita which better reflects the realities of IPN participation.

The ESCAP estimates are line with the reported actual total expenditure on transport infrastructure and are consistent with reported ongoing or planned major infrastructure projects as reported in the ESCAP *Review*. Finally, the results for the latter half of the 1990s are roughly in line with estimates reported in the 1994 ESCAP theme study (annex table III.2), except for roads where lower unit costs were assumed previously.

Annex table III.2. ESCAP theme study 1994 results of expected annual average investments for the ESCAP region for 1993 to 2000

ESCAP theme study 1994 estimates					
Annual average investments per year [billion (2002) United States dollars]					
Total	Roads	Railways	Airports	Container ports	Urban mass-transit
55	20.6	9.75	8.14	4.64	12.34
Source: ESCAP, <i>Infrastructure Development as a Key to Economic Growth and Regional Economic Cooperation</i> (ST/ESCAP/1364) 1994. Notes: ^a It should be noted that the definition of ESCAP region has changed since 1994. Country coverage in the 1994 study was smaller, in particular in the case of Central Asia and South-West Asia.					

ⁿ Asian Development Bank, Japan Bank for International Cooperation, World Bank, *Connecting East Asia: A New Framework for Infrastructure* (Washington D.C., World Bank, 2005).

^o Data available for 42 (of 57) ESCAP members and associate members in the ESCAP region, accounting for 99.1 per cent of the region's GDP.

^p Even though their share is actually small in terms of investments in new fixed assets.

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IV. INFORMATION AND COMMUNICATION TECHNOLOGY INFRASTRUCTURE

A. INTRODUCTION

The role of ICT in achieving the Millennium Development Goals was recognized at the World Summit on the Information Society, as reflected in the Geneva Declaration of Principles.¹ Many issues involved in transforming the digital divide into digital opportunities are identified in the Geneva Plan of Action² and the Regional Action Plan Towards the Information Society in Asia and the Pacific³ and need to be dealt with in partnership with all relevant stakeholders at the global, regional and national levels.

Against that backdrop, developing member countries are being called on to invest in the development of network infrastructure capacity to take advantage of newer, cost-effective telecommunications and computer technologies. Until recently, public telecommunications companies had the dominant role in building and maintaining core network infrastructure and providing universal access. However, privatization, liberalization and policies aimed at increasing competition in this strategic sector have increased the role of the private sector in providing ICT infrastructure. They have also hastened the adoption by many developing countries of new networking and telecommunications technologies, helped by their rapidly declining costs. Still, private telecommunications companies hesitate to provide infrastructure for rural and low-density areas and Governments still have a critical role to play in direct investment, creating an enabling environment or such interventions as setting up universal access funds by which companies can help Governments pay for community networks and public access points.

Recent estimates suggest that 80 per cent of total ICT expenditures goes to content, 15 per cent to software and application technologies and only 5 per cent to infrastructure.⁴ In recent years, the Asian and Pacific region has invested more heavily than other regions into the latter, channelling close to 10 per cent of its expenditure into basic ICT infrastructure. However, global data compilations indicate that Asian and Pacific countries vary widely in their levels of connectivity and technology infrastructure development.

The role of ICT in achieving the Millennium Development Goals is recognized at the highest political level

Asian and Pacific countries vary widely in their levels of connectivity and technology infrastructure development

¹ Adopted at the Geneva phase of the World Summit on the Information Society, held from 10 to 12 December 2003 (see document A/C.2/59/3 or visit www.worldsummit2003.org).

² Ibid.

³ Adopted at the High-level Asia-Pacific Conference for the World Summit on the Information Society, held in Tehran from 31 May to 2 June 2005 (see www.aprcwsis05.ir).

⁴ Ang Peng Hwa, "Asia's piece of the pie: Asia's entry into 'dot-com' universe", *Harvard Asia Pacific Review*, vol. 4, No. 2 (Summer 2000) (available online at <http://hcs.harvard.edu/hapr>).

The Economist Intelligence Unit gives high scores to Hong Kong, China; Singapore; the Republic of Korea; Japan; and Australia for connectivity and technology infrastructure (table IV.1). In contrast, Kazakhstan, Indonesia, Pakistan and Viet Nam have modest standings. Even China and India, which serve as major global nodes in the ICT economy and are among its largest and fastest-growing consumers and producers of technology, have low rankings for connectivity and infrastructure.

Table IV.1. Connectivity and technology infrastructure score for selected Asian and Pacific countries and areas*

Connectivity and technology infrastructure	
Hong Kong, China	8.10
Singapore	7.65
Republic of Korea	7.20
Japan	6.90
Australia	6.75
Taiwan Province of China	6.70
New Zealand	6.10
Malaysia	4.10
Thailand	3.05
China	2.50
Iran (Islamic Republic of)	2.35
Kazakhstan	1.70
India, Indonesia, Sri Lanka	1.40
Pakistan, Viet Nam	1.25

Source: The Economist Intelligence Unit, *The 2005 e-readiness rankings: A white paper from the Economist Intelligence Unit* (London, EIU, 2005).

* Ranking from 0-10.

The focus of this chapter is on basic ICT infrastructure and associated salient issues and challenges

A full examination of regional ICT investments would necessarily include devices and supporting services along with Internet/IP-based network infrastructure, but the focus of this chapter will be on basic infrastructure, comprising telephone mainlines, mobile telephones and Internet backbone, and on examining the salient issues and challenges in the region. Section B looks at the region's ICT infrastructure development and regional broadband initiatives. Section C focuses on future infrastructure expenditures needs and financing options while elaborating on the requirements for achieving internationally agreed goals, such as the Millennium Development Goals. Section D concludes with a proposal for regional cooperation on the Asia Broadband Program and highlights important policy considerations relevant to ICT infrastructure development.

B. CURRENT SITUATION

1. ASIA-PACIFIC REGIONAL OVERVIEW

A number of countries in the Asian and Pacific region are quickly and broadly rolling out high-speed Internet or broadband infrastructure. Asian Governments constantly review each other's strategies on advanced technol-

ogy infrastructures and deregulation, leading to the quick diffusion of similar Internet development practices in the leading Internet economies of Hong Kong, China; Singapore; the Republic of Korea; and Taiwan Province of China. These have some of the highest broadband usage and penetration rates in the world.⁵ The Asian and Pacific region emerges in a favourable position in global data compilations, such as the connectivity and technology infrastructure component of the 2005 Economist Intelligence Unit's e-readiness rankings.

In countries where there has been traditional cooperation and even collaboration between the national Government and industry, such as the Republic of Korea, the Internet has had a broad influence. This trend will become even more evident as increased collaboration occurs between Internet service providers and their suppliers. Some of the top Internet service providers and suppliers in Asia and the Pacific are tapping into new service development opportunities in non-traditional markets, such as China and India.

Japan's NTT DoCoMo, one of the earliest mobile Internet service providers, has a new research and development (R&D) operation in Beijing reportedly developing fourth-generation (4G) technology that is 10 times faster than any network operating today. Cisco Systems is also opening an Asian R&D centre in Shanghai, China, to supplement work done at its largest regional centre, in India. Both companies aim to benefit from China's lower development costs and to demonstrate long-term commitment to one of the world's largest future Internet markets.

Many Asian and Pacific Internet service providers are State-owned, but this has not caused much of a slowdown in the adoption of advanced technology. In Japan, there is highly effective deregulation and unbundling of local loop and last-mile services to business and residential markets giving Japanese consumers some of the cheapest broadband services in the world. Competition in broadband services in Japan has increased significantly, and high-consumption Internet subscribers rose to almost 13 million in 2004, up from less than 1 million in 2001.

The Asian and Pacific region is among the first in the world where liberalization, privatization and competition began soon after the divestiture of AT&T in 1984. By the turn of the century, most countries in the region had opened up the telecommunications service industry to private sector participation.

Most countries segregate policy and regulatory functions in order to prevent the same company from providing and operating network infrastructure and services. This has allowed the industry to grow in an open, competitive market, resulting in remarkably high annual growth rates for cellular mobile services. The 1999-2004 compound annual growth rate (CAGR) for cellular services in Maldives was 107.8 per cent, in China 50.5 per cent and in India 90.5 per cent. The average for the whole region was above 38 per cent. After a few early market hiccups, the private sector has made steady progress and by 2003-2004 had taken the lead over public sector operators in providing basic⁶ telecommunication services (fixed and

Through deregulation and decentralization, many Governments are creating an enabling environment for the development of telecommunications

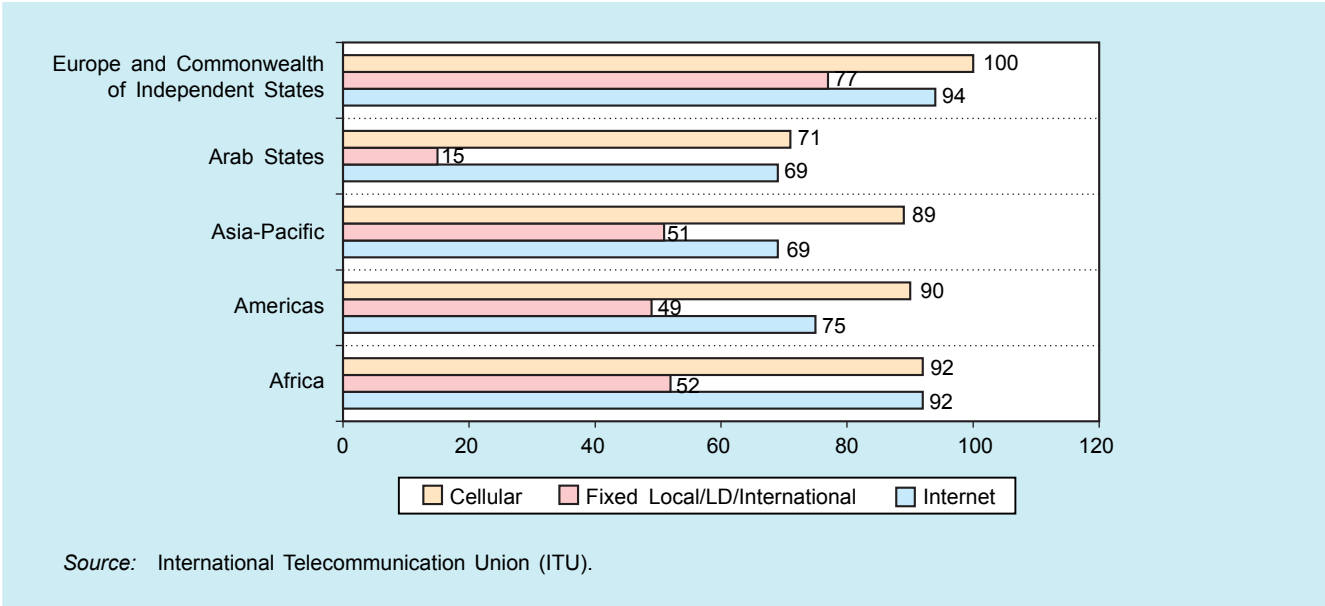
⁵ Greg Pelling, *Cisco Net Impact: Competitive Advantage from Internet Innovators in Asia Pacific and Japan* (Singapore, Wiley, 2005).

⁶ According to the definition of the World Trade Organization, basic services mean fixed, cellular mobile, national and international long distance services, among others. Some countries consider fixed access service as basic service and exclude cellular mobile.

cellular mobile access, national and international long distance) and Internet services by 2003-2004 (figure IV.1). The average proportion of fully or partially privatized incumbents among Asian and Pacific countries is 53 per cent.

Figure IV.1. Privatization/competition in ICT services

(Percentage)



Since the cellular mobile penetration had risen to 15.83 per 100 inhabitants for the Asian and Pacific region by 2003 overtaking the fixed lines by early 2002, the future growth area would indeed be mobile. But given the low fixed line density far behind that of the Americas at 37 and Europe at 43, Asia-Pacific demand for fixed lines is likely to remain positive for the next 4 to 5 years, although in 2004 there were already signs of negative growth in fixed main telephone lines from some of the OECD and more developed countries e.g., Japan (-1.3 per cent), New Zealand (-0.7 per cent), Malaysia (-3.1per cent), Singapore (-1.9 per cent) and the Republic of Korea (-0.3 per cent).

The Asia-Pacific region continues to witness robust growth in investment in ICT infrastructure

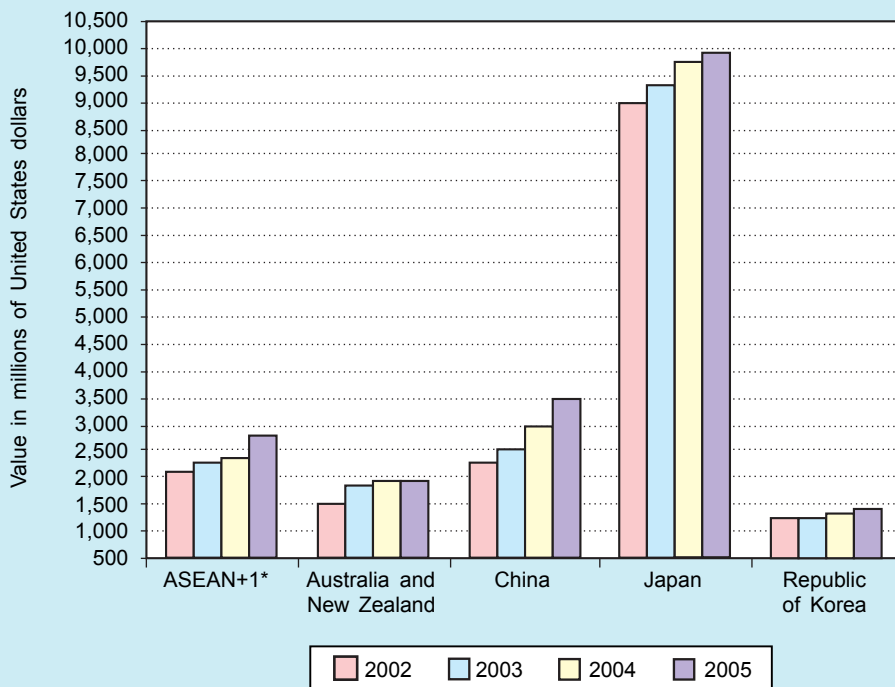
The Asian and Pacific region continues to witness robust growth in investment in basic ICT infrastructure, particularly in China, followed by ASEAN, although neither comes close to the magnitude of Japan's standard ICT investments.

2. PACE OF ICT INFRASTRUCTURE DEVELOPMENT

(a) Fixed and mobile infrastructure

Association of Southeast Asian Nations

In the early years of liberalization, the Association of Southeast Asian Nations (ASEAN) took the lead in expanding infrastructure and improving operational efficiency with private capital and expertise. Thailand, without waiting to amend legislation that mandated State ownership of telecom infrastructure, allowed private investment in network infrastructure through concessions by the State-owned monopoly operator for basic services, the Telephone Organization of Thailand. It also adopted an innovative build operate and transfer (BOT) financing scheme to attract private sector partici-

Figure IV.2. Comparison of investment in basic ICT infrastructure, 2002-2005

Source: Extrapolated from estimates by the International Data Corporation (IDC).

* ASEAN+1 includes ASEAN member countries and India

pation in network infrastructure and operations. Expansion of ICT infrastructure as reflected by main exchange lines and mobile subscriptions per 100 inhabitants grew at a CAGR of 7.09 per cent and 56.1 per cent per year from 1995 to 2004 respectively.

South Asian Association for Regional Cooperation

All South Asian Association for Regional Cooperation (SAARC) member countries have liberalized their telecom sector and set up the policy, regulatory and legal framework to foster speedy growth with limits on foreign investment in some countries (for example, India). Development that took many SAARC member countries a decade to achieve prior to private sector participation and competition is now being achieved by them in less than a year. Sri Lanka was the first SAARC member to set up an independent regulator and allow private sector entry. Pakistan, India, Maldives and others followed suit and the region has experienced steady growth in telephone users. The (weighted) average penetration per 100 inhabitants in SAARC member countries rose in 2004 to 3.54 per cent for fixed lines and 4.04 per cent for mobile services.

Development that took many SAARC member countries a decade to achieve prior to private sector participation and competition is now being achieved by them in less than a year

Economies in transition

In the subregion that includes Central Asia and the Caucasus, (weighted) average penetration per 100 inhabitants for fixed and mobile services is 20 and 36 respectively, higher than the corresponding figures for SAARC member countries. Mobile service subscriptions, however, have not picked up in the way they have in ASEAN and SAARC member countries. The

countries of the Commonwealth of Independent States need to revise policies in order to place ICT development on a fast track.

China

China has maintained consistently high ICT and economic growth after adopting entrepreneurial and free market principles in the 1980s. It has the region's largest network and one of the world's largest markets for ICT equipment and services (table IV.2). Many major cities are reaching telecommunications saturation but penetration in the rest of the country is still low compared with developed countries, particularly in rural areas.

India

The Indian telecom sector is undergoing a dynamic change. Major policy reforms since 1999 have resulted in the fastest ever expansion of the telecom network. All basic and value-added-services have been opened up to the private sector with total foreign investment limit raised to 74 per cent of the capital. To ensure balanced development of ICT in all the regions, the Universal Service Obligation Fund has been created to support the funding of expansion of services in rural and remote areas. The intense competition in the sector has resulted not only in steep reduction of tariffs for national and international long distance telecommunication services but also better quality of service and provisioning of new features to subscribers. India's Telecom Network with over 93 million lines is among the tenth largest networks in the world and the second largest among the emerging economies (after China) offering a wide range of services. India with a telecom penetration rate (combined fixed and mobile) of about 9 per 100 inhabitants has a tremendous scope for investment and further growth in the sector.

Islamic Republic of Iran

The number of fixed telephone lines is three times the number of mobile subscribers (table IV.2), but they are expected to be equal by 2009, reaching 35 million in total. That would represent a fixed and mobile density of 50 per 100 persons.

Japan

Japan has the region's most highly developed ICT infrastructure, with the highest numbers of users of broadband and Internet protocol (IP) telephones. In 2000, the number of mobile telephone subscribers exceeded that of fixed telephone subscribers. The number of fixed-line telephones was 58.79 million in March 2004, a slight increase over the previous fiscal year. Mobile telephone subscriber numbers are still growing but at a slower rate and in 2004 reached 91.47 million.

Republic of Korea

In 1960, the Republic of Korea had a fixed-line density of 0.36 per 100 inhabitants, among the lowest in the world. It now leads the world in broadband penetration and has developed into a world leader in ICT components and equipment manufacturing and services.

(b) Internet infrastructure in ASEAN+1⁷ member countries

ASEAN+1 includes sophisticated Internet economies, such as Singapore, developing Internet economies, such as Brunei Darussalam, Indonesia,

⁷ ASEAN+1 includes ASEAN member countries and India.

Japan has the region's most highly developed ICT infrastructure, the Republic of Korea leads the world in broadband penetration; China and India are catching up fast

Malaysia, the Philippines and Thailand, and emerging Internet economies, including Cambodia, the Lao People's Democratic Republic, Myanmar and Viet Nam. India is included in the developing Internet economies of this group because of its current stage of development and growing influence in the region, hence the acronym "ASEAN+1." Spending on basic ICT infrastructure in ASEAN+1 is projected to increase from about \$2.2 billion in 2002 to \$2.8 billion in 2005, including increased spending on an Internet backbone. This group is expected to rival China as the region's most aggressive investor in the Internet.

Table IV.2. Telecommunication development in selected Asian countries

Country	Reference year	Fixed lines (millions)	Mobile (millions)	Telephone density (per 100 persons)
China	2004	311.75	334.82	23.98 (fixed) 25.76 (mobile)
India	2004	43.96	47.30	4.07 (fixed) 4.37 (mobile)
Iran (Islamic Republic of)	2003 and 2004	14.57	4.30	21.97 (fixed) 6.16 (mobile)
Japan	2004	58.79	91.47	46.00 (fixed) 71.58 (mobile)
Republic of Korea	2004	26.6	36.6	55.31 (fixed) 76.09 (mobile)

Source: International Telecommunication Union (ITU), (2004).

Emerging Internet economies

The emerging Internet economies of Cambodia, the Lao People's Democratic Republic, Myanmar and Viet Nam are the latest adopters of the Internet in Asia and still have the greatest hurdles to overcome with regard to infrastructure. Governments have yet to develop an adequate network infrastructure to support the expansion of Internet usage. Only a small percentage of the population has Internet access, mostly in the larger urban centres due to the lack of connectivity, which is largely restricted to telephone lines.

Usage is restricted mainly to e-mail, browsing and information-gathering. In the major institutions, such as government, health care and education, Internet absorption is still at an early stage. Universities have some Internet access for students, but at the primary and secondary school level it is almost non-existent. Many government ministries have websites, but none share a website. Business usage is low, probably due to limited network infrastructure, high costs and lack of sophisticated business tools on the websites.

In least developed countries such as Cambodia and Myanmar, or even better-off Viet Nam, it is difficult to justify spending millions on Internet initiatives when faced with pressing needs for food, health care, education and employment. However, they will be able to build their Internet capabilities with proven, less expensive, optimal-use Internet technologies when they do decide to make that investment.

In emerging Internet economies, Internet usage is limited mainly to e-mail, browsing and information-gathering

Developing Internet economies

Developing Internet economies have Internet access mainly in the major cities, but there is little access in rural areas

By contrast, India, Thailand, Malaysia, the Philippines, Brunei Darussalam and Indonesia are arguably the most economically diverse group in ASEAN+1. Internet usage in these six countries ranges from just over 1 per cent of the population in Indonesia to almost 20 per cent in Malaysia. Internet access among the major cities and provincial capitals is good but rural access is still limited by the lack of telephone connectivity and personal computers (PCs). Major public institutions have varying degrees of connectivity. Universities and colleges have full Internet access, and access for secondary and primary schools is becoming more common. In the Philippines, more than one third of schools now have Internet access.

Connection and access speed within these countries is moderate and all have a solid Internet infrastructure comprising fibre optics, microwaves and satellites, with access to high-speed asymmetric digital subscriber lines (ADSL) and cable modems. In contrast to the emerging countries, this group has an abundance of Internet service providers – between two dozen and four dozen each. Due to the previous network infrastructure build-out and competition, the cost of Internet usage is lower and entry into the Internet service provider market is relatively easy. Internet usage includes not only e-mail and browsing, but also more advanced usage, such as e-commerce and e-marketplaces.

India is still in the earliest stages of Internet development compared with some other countries of the Asian and Pacific region. Despite significant progress in Internet and software development, India's lack of Internet infrastructure, outdated and costly service regulation in some key areas, and the sometimes slow speed with which it implements development plans, puts its Internet status behind a more aggressive China. Moreover, it suffers from an extreme divergence between the small percentage of its people who are spearheading the expansion of the Internet economy with world-class capabilities, and a large percentage of the population living in some of the region's most dire conditions of poverty who will not have access for years.

However, Internet usage has exploded since 2001 with the expansion of cyber cafes. In 2004, the number of Internet users in India jumped to 50 million, up from 31 million subscribers in 2003. Moreover, India has gained most from the outsourcing of ICT and Internet services since the 2001 global economic downturn and now controls more than 80 per cent of the global application outsourcing market, increasing awareness of the Internet. It would appear, however, that the country seems to fit into two types of Internet classifications: an emerging Internet economy and a developing Internet economy. A large percentage of its population live in poverty more dire than anything seen in most of ASEAN+1, while a small percentage of its people are spearheading the expansion of the Internet economy with world-class capabilities. Though this divergence happens in most countries, the scale is extreme in India. So, while a small percentage of its population will eventually have advanced access to the Internet, it is expected that most will not for years to come.

A mature Internet economy: Singapore

Mature Internet economies widely use the Internet for sustainable development

The active development of the Internet by the Government of Singapore resulted in more than 61 per cent of the population being connected in 2004, behind only Hong Kong, China, and the Republic of Korea for connectivity. Broadband access is pervasive and Singapore is one of the world's most sophisticated users of Internet technologies in the public

and private sectors. Singapore cannot afford to lag behind the world leaders in its use of ICT. Its main source of income is trade and high-tech industries and its infrastructure is one of the main attractions for foreign companies looking to invest in the country or region. To maintain this advantage, it must quickly identify and exploit ICT and Internet trends.⁸

3. REGIONAL BROADBAND INITIATIVES

Several regional initiatives focusing on increasing broadband deployment and usage have been launched by organizations including the Asia-Pacific Telecommunity (APT), Asia-Pacific Economic Cooperation (APEC) forum, the World Bank Group, ASEAN, the Asia-Pacific Broadcasting Union (ABU), various trade associations and United Nations agencies, such as UNDP and ITU.⁹ Many of these initiatives look at key themes that need to be addressed to bring broadband to more people in the region:

Regional broadband initiatives are vital for bringing ICT benefits to all

- The Government as a lead adopter/demand stimulator
- Developing regulations to stimulate competition and infrastructure deployment
- Developing spectrum management policies to stimulate wireless broadband use
- Creating sustainable broadband business models suitable for the region
- Understanding and meeting customer expectations
- Addressing the special needs/issues of rural areas
- Giving broadband its role within universal service obligations
- Making the private sector a partner in broadband deployment
- Supporting the development of local web content.

Other regional initiatives are bilateral; for example, one between Japan and ASEAN calls for increased cooperation to support broadband development in ASEAN members, Japan and the region overall.

Japan is also coordinating the Asia Broadband Program¹⁰ announced in March 2004, which aims to enable broadband access in Asia, construct intraregional broadband networks that will facilitate robust information flows; facilitate the transition of IPv4 to IPv6 for next-generation mobile communications and create an environment for the secure and easy use of ICT. It will also digitize and archive major cultural assets in Asian economies and develop machine-translation technologies between major languages in Asia and put them to practical use. The project is also intended to dramatically increase the number of ICT engineers and researchers in Asia.

⁸ Shri Pankaj Agrawala and J.S. Sehra, "Construction of broadband network environment in Asia", discussion paper presented at the Asia IT Ministers' 2nd Summit, held in Hyderabad, India, on 12 and 13 January 2004 (available online at <http://asiaitsummit.nic.in>).

⁹ For the Asia-Pacific Telecommunity, see www.aptsec.org; for the Asia-Pacific Economic Cooperation Telecommunications & Information Working Group, see www.apectelwg.org; for the World Bank's Global Information & Communication Technologies Department, see www.worldbank.org/ict; for the Association of Southeast Asian Nations, see www.aseansec.org; for the Asia-Pacific Broadcasting Union, see www.abu.org.my; for the United Nations Development Programme, see www.undp.org; and for the International Telecommunication Union, see www.itu.int.

¹⁰ The website of the Asia Broadband Program may be accessed at www.asia-bb.net/en.

Also noteworthy is the Asia Mobility Initiative, launched in April 2003 by Telstra, Maxis, M1, Smart and HK CSL to focus on content sharing, interoperability and cooperation on new mobile data applications. One month earlier, StarHub, Maxis, Telstra, China Netcom and KT had announced plans to cooperate on roaming and other technical/marketing matters related to Wi-Fi (wireless fidelity) deployment.

C. FUTURE INFRASTRUCTURE DEVELOPMENT NEEDS

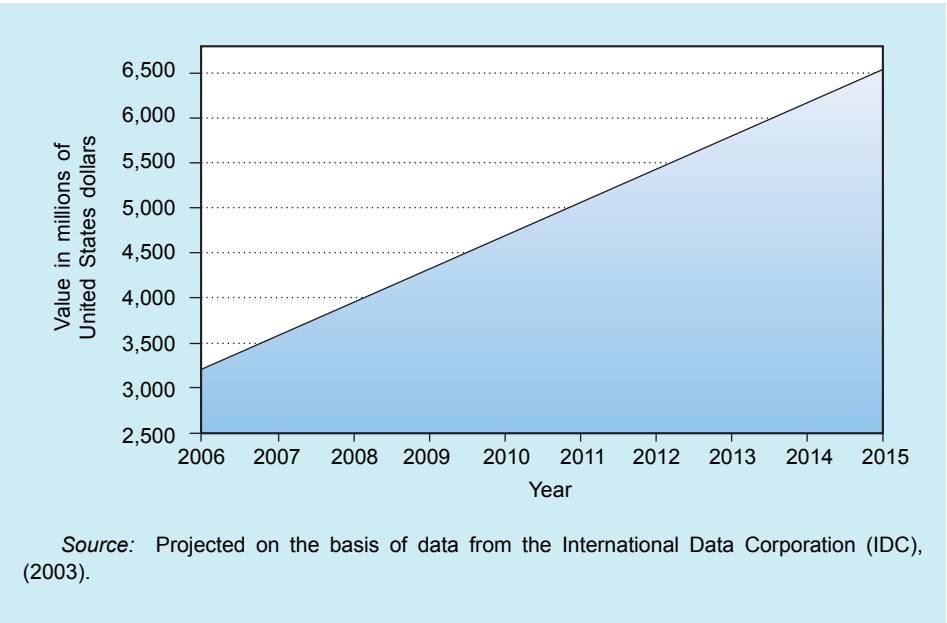
1. REGIONAL ICT OUTLOOK AND PROJECTED INFRASTRUCTURE EXPENDITURES

Deployment of the latest ICT and broadband technologies is expected to strengthen regional integration

The ability of Asian and Pacific organizations and businesses to collaborate effectively across borders and to use modern ICTs and the Internet to do so is likely to be a key factor in the region's success. Internet-based collaboration will strengthen integration in a region that by 2015 will have 3 billion people, approaching the size of the United States or the European Union, and will offer the world's largest developing markets, the lowest cost manufacturing and services and the highest penetration of leading Internet infrastructure. The markets include:

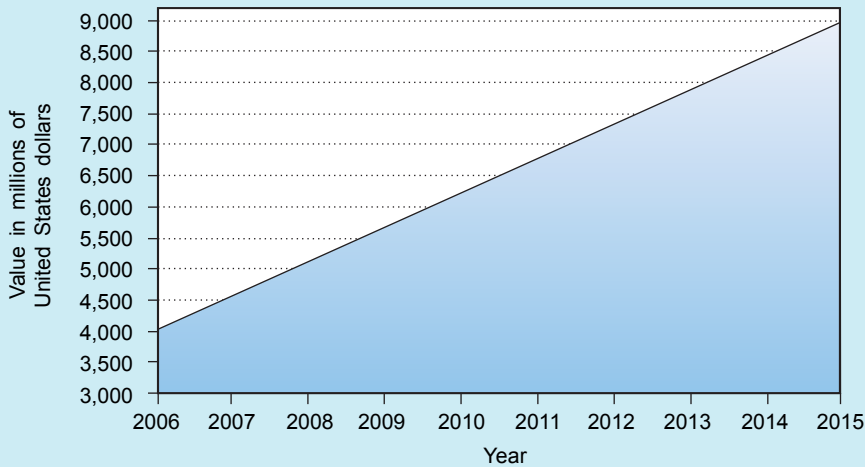
- ASEAN+1, which includes mature, developing and emerging economies with different levels of Internet investment, development and use, but many countries debate whether they should provide basic infrastructure, adequate nutrition and education or buy Internet technologies that can attract development expertise and resources;

Figure IV.3. ASEAN+1: projected investment in basic ICT infrastructure, 2006-2015



- China, where the Internet will have a potentially greater impact than anywhere else in the world, providing a catalyst for the development of small to mid-sized businesses at a pace never before imagined;

Figure IV.4. China: projected investment in basic ICT infrastructure, 2006-2015



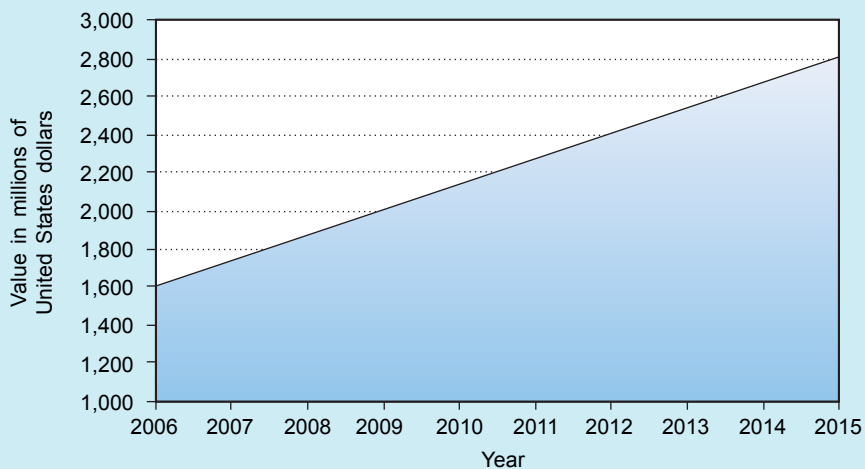
Source: Projected on the basis of data from the International Data Corporation (IDC), (2003).

In China, the Internet is being used to develop small to mid-sized businesses

- The Republic of Korea, which views the Internet and ICT as a key component of its strategic development and its ability to sustain its competitive advantages, has both high-level government backing and the infrastructure in place to support rapid growth for business and social uses;

The Republic of Korea views the Internet and ICT as a key component of its strategic development

Figure IV.5. Republic of Korea: projected investment in basic ICT infrastructure, 2006-2015

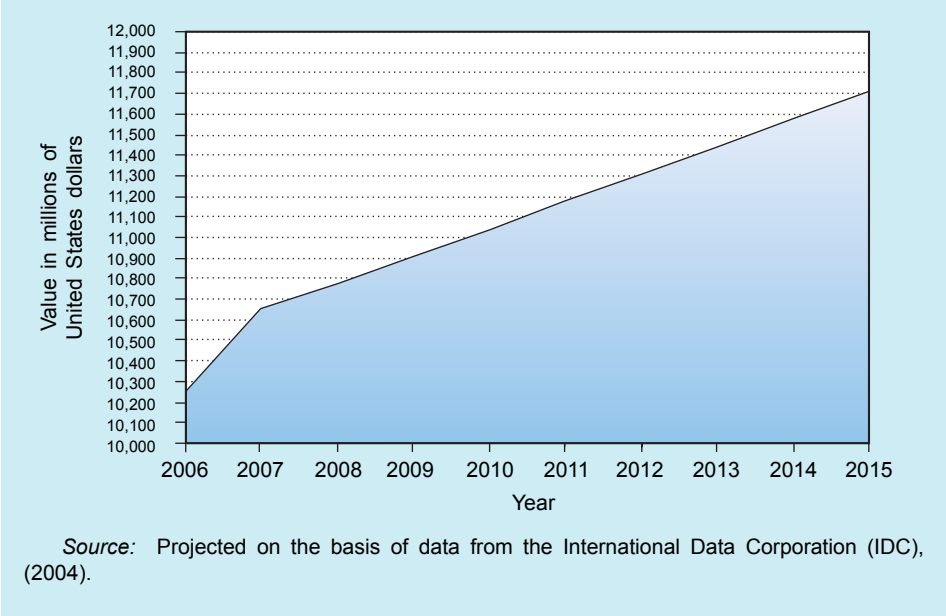


Source: Projected on the basis of data from the International Data Corporation (IDC), (2003).

Japan has reinvigorated business with impressive use of the Internet

- Japan, which has reinvigorated business with impressive use of the Internet by some leading companies to achieve change and productivity gains. More organizations are expanding the use of Internet-based solutions to achieve sustained growth. This could be the start of Japan's next major economic evolution and growth cycle.

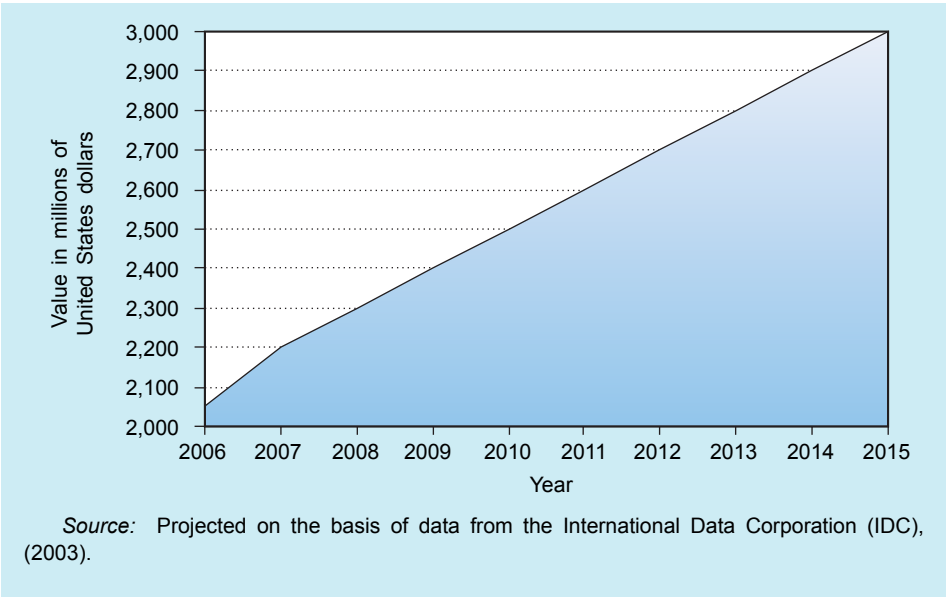
Figure IV.6. Japan: projected investment in basic ICT infrastructure, 2006-2015



Australia and New Zealand are using ICT to tackle the need for continuous productivity gains

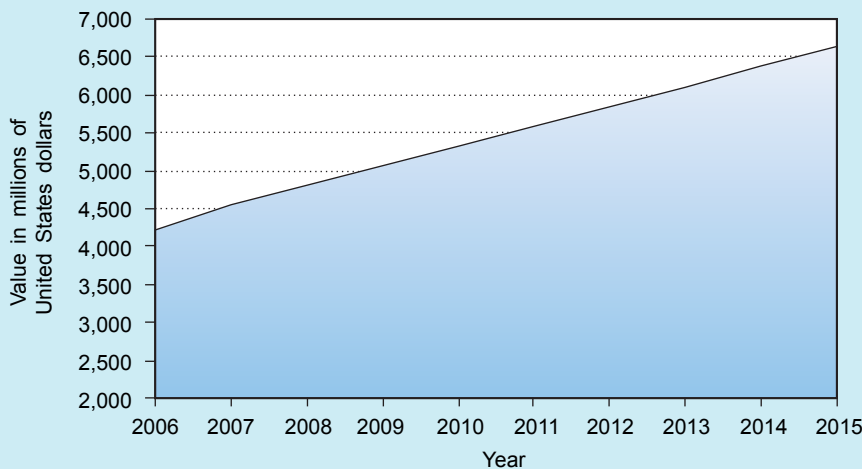
- Australia and New Zealand, which are using ICT pragmatically and innovatively in government and the private sector to tackle issues of vast geography, small populations, limited availability of investment funds and the need for continuous productivity gains;

Figure IV.7. Australia and New Zealand: projected investment in basic ICT infrastructure, 2006-2015



- Other Asian and Pacific developing countries which are marginalized or emerging Internet economies, Governments and multilateral organizations, such as ADB, UNDP and the World Bank, can be expected to play the main role in funding ICT infrastructure, be it telecommunications lines, PCs for schools or Internet access for communities.

Figure IV.8. Other Asian and Pacific developing countries: projected investment in basic ICT infrastructure, 2006-2015



Source: Projected on the basis of data from the International Data Corporation (IDC), (2003).

2. FINANCING NEEDS

Total annual investments in basic ICT infrastructure in the Asian and Pacific region for the next 10 years (2006-2015) will amount to an estimated \$32.7 billion, of which \$19.1 billion will be for developing countries of the region (table IV.3). China will enjoy the highest growth, followed by ASEAN members and India, although in sheer magnitude of investment, none will surpass Japan. The other Asian and Pacific developing countries, which most need financial assistance, are projected to need \$5.5 billion in this period.

3. OPTIONS FOR FINANCING ICT

Experience shows that the private sector often provides services more effectively than Governments and this is certainly true in telecommunications. The phenomenal spread of mobile telephones in the past decade, particularly in the Asian and Pacific region, was driven by the ability of private providers to move quickly to satisfy a pent-up need for telephony as soon as they were allowed into the market. Private companies have proved more efficient and flexible than State-owned monopolies in keeping up with technological developments and competition between them brings lower prices.

The success of the private sector does not mean that Governments and aid donors should withdraw from ICT provision altogether. Private sector success often depends on support from Governments and donors and some development needs will certainly continue to require public investment. Government and private sector partnerships are essential for ICT financing.

Government and private sector partnerships are essential for ICT financing

Table IV.3. Annual ICT infrastructure financing needs

Country/region	Amount (Billions of United States dollars)	Percentage
Japan	11.1	33.9
China	6.5	19.9
ASEAN+India	4.9	15.0
Australia and New Zealand	2.5	7.6
Republic of Korea	2.2	6.7
Other developing countries*	5.5	16.8
Total	32.7	100
All developing countries of the region (excluding Australia, Japan and New Zealand)	19.1	58.4

Source: Projected on the basis of data from the International Data Corporation (IDC), 2003.

Note:

* All developing countries of the region excluding ASEAN+1, China and the Republic of Korea.

Governments are responsible for creating the conditions that attract private sector investors

Creating an enabling environment for investment

Governments are responsible for creating the conditions that attract private sector investors. They must make laws, regulations and start-up procedures for private companies as simple, transparent and predictable as possible; ensure fair competition; and ensure that back-up services, skilled personnel and capacity are in place to enable operations to run smoothly. Without an enabling environment, investment will not be made or will not be effective in providing services efficiently and at the best price. While each country needs to develop its own policy and strategies, global communications require regional and international governance.

Financial support

Investors may be wary if a project seems to be very risky, has high start-up costs or will not generate profit for several years. Donors offer financial assistance, such as loans or risk mitigation, especially for the early stages of projects, to enable private companies to operate in areas that might not otherwise be considered commercially attractive or viable.

Public-private partnerships

The private sector is good at supplying wealthier and urban populations that can easily pay for services but may not be willing to supply poor, marginalized and rural people – the very people who should be the target of development aid. Large distances and thinly spread populations make for high infrastructure costs in providing fixed-line telephone systems for rural or remote areas. Poverty also means that the use of telephones will probably be low. Private companies are starting to look seriously at how they can serve the poor profitably, but market gaps remain, requiring government and donor aid.

Donors can help Governments to develop policies and projects for meeting the ICT needs of the poor, by supporting research and consultation. They can encourage and co-finance ICT projects that benefit the poor

directly, such as local community information points or community e-centres, without losing sight of the need for ICT projects to be sustainable in the long run. They can also help to establish cross-subsidy schemes or innovative public-private partnerships to encourage commercial network operators to channel investments towards less commercially attractive regions.

Partnership for regional projects

The construction of regional infrastructure presents another challenge that the market is unlikely to solve unaided. Building an effective telecommunications backbone to link different Asian and Pacific countries and regions is essential, but this will require so much coordination, political commitment, policy and regulatory reform and institution-building, apart from significant physical infrastructure, that the challenge is beyond the capability of any single private investor or development bank. Regional cooperation is indispensable for linking different countries.

*Regional cooperation
is indispensable for
linking different
countries*

Many important aspects of ICT infrastructure usage and governance depend on collaboration among countries – among neighbours, regionally or globally. Donors are examining options for setting up international development partnerships that mobilize public and private resources to tackle large issues that demand such coordination or are beyond the capacity of individual donors.

Meeting the Millennium Development Goals

An estimated \$50 billion in additional aid would be needed to achieve the Millennium Development Goals globally by 2015, over and above the development funds already promised in the Monterrey Consensus.¹¹ A significant part of this will likely be spent on ICT to make services more efficient and effective, support good governance and enable economic development. Many least developed countries and landlocked developing countries which are furthest from achieving the Goals, need ICT to help them stimulate their economies and integrate them into the world economy.

*ICT is an essential
tool to stimulate
developing economies
and integrate them
into the world
economy*

D. THE WAY FORWARD

1. REGIONAL COOPERATION IN ICST INFRASTRUCTURE DEVELOPMENT

Despite the differences between countries in the region, opportunities exist for regional cooperation at various levels to implement the objectives set out in the Millennium Development Goals and action lines of the Plan of Action of the World Summit on the Information Society.¹² Such cooperation can and should be driven by the private sector and other enablers, such as international and regional financial institutions, and facilitated by member States through various modalities and mechanisms. ESCAP can play an important role in facilitating a regional consensus and promoting regional cooperation in the three areas described below.

¹¹ Monterrey Consensus of the International Conference on Financing for Development (*Report of the International Conference on Financing for Development, Monterrey, Mexico, 18-22 March 2002* (United Nations publication, Sales No. E.02.II.A.7), chap. I, resolution 1, annex).

¹² Adopted at the Geneva phase of the World Summit on the Information Society, held from 10 to 12 December 2003 (see document A/C.2/59/3 or visit www.worldsummit2003.org).

Asia-Pacific Broadband Program

A broadband network will provide the foundation on which to build an inclusive regional information society

The Bangkok Agenda for Broadband and ICT Development in the Asian and Pacific region, adopted at the Asia-Pacific Broadband Summit in July 2004, called for the creation of a broadband network in the region that involves agreement on a set of common principles by all Asian and Pacific stakeholders, including Governments, the public sector and civil society. The network will provide the foundation on which to build an inclusive regional information society which can develop better responses to such issues as poverty eradication, the creation of knowledge and the promotion of sustainable development.

The initiative raises many issues, from building infrastructure to intellectual property and information security, highlighting the need for an institutional platform to facilitate contact and debate. ESCAP, as the only intergovernmental organization covering the entire Asian and Pacific region, is well placed to undertake that role. It may focus on creating the necessary regional consensus, helping to produce an enabling policy and regulatory environment, building the requisite skills base, promoting broadband applications (e-government, e-business, e-environment, e-learning and e-health) and developing content.

Such an initiative would complement and extend the activities of the Government of Japan in realizing the Asia Broadband Program, including the North-South Submarine Fiber-Optic Cable Link Project in Viet Nam, which runs a fibre-optic cable 2,000 kilometres from north to south. The initiative is therefore expected to prompt other national and/or subregional hubs to be linked up to this initial regional broadband effort.

Knowledge-based disaster management

The catastrophic Indian Ocean tsunami, Hurricane Katrina and the South Asian earthquake underlined the constant threat of disasters that may bring great loss of human life and property. Most technical support tools supporting knowledge-based disaster management are enabled by information, communication and space technologies. As a follow-up to the World Conference on Disaster Reduction held in Kobe, Japan, in January 2005, the Regional Plan of Action towards the Information Society included a regional cooperation framework on knowledge-based disaster management.

For implementation of disaster management-related activities,

- ESCAP has established a regional trust fund for the tsunami early warning system in the Indian Ocean and South-East Asia, with the first contribution of \$10 million coming from the Government of Thailand. ESCAP is promoting regional/subregional, multinodal and integrated approaches for establishing early warning systems for tsunamis and other disasters;
- ESCAP received a \$1 million contribution from the Government of the Republic of Korea for technical cooperation in disaster preparedness in tsunami-affected countries and \$125,000 from the Government of Germany for South-South cooperation on tsunami and other disaster risk management.

ESCAP is working with space service providers and national disaster management authorities to develop regional cooperative mechanisms for

using space technology for disaster management. Spacefaring countries such as China, India and Japan have given ESCAP strong support by providing relevant space information products and services, exploring cooperation on a disaster monitoring satellite constellation and exploring ways to deliver products and services to disaster management authorities.

ESCAP is discussing with ITU and the Asia-Pacific Satellite Communications Council on how to help Asian and Pacific countries to establish emergency communication capabilities and the possibility of setting up regional or subregional standby systems.

ESCAP is also working with relevant organizations and countries on the possibility of providing the region with drought monitoring information services in line with the recommendations of the Asian Conference on Disaster Reduction, held in Beijing from 27 to 29 September 2005.

Satellite strengthened connectivity and applications

ESCAP is implementing projects on satellite broadband-based community e-centres, and on application models of satellite-based e-learning tools for population development and family planning. In cooperation with ITU, the United Nations Office for Outer Space Affairs and the Asia-Pacific Satellite Communications Council, ESCAP initiated a survey on satellite broadband resources to help less developed countries understand their availability and affordability, and to lay a foundation for public-private partnerships that deliver satellite broadband service and development-oriented ICT applications.

***ESCAP is
implementing projects
on satellite
broadband-based
community e-centres***

2. CONCLUSION

Developing a strong Internet environment is a common goal for Asian and Pacific Governments, but the quality of government support varies greatly when it comes to implementing e-business and wider e-societal initiatives and fostering the necessary telecommunications infrastructure. Countries and areas such as Hong Kong, China, the Republic of Korea, Singapore and Australia are shaping technical, legal, economic and social environments to promote Internet use, but many other countries are lagging behind.

In order to create an environment that promotes wider use of the Internet and an all-inclusive information society, Governments need to address four general issues:

- ***Making the Internet available to everyone.*** Improving the local infrastructure and reducing access costs enable large parts of the local population to go online. Creating an enabling environment that encourages needed investment and public-private partnerships to expand the much-needed rural infrastructure is another important challenge;
- ***Developing legal and security frameworks for online activities.*** Australia, the Republic of Korea and Singapore have taken the lead in developing comprehensive e-legislation that covers digital signatures, encryption, public key infrastructure, protection of intellectual property and online taxation;

- **Promoting e-government and e-business effectively.** Strong central bodies that coordinate e-government and e-business initiatives in areas of national importance are effective tools to foster good government-to-consumer (G2C) and business-to-consumer (B2C) environments;
- **Allowing foreign investment in telecoms and Internet service providers.** Limits on foreign shareholdings in telecoms and Internet service providers have eased in many Asian and Pacific countries but the region needs to allow freer access to telecommunication and Internet service provider infrastructure.¹³

Developing countries need to focus on providing rural areas with ICT infrastructure and access to narrow the digital divide

Developing countries where ICT infrastructure is available mainly in urban areas need to focus on providing rural areas with infrastructure and access in order to narrow the digital divide. Governments can utilize innovative business models, such as universal access funds or franchised community e-centres, to help finance infrastructure in rural or thinly populated areas.

In order to encourage businesses to increase the use of ICT, the government or industry regulator must continue to benchmark network and Internet tariffs, reliability and bandwidth against the more mature Internet economies and developed countries. World-class ICT infrastructure at competitive tariffs is essential to attract FDI in higher value-added businesses, such as design, processing, packaging, distribution and marketing.

¹³ David C. Michael and Greg Sutherland, *Asia's Digital Dividends: How Asia-Pacific's Corporations Can Create Value from E-Business* (Singapore, Wiley, 2001).

V. ENERGY INFRASTRUCTURE

A. INTRODUCTION

Energy has always been critical for economic growth and social development. As economies develop, energy consumption grows more or less in parallel. An adequate and affordable energy supply is needed to meet the demands of industry, commerce and domestic users and to enable the movement of people and goods.

Energy is critical for economic growth, social development and poverty reduction

Energy is also closely linked to poverty reduction because it is central to practically all aspects of the core conditions of poverty – such as poor health, lack of access to water, sanitation, and education. Enhancing access to energy services to reduce poverty and enable economic growth in a sustainable manner is a major challenge that countries must address in order to achieve the MDGs.¹ However, energy development also has a significant impact on the environment, locally and globally. The commercial energy sector is one of the main sources of greenhouse gas emissions, contributing to global warming. Traditional energy sources, such as biomass, used by people who lack access to modern energy supplies, can have an impact on local air quality due to the generally inefficient combustion process and frequency of exposure.

For the Asian and Pacific region, which has the world's highest economic growth rate but is also home to the majority of the world's poor, energy infrastructure development presents a critical challenge. Countries experiencing rapid economic and social development, such as China and India, have an acute need to find stable and sustainable energy supplies. However, in order to supply the energy that the region needs for future economic growth and to reduce the large portion of its population without access to modern energy supplies will require a substantial increase in the size and diversification of energy infrastructure. Northern and Central Asia, endowed with rich reserves of fossil fuels, will be important for the region's energy, and hence energy cooperation is proposed both within and outside the subregion.

To meet its development needs, the region uses a number of energy sources. Those without access to modern energy supplies mostly use biomass, while most electricity supplies are generated by fossil fuels. The use of renewable energy, such as solar, geothermal and wind, is rapidly increasing but still accounts for only a small share of total energy supplies. Nuclear power is also used by some countries.

¹ UN-Energy, *The Energy Challenge for Achieving the Millennium Development Goals* (New York, United Nations, 2005) (<http://esa.un.org/un-energy/>, accessed December 2005).

The primary focus of the present chapter will be to assess the infrastructure requirements for commercial fossil fuels and the emerging alternative energy market, both of which are likely to play a significant role in determining the future energy policies. The priority that nations give to achieving energy security, often considered an issue of national security, sometimes prevents policymakers from seeing the benefits of cooperation with neighbouring countries. More effort to address energy issues jointly at the regional and subregional levels could complement the endeavours of national Governments and facilitate initiatives that address energy issues in a more sustainable and systematic manner.

Energy infrastructure normally includes:

- The physical infrastructure required for the exploration, development and production of energy;
- Transformation of energy, such as electric power generation and oil refining;
- Transmission and distribution of energy, such as electric power transmission lines and oil and gas pipelines;
- Storage of energy products.

The chapter will cover the role of most of these infrastructure types in energy development. Section B discusses the status of energy supply and demand and factors important to development of the energy sector, including its impact on the environment and some key examples of energy cooperation. Section C discusses energy projections that highlight general trends and factors that may shape the region's future energy investment needs. Section D concludes with a way forward, an overview of future requirements and possible options for the involvement of ESCAP in facilitating cooperation in energy.

B. CURRENT SITUATION

The Asian and Pacific region has experienced the world's highest economic growth rate in recent times, and the resulting income rise, together with a growing population, has led to a surge in energy demand that is expected to continue.

In 2002, per capita global energy consumption stood at 1.42 tons of oil equivalent (toe), while average per capita energy consumption in the ESCAP region was 0.87 toe (figure V.1). The energy consumed by the region's developed countries amounted to 4 toe per person. By contrast, the developing countries of the region, which have 96 per cent of the region's population, averaged only 0.74 toe per capita. Consumption in the developed Pacific countries² and North and Central Asia was well above the world average. In the Pacific island developing countries, South Asia, South-East Asia and East and North-East Asia, it was still well below the global average.

This low per capita consumption partially reflects the extent of the Asian and Pacific population that lacks access to basic energy services. Levels of access vary widely from a high of 100 per cent in Singapore to a low of 5 per cent in Myanmar.³ Of the 2.4 billion people worldwide relying

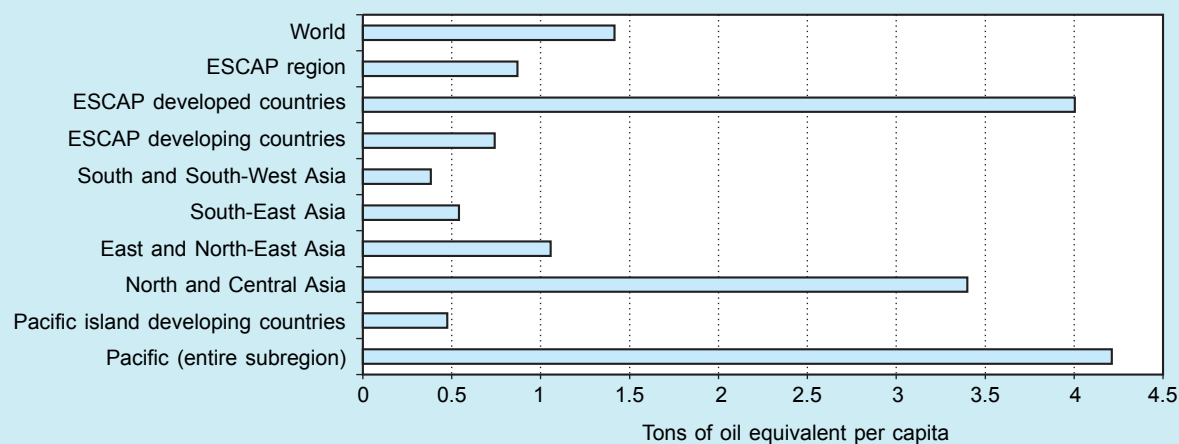
Per capita energy consumption in the region's developed countries is more than four times that of its developing countries, which have 96 per cent of the region's population

² These countries are Australia and New Zealand.

³ International Energy Agency, *World Energy Outlook 2004* (Paris, IEA, 2004).

on biomass for cooking and heating in 2002, 1.7 billion people are from developing Asian countries. Of these, 1.3 billion were in China and India. Out of approximately 1.6 billion people globally who did not have access to electricity in 2002, 63 per cent or 1.02 billion people were in Asia and the Pacific (table V.1). Of these, 77 per cent lived in Bangladesh, India and Indonesia.

Figure V.1 Per capita energy consumption (2002)



Source: Extrapolated from United Nations. *Common Database*, <http://unstats.un.org/unsd/cdb/cdb_help/cdb_quick_start.asp>, accessed September/October 2005.

Table V.1. Population without access to electricity, 2002

	Population without electricity (millions)
World	1 623
Asia and the Pacific	1 019
Afghanistan	22.5
Bangladesh	100.5
Cambodia	11.3
China	13.2
Democratic People's Republic of Korea	18
India	582.6
Indonesia	100.5
Malaysia	0.7
Mongolia	0.3
Myanmar	46.4
Nepal	17.9
Pakistan	68.1
Philippines	8.7
Singapore	0
Sri Lanka	6.5
Thailand	5.5
Viet Nam	16.3
Other Asia	0.05

Source: International Energy Agency, *World Energy Outlook 2004* (Paris, IEA, 2004).

Over the past 25 years, developing countries have extended electricity supply to more than 1.3 billion people, 500 million in rural and 800 million in urban areas, but large gaps in access remain, especially in rural areas of the Asian and Pacific region. For example, in South and South-East Asia, electrification levels range from 30 to 50 per cent for rural areas, compared with a range of 68 to 90 per cent in urban areas.

Developing appropriate energy infrastructure to supply the vast majority of the population living in rural areas is a particular challenge

Developing appropriate energy infrastructure to supply the vast majority of the population living in rural areas is a particular challenge in Asia and the Pacific, although many Governments now see the benefits of using renewable resources for rural services.

Commercial energy production in the Asian and Pacific region grew over 6 per cent annually between 1980 and 2002, much higher than the global average growth rate of about 1.6 per cent), even though production slowed substantially between 1995 and 2002. This growth was experienced primarily in ESCAP developing member countries (table V.2). The region's energy consumption, up by almost 5 per cent per year in this period, also grew much faster than the global average (table V.3), fuelling its substantial economic growth and poverty reduction efforts.

Table V.2 Energy production and annual production growth rates

	Energy consumption (Million tons of oil equivalent)						Annual growth rate (Percentage)		
	1980	1985	1990	1995	2000	2002	1980-2002	1980-1995	1995-2002
South-East Asia	136.4	157.6	241.8	313.5	368.2	403.0	4.8	5.3	3.2
East and North-East Asia	515.2	699.7	856.8	1 048.2	890.9	1 096.5	3.3	4.5	0.6
North and Central Asia	..	..	..	1 149.6	1 206.6	1 302.5	..	..	1.6
Pacific	84.9	126.3	166.3	206.4	251.8	274.3	5.2	5.7	3.6
South and South-West Asia	182.1	285.1	397.7	490.2	564.9	567.0	5.1	6.4	1.8
ESCAP developing countries	789.6	1 079.0	1 430.8	2 913.7	2 934.7	3 280.1	6.4	8.5	1.5
ESCAP developed countries	129.1	189.7	231.8	294.3	347.7	363.2	4.6	5.3	2.7
ESCAP	918.7	1 268.7	1 662.6	3 207.9	3 282.4	3 643.2	6.2	8.1	1.6
World	6 661.6	7 029.6	8 140.0	8 613.0	9 150.3	9 510.2	1.6	1.6	1.3

Source: ESCAP staff estimates based on data from United Nations. *Common Database*, <http://unstats.un.org/unsd/cdb/cdb_help/cdb_quick_start.asp>, accessed September/October 2005.

Note: (..) data is not available.

In 2002, almost 57 per cent of global commercial solid fuel production occurred in the Asian and Pacific region, which also consumed 54 per cent of global solid fuel. The East and North-East Asian subregion accounted for 35 per cent of the global consumption, with South and South-West Asia consuming around 10 per cent (see figures V.2 and V.3).

Gas production in the ESCAP region, predominantly from North, Central and South-East Asia, reached 41 per cent of global production. However, only 34 per cent of global gas consumption occurred in the ESCAP region, which exported significant quantities of natural gas, primarily from North and Central Asia.

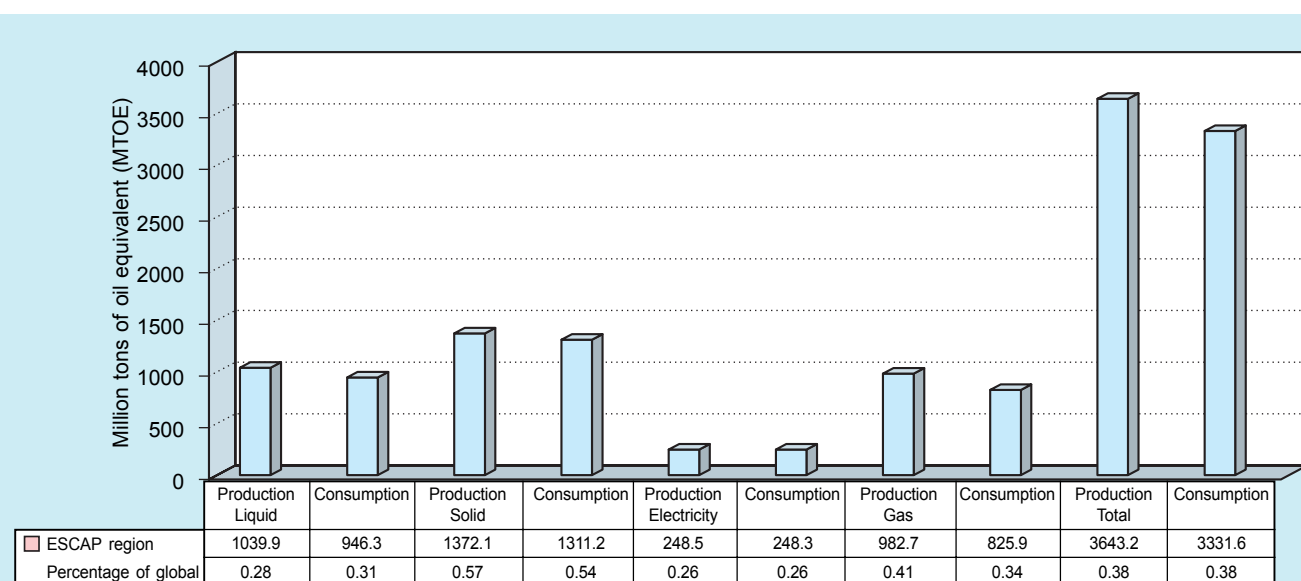
Table V.3 Energy consumption and annual consumption growth rates

	Energy consumption (Million tons of oil equivalent)						Annual growth rate (Percentage)		
	1980	1985	1990	1995	2000	2002	1980- 2002	1980- 1995	1995- 2002
South-East Asia	75.2	88.6	150.4	203.1	256.0	288.4	6.0	6.4	4.5
East and North-East Asia	770.2	945.2	1 179.4	1 484.6	1 394.7	1 585.4	3.2	4.2	0.8
North and Central Asia	..	..	..	729.3	724.1	738.5	..	..	0.2
Pacific	74.7	88.5	105.3	115.8	130.6	134.0	2.6	2.8	1.9
South and South-West Asia	168.3	237.5	330.6	434.8	565.8	585.3	5.6	6.1	3.8
ESCAP developing countries	705.2	940.5	1 268.2	2 408.3	2 473.6	2 725.3	6.1	8.0	1.6
ESCAP developed countries	383.1	419.3	497.5	559.3	597.6	606.3	2.0	2.4	1.0
ESCAP	1 088.3	1 359.8	1 765.7	2 967.5	3 071.2	3 331.6	5.0	6.5	1.5
World	6 157.2	6 732.3	7 573.5	7 976.0	8 442.9	8 784.6	1.6	1.6	1.2

Source: ESCAP staff estimates based on data from United Nations. *Common Database*, <http://unstats.un.org/unsd/cdb/cdb_help/cdb_quick_start.asp>, accessed September/October 2005.

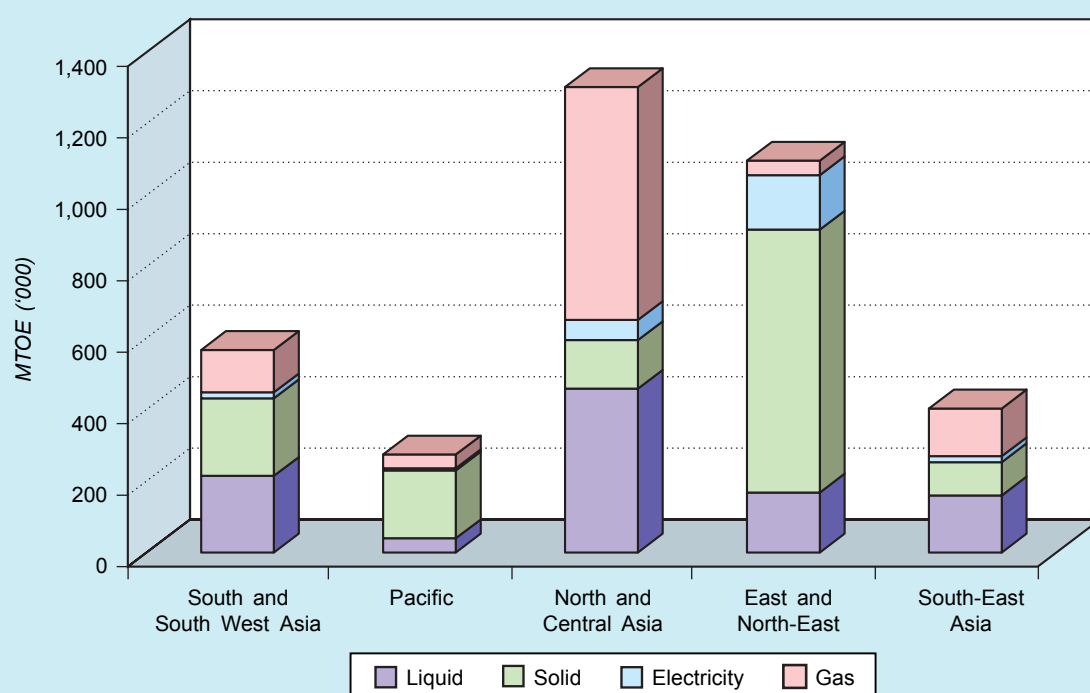
Note: (..) data is not available.

Figure V.2 Production and consumption of energy types in the ESCAP region, 2002



Source: Extrapolated from United Nations, *Common Database*, <http://unstats.un.org/unsd/cdb/cdb_help/cdb_quick_start.asp>, accessed September/October 2005.

Liquid fuels, such as oil, accounted for 31 per cent of total commercial energy consumption in the ESCAP region, but only 28 per cent of that was produced in the region, primarily the Islamic Republic of Iran and North and Central Asia. Electricity production and consumption in 2002 were both about 26 per cent of the global figure. Most electricity trading occurred between neighbouring countries. Transmission loss is one factor that has limited the expansion of the electricity grid to rural areas even within countries (table V.4).

Figure V.3 Energy production by subregion, 2002

Source: ESCAP staff estimates based on United Nations, *Common Database*, <http://unstats.un.org/unsd/cdb/cdb_help/cdb_quick_start.asp>, accessed September/October 2005.

Table V.4 Share of global energy production and consumption in ESCAP region

	Production (Percentage of world total)					Consumption (Percentage of world total)				
	Liquid	Solid	Electricity	Gas	Total	Liquid	Solid	Electricity	Gas	Total
South-East Asia	4.3	3.8	1.7	5.6	4.2	4.8	2.0	1.7	3.3	3.3
East and North-East Asia	4.5	30.4	16.0	1.7	11.5	15.0	35.1	16.0	5.6	18.0
North and Central Asia	12.3	5.6	5.9	27.3	13.7	4.0	4.9	5.8	18.6	8.4
Pacific	1.1	7.8	0.6	1.6	2.9	1.4	2.3	0.6	1.2	1.5
South and South-West Asia	5.7	9.0	1.8	5.0	6.0	6.2	10.0	1.8	5.8	6.7
ESCAP region	27.8	56.7	26.0	41.1	38.3	31.4	54.3	25.9	34.4	37.9
World	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

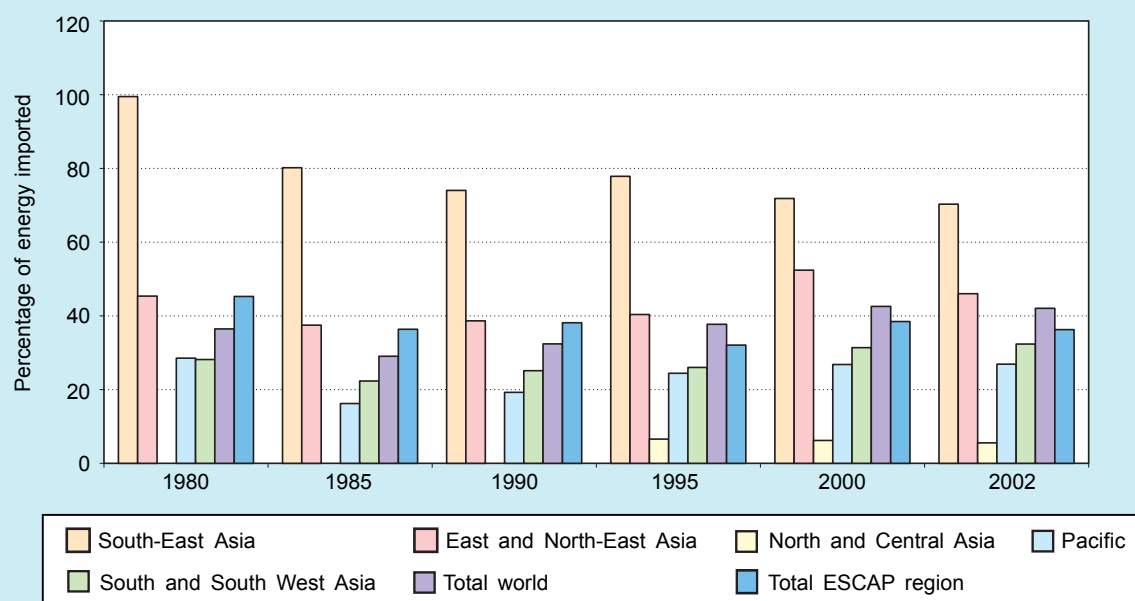
Source: ESCAP staff estimates based on data from United Nations, *Common Database*, <http://unstats.un.org/unsd/cdb/cdb_help/cdb_quick_start.asp>, accessed September/October 2005.

In 2002 the region depended on imported fuels for only 36 per cent of its needs... but some subregions, such as South-East Asia, imported 70 per cent of their energy

In 2002, the ESCAP region's overall commercial energy consumption equalled to 37.9 per cent of global energy consumption, while commercial energy production accounted for only 38.3 per cent of global production.

In 2002, the region depended on imported fuels for only 36 per cent of its energy needs lower than the global average of 42 per cent, but some subregions, such as South-East Asia, imported 70 per cent of their energy (figure V.4).

Import-dependent countries are vulnerable to rising oil prices that may result from natural disasters and political instability and adversely affect national

Figure V.4 Import dependency^a

Source: ESCAP staff estimates based on United Nations, *Common Database*, <http://unstats.un.org/unsd/cdb/cdb_help/cdb_quick_start.asp>, accessed September/October 2005.

Notes:

- ^a Import dependency is calculated from the total subregional imports divided by the total subregional consumption. Variations between countries within the subregion are not reflected, nor is the origin of the imported fuel.

economic development. Furthermore, population growth and development targets create pressure on indigenous energy resources, increase import dependency, threaten energy security and require huge investments in energy infrastructure. Diversifying energy options through intraregional cooperation and utilizing local and regional resources, including renewable resources, will be extremely important in determining future energy infrastructure requirements.

The difference in import dependency is one of many disparities between countries of the region. As a result of uneven distribution of energy reserves, some Asian and Pacific countries or subregions are net exporters, while others are net importers. At the end of 2004, half the world's global coal reserves were located in the Asian and Pacific region, but the largest reserves are limited to a few countries. The Russian Federation, for example, is estimated to have enough coal to last over 500 years on the basis of its current production capacity (table V.5). The Central and South Asian subregions have substantial reserves of natural gas and oil which will be important for future energy resource trade and will require substantial investment in infrastructure.

In contrast to its fossil fuel resources, the Asian and Pacific region is endowed with abundant renewable energy resources, such as wind energy, biomass, geothermal, hydropower, solar energy and others. However, huge renewable energy resources remain untapped despite the surge in energy demand over the past few decades.⁴ The Governments of Asian and Pacific

Diversifying energy options through intraregional cooperation and utilizing local and regional resources will be extremely important in determining future energy infrastructure requirements

⁴ ESCAP, *Energy Services for Sustainable Development in Rural Areas in Asia and the Pacific: Policy and Practice*, Energy Resources Development Series No. 40 (United Nations publication, Sales No. E.05.II.F.25).

Table V.5. Fossil fuel reserves at the end of 2004^a

	Natural gas			Oil			Coal		
	Amount (Trillions of cubic metres)	Share of world total (percentage)	R/P ratio	Amount (Billions of barrels)	Share of world total (percentage)	R/P ratio	Amount (Million tons)	Share of world total (percentage)	R/P ratio
Australia	2.46	1.4	69.9	4.0	0.3	20.4	78 500	8.6	215
Azerbaijan	1.37	0.8	*	7.0	0.6	60.2			
Bangladesh	0.44	0.2	33.0						
Brunei	0.34	0.2	28.3	1.1	0.1	13.6			
Darussalam									
China	2.23	1.2	54.7	17.1	1.4	13.4	114 500	12.6	59
Democratic People's Republic of Korea							600	0.1	21
India	0.92	0.5	31.3	5.6	0.5	18.6	92 445	10.2	229
Indonesia	2.56	1.4	34.9	4.7	0.4	11.5	4 968	0.5	38
Iran, (Islamic Republic of)	27.50	15.3	*	132.5	11.1	88.7			
Japan							359	<	268
Kazakhstan	3.00	1.7	*	39.6	3.3	83.6	31 279	3.4	360
Malaysia	2.46	1.4	45.7	4.3	0.4	12.9			
Myanmar	0.53	0.3	71.0						
New Zealand							571	0.1	115
Pakistan	0.80	0.4	34.4				3 050	0.3	**
Papua New Guinea	0.43	0.2	*						
Republic of Korea							80	<	25
Russian Federation	48.00	26.7	81.5	72.3	6.1	21.3	157 010	17.3	**
Thailand	0.43	0.2	21.1	0.5	<	6.3	1 354	0.1	67
Turkey							4 186	0.5	87
Turkmenistan	2.90	1.6	53.1	0.5	<	7.4			
Uzbekistan	1.86	1.0	33.3	0.6	<	10.6			
Viet Nam	0.24	0.1	56.5	3.0	0.2	19.0	150	<	6
Other Asia Pacific	0.38	0.2	38.4	0.9	0.1	13.2	312	<	34

Source: BP, *BP Statistical Review of World Energy 2005*, <www.bp.com/statisticalreview>, accessed December 2005.

Notes:

^a Reserves/production (R/P) ratio is the quantity of reserves remaining at the end of the year divided by the production in that year, the result being the length of time that those remaining reserves would last if production were to continue at that level.

* Over 100 years for gas and oil.

** Over 500 years for coal.

< Less than 0.05 per cent

countries are increasingly opting to build sustainable energy systems which take advantage of the locally available and environmentally benign renewable energy resources. Moreover renewable energy could play a vital role in reducing dependence on imported energy and widening access to energy services in rural and remote areas, harnessing the huge potential for meeting developmental goals of poverty alleviation, gender equity and access to services set by the Johannesburg Plan of Implementation (table V.6).⁵

⁵ *Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August-4 September 2002* (United Nations publication, Sales No. E.03.II.A.1 and corrigendum), chap. I, resolution 2, annex.

Table V.6. Rural electricity access rates for 2002 and renewable energy targets for selected countries

Country	Targets		
	Access to electricity of rural population (percentage)	Share of renewable energy (percentage)	Target year
Bangladesh	100	5 10	2010 2020
Cambodia	70	90	2030
China	100	10 per cent of electricity power capacity 5 per cent of primary energy 15 per cent of primary energy	2010 2010 2020
India	100	10 per cent of added electric power capacity	2003-2012
Lao People's Democratic Republic	70 90	100 100	2010 2020
Nepal	22 65 95	91 93 95	2007 2017 2027
Pakistan	100	10	2007 2015
Philippines	100	~40 100 per cent increase in renewable energy power capacity	2013
Thailand	100	8 per cent of total primary energy	2006 2011
Viet Nam	90 households electrified 100 households electrified	2 3	2010 2020

Source: ESCAP, *Energy Services for Development in Rural Areas in Asia and the Pacific: Policy and Practice*, Energy Resources Development Series No. 40 (United Nations publication, Sales No. E.05.II.F.25).

Energy use results in many environmental pressures locally, regionally and globally. Some of the local, regional and global effects of the region's energy use are as follows:

- Air pollution in the region is serious, particularly in urban areas. Emissions of sulphur dioxide and particulates are severe in China, India and several East Asian and South-East Asian countries. Similarly, the concentrations of suspended particulate matter and lead in most large Asian cities are rated from moderate to heavy;
- Soil acidification as a result of increasing sulphur dioxide emissions is becoming an issue in the region;
- The energy sector is one of the most significant sources of greenhouse gases. Heavy reliance on fossil fuels has caused the share of developing Asian countries in global emissions of carbon dioxide to increase from 19 per cent in 1990 to 25 per cent in 2001 and it is expected to reach 32 per cent in 2025.

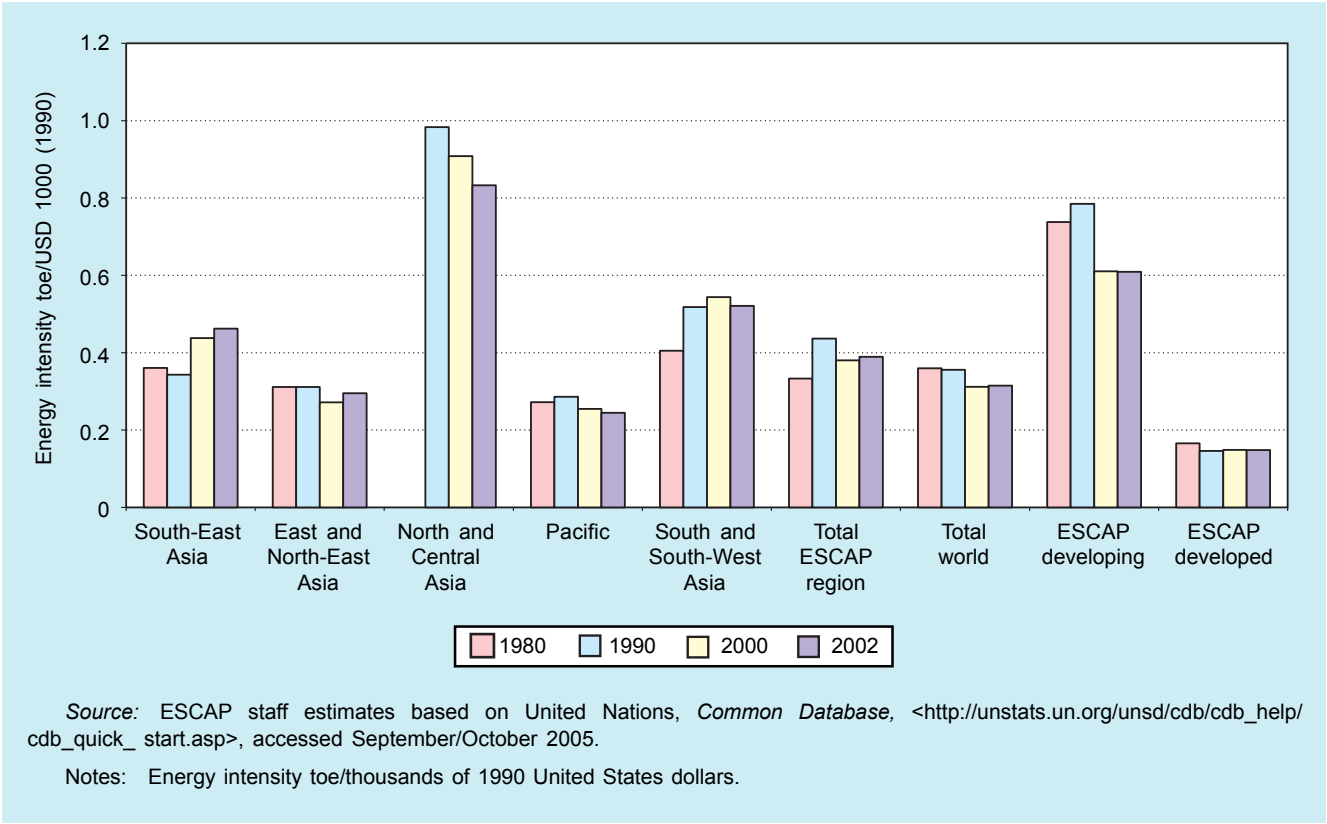
Energy use results in many environmental pressures locally, regionally and globally

- Indoor air pollution resulting from the utilization of biomass in cooking has caused health problems in rural areas. In India, for example, indoor air pollution claims 500,000 deaths annually, mainly women and children under five years of age.⁶

Effective demand management can reduce investment costs and environmental impacts substantially

Many Governments are now implementing aggressive energy conservation strategies to help curb the rising energy demand, recognizing that effective demand management can reduce investment costs and environmental impacts substantially. Analysis of energy intensity, which measures the amount of energy used to produce \$1,000 worth of economic output, shows that between 2000 and 2002, North, Central, South and South-West Asia along with the Pacific are the only subregions to have improved energy efficiency (see table V.5). In contrast, South-East Asia and East and North-East Asia are consuming more energy to produce the same amount of GDP.

Figure V.5 Energy intensity



These inefficiencies offer opportunities for substantial savings. Amid rising oil prices, it is especially prudent, for oil import-dependent countries to adopt eco-efficient practices and alternative energy sources to support more cost-effective and environmentally sustainable development.

Reducing or eliminating fuel subsidies so that the cost of energy is transferred to consumers is a key tool to encourage energy conservation.

⁶ ESCAP, *Energy Services for Sustainable Development in Rural Areas in Asia and the Pacific: Policy and Practice*, Energy Resources Development Series No. 40 (United Nations publication, Sales No. E.05.II.F.25).

Until recently, Indonesia and Malaysia heavily subsidized fuel but, prompted by rising oil prices, have adjusted their energy policies and fuel subsidies.⁷ However, the prices, subsidization and taxation of energy vary widely across the region. For example, Malaysia spent 12 per cent of its total State revenue on subsidizing fuel in 2004, setting the price of diesel at 18 cents per litre. By contrast, the Republic of Korea obtained 33 per cent of its State revenue from fuel taxes included in a diesel price of 95 cents per litre.⁸

1. ENERGY COOPERATION

Continued dynamic development in Asia and the Pacific will need access to energy supplies on a sustainable basis but, while some countries are endowed with abundant resources, including coal, oil, natural gas and hydro-energy, others are resource-deficient and dependent on imports. Such disparities, however, highlight the benefits of energy cooperation. Initiatives under discussion or already taken by the Association of Southeast Asian Nations (ASEAN), ASEAN+3, Asia Pacific Economic Cooperation (APEC) and the Asian Cooperation Dialogue illustrate a trend towards cooperation. Several bilateral and national initiatives also provide or seek alternative supply sources.

Since 2001, ESCAP has been facilitating the establishment of an intergovernmental collaborative mechanism for energy cooperation in North-East Asia, where Governments have agreed to work towards “improved energy security in North-East Asia through energy cooperation in a sustainable manner” by 2020.⁹ The plans aim to (a) increase the supply of energy in the North-East Asian subregion, lessening dependence on energy imports; (b) optimize efficiency in the supply and use of energy; and (c) minimize the environmental impact of energy production and consumption through an improved energy mix and greater energy efficiency. The collaborative mechanism on energy cooperation in North-East Asia was established in November 2005 and includes a Working Group on Energy Planning and Policy that aims to identify and share information and data. It also aims to carry out a study by the end of 2007 to identify the potential for energy trading and the challenges involved.

An ESCAP study prepared in 1987 identified a significant potential for transboundary power development and exchange in South and South-East Asia.¹⁰ ASEAN followed up by developing joint programmes and coordinating activities through the ASEAN Plan of Action for Energy Cooperation, 1999-2004¹¹ which is reviewed and revised every five years and oversees the ASEAN Power Grid and Trans-ASEAN Gas Pipeline.

Energy trading in Asia and the Pacific is limited, consisting mostly of trade in liquefied natural gas (LNG), with some small-scale gas trading through pipelines in South-East Asia and West and Central Asia. Natural gas

Since 2001, ESCAP has been facilitating the establishment of an intergovernmental collaborative mechanism for energy cooperation in North-East Asia

Natural gas pipelines that cross borders help to enhance energy security by sharing risks and rewards in their development and use

⁷ Gerhard P. Metschies, *International Fuel Prices 2005* (Kelkheim, Germany, Metschies Consult, 2005) (available online at www.international-fuel-prices.com or www.gtz.de/fuelprices, accessed December 2005).

⁸ Ibid.

⁹ Ulaanbaatar Statement of Senior Officials on Energy Cooperation in North-East Asia, adopted on 17 November 2005.

¹⁰ UNDP/ESCAP, *Trans-country Power Exchange and Development* (ST/ESCAP/474), May 1987.

¹¹ Adopted on 3 July 1999 at the Seventeenth Meeting of ASEAN Ministers of Energy, held in Bangkok (see www.aseansec.org).

pipelines that cross borders help to enhance energy security by sharing risks and rewards in their development and use, but opportunities also exist in most subregions for electric power generation, sharing or trade using natural gas or hydropower.

In the late 1990s, the Asia-Pacific Economic Cooperation (APEC) forum proposed an Asian gas grid through the Partnership for Equitable Growth (PEG), a non-profit organization working with the private sector. The aim of the gas grid is to link gas networks and underdeveloped gas resources in Indonesia, Malaysia, Thailand and possibly Viet Nam and feed gas to major demand centres, such as China. ESCAP is supporting the project to encourage public-private partnerships in the region and develop a link with the North-East Asia energy cooperation initiative.

In 2000, the Economic Cooperation Organization (ECO)¹² adopted the Plan of Action for Energy/Petroleum Cooperation in the ECO Region (2001-2005),¹³ which provides for trading power, boosting efficiency and conservation, and cooperating in the refining of petroleum. Several ECO member States have proven world-class oil and gas reserves and new developments in this field, especially related to offshore hydrocarbon deposits, are increasing the subregion's role in world oil and gas markets. The subregion also has considerable hydropower resources and other fossil fuels, but the distribution of these resources and the related production capacities is uneven among member States. While some are net energy importers, others import energy from the world market. However, all member States are very much concerned with modernizing their energy sector, improving efficiency and related environmental issues creating many opportunities for cooperation.

Addressing energy security in the Pacific would require having efficient oil transport and storage facilities as well as demand-side management and increasing the utilization of renewable energy

In the Pacific, the South Pacific Applied Geoscience Commission (SOPAC) has drawn up a regional energy policy¹⁴ in consultation with national policymakers. Although issues in the Pacific may be different from those in Asia, energy security is still a major concern, and addressing it would require having efficient oil transport and storage facilities as well as demand-side management and increasing the utilization of renewable energy.

Cooperation between developing countries and between developed and developing countries is gaining ground, helped by the significant progress some countries have made developing and adapting renewable energy technologies, such as mini- and micro-hydropower, biogas, bio-fuel, solar and wind energy technologies. Moreover, these countries are offering to share their experience with others. The private sector is also showing a greater interest in partnering with governments and local communities to develop and operate renewable energy power plants and bio-fuel, such as ethanol and bio-diesel. However, the Asian and Pacific region will need substantial investments, a common vision and regional and subregional energy cooperation to sustain its economic growth and meet the basic energy needs of its people.

¹² The members of ECO are Afghanistan, Azerbaijan, Islamic Republic of Iran, Kazakhstan, Kyrgyzstan, Pakistan, Tajikistan, Turkey, Turkmenistan and Uzbekistan.

¹³ Adopted at the First Ministerial Meeting on Energy/Petroleum, held in Islamabad on 8 November 2000 (see www.ecosecretariat.org).

¹⁴ For information about the Pacific Islands Energy Policy and Strategic Action Plan (PIEPSAP), see www.sopac.org.

C. FUTURE INFRASTRUCTURE DEVELOPMENT NEEDS

Forecasts of energy demand can vary depending on different development paradigms. The International Energy Agency (IEA) estimates that the Asian and Pacific region's energy demand will reach 7 billion toe by 2030, more than 42 per cent of the total world energy demand of 16.5 billion toe per year on the basis of current development approaches (table V.7). Other projections applying alternative development paradigms produce different conclusions discussed later.

The region's energy demand is estimated to reach 7 billion tons of oil equivalent (toe) by 2030, more than 42 per cent of the total world annual energy demand of 16.5 billion toe

Table V.7. Total primary energy supply projection, 2030

(Million tons of oil equivalent)

	Asia and the Pacific	World	World alternative projection ^a
Coal	2 333	3 601	2 744
Oil	2 100	5 766	4 995
Gas	1 294	4 130	3 701
Nuclear	343	764	868
Hydro	134	365	367
Biomass and waste	732	1 605	1 648
Other renewables	91	256	330
TOTAL	7 027	16 487	14 654

Source: International Energy Agency, *World Energy Outlook 2004* (Paris, IEA, 2004).

Notes:

^a The alternative projection incorporates the effect of environmental policies considered in OECD countries during 2002 but not implemented at the time.

Approximately one third of the energy demand in Asia and the Pacific is estimated to be met by coal, which will account for almost 65 per cent of global coal use by 2030. Almost half the energy demand in the Asian and Pacific region, or almost 3,400 Mtoe, is expected to be met in 2030 by oil and gas, the world's primary global energy sources, meeting 60 per cent of total annual energy demand.

Nuclear power is important for some countries in the region and its use is projected to grow from about 170 Mtoe in 2002 to over 340 Mtoe in 2030.¹⁵ Biomass is widely used in the region, particularly in areas without access to modern energy sources, and a slight increase in its use is forecast by 2030,¹⁶ but this will depend on how far Governments increase access to modern energy services. The use of hydropower and other modern renewable energy sources, such as wind, solar and geothermal energy, is increasing but is expected to supply only 3 per cent of the region's annual energy demand in 2030.

¹⁵ International Energy Agency, *World Energy Outlook 2004* (Paris, IEA, 2004).

¹⁶ Ibid.

Total global investment in energy infrastructure will reach approximately \$16.5 trillion between 2001 and 2030, of which the developing Asian and Pacific region will require over \$5.5 trillion

On these energy demand projections, the IEA estimates that total global investment in energy infrastructure will reach approximately \$16.5 trillion between 2001 and 2030, of which the Asian and Pacific region will require over \$6.5 trillion (table V.8). Developing Asian and Pacific countries (excluding the Republic of Korea) would require an estimated \$5.5 trillion during the next 30 years or \$185 billion annually until 2030 (see table V.9)

Although projected demand for coal is substantial, the level of investment required should be lower than for other fuels, consisting mainly of spending on mining and transportation. More than half of the investment in the oil and gas sectors will be for exploration and development, but oil, refining will also require substantial investment, estimated at around \$160 billion between 2001 and 2030, or more than \$5.3 billion per year, to meet strong regional demand for refined products and energy security.¹⁷

Table V.8. Energy investment projections, 2001-2030

(Billions of year 2000 United States dollars)

	Asia-Pacific ^a	World ^a	Universal electricity access (world)	Alternative world scenario ^b
Coal	197	398		
Electricity	4681	9 841		
Oil	766	3 096		
Gas	919	3 145		
Total	6 563	16 481	17 146	14 338^c
Average annual investment	218	549	572	478

Source: Organisation for Economic Co-operation and Development/International Energy Agency, *World Energy Investment Outlook 2003* (Paris, OECD/IEA, 2003), and *World Energy Outlook 2004* (Paris, OECD/IEA, 2004).

Notes:

- ^a Figures in this column are from the reference scenario, which is based on a consistent set of assumptions about macroeconomic conditions, population growth, energy prices, government policies and technology and only takes into account government policies that had been implemented by mid-2002.
- ^b Alternative world scenario projections incorporate the effect of environmental policies considered in OECD countries during 2002 but not implemented at the time.
- ^c Estimated on the basis of a 13 per cent decrease to supply-side investment.

The IEA also estimates global investment of around \$65 billion for oil pipelines in this period, with a large share of it required for North, North-East and Central Asia. A number of oil pipelines extending from the Russian Federation, Azerbaijan and Kazakhstan, to China, South Asia and other areas of the North and Central Asian subregion are already in various stages of planning or construction and are due to be completed by 2007.¹⁸ The expected cost of these projects alone is over \$14 billion, but more are being planned in view of the large reserves of fossil fuels in North and Central Asia and the Islamic Republic of Iran (table V.5). For example, another pipeline has been proposed from the Islamic Republic of Iran through Pakistan to India.

¹⁷ Organisation for Economic Co-operation and Development/International Energy Agency, *World Energy Investment Outlook 2003* (Paris, OECD/IEA, 2003) (available online at www.iea.org).

¹⁸ Ibid.

Table V.9. Energy investment projections for several Asian and Pacific countries and country groupings based on current trends, 2001-2030*(Billions of year 2000 United States dollars)*

	World	OECD Pacific ^a	Russian Federation and transition economies ^b	China	India	Other South and East Asia ^c	Asia-Pacific ^d	Developing countries of Asia-Pacific ^e
Coal	398	36	13	123	25		197 ^f	161
Electricity	9 841	809	377	1 913	665	917	4 681 ^g	3 872
Oil	3 096	44	440	119	32	131	766 ^h	722
Gas	3 145	111	440	98	44	226	919 ⁱ	808
Total	16 481	1 000	1 270	2 253	766	1 274	6 563	5 563

Source: Organization for Economic Co-operation and Development/International Energy Agency, *World Energy Investment Outlook* (Paris, OECD/IEA, 2003).

Notes:

^a *OECD Pacific* comprises Australia, Japan, New Zealand and the Republic of Korea.

^b *Russian Federation and transition economies* comprises Azerbaijan, Kazakhstan, the Russian Federation, Turkmenistan and Uzbekistan.

^c *Other South and East Asia* comprises Afghanistan, Bangladesh, Bhutan, Brunei Darussalam, the Democratic People's Republic of Korea, Fiji, French Polynesia, Indonesia, Kiribati, Malaysia, Maldives, Myanmar, Nepal, New Caledonia, Pakistan, Papua New Guinea, Philippines, Samoa, Singapore, Solomon Islands, Sri Lanka, Thailand, Vanuatu, Viet Nam and Taiwan Province of China.

^d *Asia-Pacific* is the sum of OECD Pacific, Russian Federation and transition economies, China, India and other South and East Asia but excludes the Islamic Republic of Iran and certain central Asian economies in transition as detailed in notes f through i.

^e Excluding the Republic of Korea.

^f *Coal* includes the Russian Federation but excludes Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Turkmenistan, Uzbekistan and Tajikistan.

^g *Electricity* includes the Russian Federation but excludes Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Turkmenistan, Uzbekistan and Tajikistan.

^h *Oil* includes Azerbaijan, Kazakhstan, the Russian Federation, Turkmenistan and Uzbekistan but excludes Armenia, Georgia, Kyrgyzstan and Tajikistan.

ⁱ *Gas* includes Azerbaijan, Kazakhstan, the Russian Federation, Turkmenistan and Uzbekistan but excludes Armenia, Georgia, Kyrgyzstan and Tajikistan.

The gas sector similarly will require investment mainly in exploration and development, but in the Asian and Pacific region transmission and distribution will require almost \$360 billion.

Many Asian and Pacific countries will need to channel a large portion of their investment into expanding electricity generating capacity, transmission and distribution networks. The Northern and Central Asian subregions, particularly China and the Russian Federation, are likely to account for the bulk of infrastructure development, with over 50 per cent, or \$3.5 trillion, required from 2001 to 2030. China alone is estimated to need some 800 gigawatts of capacity by 2030, simply to maintain its current growth rate. Much of this energy will come not only from coal and hydropower but also from natural gas and nuclear power, the use of which is expanding. The Government of China announced that it would expand the use of renewable energy sources to 15 per cent by 2020.¹⁹ India is estimated to require over

Many Asian and Pacific countries will need to channel a large portion of their investment into expanding electricity generating capacity and transmission and distribution networks

¹⁹ ESCAP, *Meeting the Challenges in an Era of Globalization by Strengthening Regional Development Cooperation* (United Nations publication, Sales No. E.04.II.F.24, 2004).

\$760 million, or almost 12 per cent of total infrastructure investment in the Asian and Pacific region, mostly for the electricity sector. Other South and South-East Asian countries will account for about 20 per cent of Asian and Pacific investments, or \$1.27 trillion, again primarily for electricity.

Projected investments are based on current development trends and, as such, would still leave 1.4 billion people worldwide without access to electricity in 2030

However, the projected investments are based on current development trends and, as such, would still leave 1.4 billion people worldwide without access to electricity in 2030. The cost of providing universal access would require approximately \$665 billion, nearly 80 per cent of it for Africa and South Asia. South-East Asia also requires substantial investment as less than 10 per cent of the population of some countries in this subregion have access to electricity.

Some countries have set ambitious targets for expanding energy access in rural areas using renewable energy. In some instances, this is more cost-effective than extending the electricity grid. The traditional approach to electrifying rural areas has been to extend the electricity grid system or to have local grids connected to diesel power plants, but these options often prove to be inefficient and expensive. Fortunately, as the technology of some new renewable energy sources matures, its cost comes down, and energy distribution using locally available resources are rapidly becoming a good alternative option for rural energy supplies.

Alternative development paradigms could be more economical, socially beneficial and environmentally sustainable

Alternative estimates by IEA take account of environmental policies under discussion but not yet implemented in OECD countries in 2002. The policies included curbs on carbon dioxide emissions, increased use of renewable energy, increased energy efficiency and reduction of local air pollution and energy import dependence. Total global investments in the energy sector between 2001 and 2030 in this scenario are estimated to cost over \$2 trillion (or 13 per cent) less than investments under the traditional development scenario, due primarily to savings in the electricity sector. This would equate to annual savings of about \$71 billion between 2001 and 2030. Higher capital investment costs required for renewable energy infrastructure would be offset by reduced energy demand and savings in transmission and distribution network costs. The IEA estimates that much of the savings would be transferred to consumers.²⁰ Other projections based on different development paradigms project even greater savings. Alternative development paradigms could be more economical, socially beneficial and environmentally sustainable.

Substantial savings can be made by following an ecologically driven development approach

The UNDP 2000 *World Energy Assessment*²¹ projects that the total required investment in energy in 1990-2020 will be \$15.7 trillion under a high-growth scenario that assumes abundant fossil fuel resources, \$12.4 trillion under a medium-growth scenario based on current practice or \$9.4 trillion under a more ecologically focused growth strategy that incorporates more energy efficiency and renewable energy policies (table V.10). The ecologically driven strategy equates to spending around \$100 billion per year in 1990 dollars less than the medium-growth approach and over \$200 billion per year less than the high-growth approach. Primary energy consumption is substantially lower in the ecologically driven scenario, while gross world product is comparable to the middle growth rate.

²⁰ International Energy Agency, *World Energy Outlook 2004* (Paris, IEA, 2004).

²¹ UNDP, United Nations Department of Economic and Social Affairs and World Energy Council, *World Energy Assessment: Energy and the Challenge of Sustainability* (United Nations publication, Sales No. 00.III.B.5) (available online at www.undp.org/energyandenvironment).

Table V.10. Projections of energy demand and various indicators based on different development scenarios

Indicator	Year	High growth	Middle growth	Ecologically driven
Global energy investment (trillion 1990 dollars)	1990-2020	15.7	12.4	9.4
	2020-2050	24.7	22.3	14.1
Primary energy consumption (exajoules)	1990	379	379	379
	2050	1 041	837	601
	2100	1 859	1 464	880
Primary energy intensity (megajoules per 1990 dollar of gross world product)	1990	19	19	19
	2050	10.4	11.2	8
	2100	6.1	7.3	4
Gross world product (trillion 1990 dollars)	1990	20	20	20
	2050	100	75	75
	2100	300	200	220
Net carbon dioxide emissions (gigatons of carbon)	1990	6	6	6
	2050	9 - 15	10	5
	2100	6 - 20	11	2
Carbon intensity (grams of carbon per 1990 dollar of gross world product)	1990	280	280	280
	2050	90 - 140	130	70
	2100	20 - 60	60	10
Sulphur dioxide emissions (millions of tons of sulphur)	1990	58.6	58.6	58.6
	2050	44.8 - 64.2	54.9	22.1
	2100	9.3 - 55.4	58.3	7.1

Source: UNDP, United Nations Department of Economic and Social Affairs and World Energy Council, *World Energy Assessment: Energy and the Challenge of Sustainability* (United Nations publication, Sales No. 00.III.B.5) (available online at www.undp.org/energyandenvironment).

Despite the differences between these scenarios, it is clear that energy demand and the cost of supplying it will be substantial in coming decades. The challenges faced in meeting demand will include securing finance and ensuring legal and institutional structures are conducive to energy development and good governance characterized by a stable, enforceable and transparent legal and regulatory framework. Governments will have an important role to play in creating and maintaining an enabling environment for investment.

Traditional financing approaches, such as using domestic savings or official development assistance (ODA), will clearly be insufficient to meet the energy sector's investment needs. Some developing countries in the region have relatively good domestic savings, but mobilizing these resources for infrastructure development will be a considerable challenge. The Russian Federation would need to invest 5.4 per cent of its GDP in energy infrastructure but had a reasonably high domestic savings rate of 37 per cent. India, alternatively, needs to invest 2.2 per cent of its GDP in energy infrastructure but had a domestic savings rate of about 20 per cent.²² Much of the investment will have to come from other financing mechanisms.

Traditional financial approaches will clearly be insufficient to meet the energy sector's investment needs

²² The Partnership for Equitable Growth (www.apecpeg.org, accessed January 2006).

Clear energy policies, good governance and a strong regulatory and institutional structure are among the basic needs to attract investment for infrastructure development

ODA has contributed an average of \$5.4 billion per year to the energy sector in developing countries worldwide,²³ much of it allocated to Asia,²⁴ but will obviously be grossly insufficient when set against the \$185 billion required each year until 2030 by the developing countries of the region.

A key issue therefore will be how to mobilize investment for energy infrastructure from the private sector, foreign direct investment, cooperation between countries and alternative approaches to infrastructure development and planning. Clear energy policies, good governance and a strong regulatory and institutional structure are among the basic needs to attract investment for infrastructure development.

Regional cooperation can be particularly beneficial in providing assistance for Governments to develop their energy infrastructure, to strengthen energy security by diversifying energy options, to build effective energy policies and institutions and to reduce costs. Such cooperation, however, requires the expertise and resources of international organizations and financial institutions to identify and implement mutually beneficial activities.

A different kind of regional cooperation is taking place around renewable energy technology and it involves the sharing of knowledge, best practices and research and development. National targets are increasingly becoming an important element of renewable energy strategies in Asia and the Pacific. However, renewable energy development is hampered by the lack of legal frameworks for independent power producers, restrictions on sites and construction, unfavourable transmission access, unclear utility interconnection requirements and excessive liability insurance requirements. It is also constrained by lack of access to credit, uncertainty over the performance and risk of such technologies and lack of technical and commercial skills and information.

D. THE WAY FORWARD

To ensure continued dynamic economic growth of the Asian and Pacific region, reliable and affordable supplies of energy is critical. As discussed earlier in the chapter, the region is a net importer of commercial energy, the dependency on which is expected to be of the order of up to 97 even to the year 2030. With the rising price of oil and other energy products, the region is facing ever increasing threats to energy security and reaching out to other parts of the world to meet its growing energy need.

Fossil fuels will remain the region's major energy source for the foreseeable future, thus ensuring that environmental pressure on the sector will continue to increase. Close policy attention will be required in order to ensure eco-efficiency and environmental sustainability. This calls for diversifying fuel options to move away from heavy dependence on high carbon energy sources, such as coal, to cleaner natural gas and accelerated efforts to increase the share of renewable energy. It also requires demand side management to improve energy efficiency among consumers.

Despite the increasing role of the private sector...the responsibility for developing energy infrastructure lies primarily with Governments

²³ Julio Lumberras, "Official development assistance for energy activities: a perspective from the NGOs", a presentation made at the Conference on Investment for Sustainability, organized by the Sustainable Energy Society of Southern Africa (SESSA), Madrid, 19-20 May 2005.

²⁴ Intergovernmental Panel on Climate Change, *Methodological and Technological Issues in Technology Transfer* (Geneva, Intergovernmental Panel on Climate Change, 2000) (www.grida.no/climate/ipcc/tectran/, accessed December 2005).

1. ENERGY COOPERATION AND THE ROLE OF ESCAP

On the other hand, the region is endowed with significant amount of both commercial and renewable energy resources. This situation provides an excellent opportunity for transboundary energy cooperation for optimum utilization of these as yet untapped resources by developing, sharing and trading them for the mutual benefit of the countries concerned. Indications to that direction are very positive as evidenced by initiatives taken by or being promoted in some of the subregions of the Asian and Pacific region. Moreover, with the open economic policy, the private sector is also showing increasing interest in partnerships with Governments.

With increased sharing of research and development, knowledge and best practices, North-South and South-South cooperation on renewable energy technology is gaining ground within the region. Moreover, the private sector is showing a greater interest in partnership with governments and local communities in developing and operating renewable-energy-based power plants and biofuel, such as ethanol and biodiesel.

It may be too ambitious to forecast a specific structure for the regional electricity market but all options should remain open in order to facilitate progress towards a more active and mutually beneficial mechanism for energy cooperation. Many hurdles need to be cleared but this is not impossible if countries work together. In recent years, ESCAP has facilitated cooperation in North-East Asia, which led to the establishment of a Working Group on Energy Planning and Policy under an Intergovernmental Collaborative Mechanism.

As natural gas has a lesser environmental impact than other fossil fuels, such as coal, it is a preferred option for helping to reduce greenhouse gas emissions. Natural gas pipelines offer benefits in terms of sharing risks, increasing security and improving transport efficiency. ESCAP is supporting public-private partnerships, such as the APEC-PEG project to build an Asian gas grid, and aims to develop a link with the North-East Asia energy cooperation initiative.

Opportunities also exist for electric power generation, using natural gas or hydropower and sharing or trading electricity in most subregions. Producing electricity locally and sharing or trading electricity, rather than exporting natural resources directly, go hand in hand with the key poverty alleviation strategy of increasing employment in the energy sector of the exporting countries.

In the light of the above, there is a need for an impetus towards a greater initiative for an integrated **trans-Asian energy system**. As noted earlier, some subregions and/or their members have already taken steps towards or are already talking about natural gas pipelines and electric power system networks. The regional initiative can support and build on these initiatives and promote linkages and synergies towards greater energy system integration – for example through the **Asian Gas Grid and Asian Power System Network**. Opportunities and also abundant for cooperation in alternative energy, including renewable energy, development. It may not happen overnight, but certainly such a system can bring together greater coordination and sustainable energy security eventually. To have an in-depth analysis of the feasibility of such an initiative, **a regional energy strategy study group** comprising selected national, regional and subregional institutions/organizations, ESCAP and interested financing institutions, may be formed to explore

There is a need for an impetus towards a greater initiative for an integrated trans-Asian energy system

the potential for energy cooperation and propose a mechanism for such collaboration. The terms of reference of group could initially include carrying out a series of studies including, assessment of energy supply options, energy market survey, energy trade potential and possibilities for public-private strategic partnership, followed by policy dialogues for identifying next steps, including the framework for a cooperation or collaborative mechanism.

2. CHALLENGES

Securing the political and financial commitment of participating countries will be one of the main challenges to realizing the potential for subregional energy cooperation.

Securing the political and financial commitment of participating countries will be one of the main challenges to realizing the potential for subregional energy cooperation. A common vision and strategic plan will be extremely important in achieving this, and extensive multilateral and bilateral negotiations will be necessary in order to clearly identify and share the responsibilities, risks and rewards among stakeholders. Countries will need a clear understanding of the type and degree of cooperation, keeping in mind that such cooperation will only complement national projects.

Raising the substantial investment required for the region's energy sector will require the expertise, resources and cooperation of international organizations and financial institutions.

In recent years, a number of initiatives have been launched or discussed to promote energy cooperation through multilateral dialogue and to secure alternative sources of energy or markets, but there is still considerable scope to exploit synergies and linkages among these initiatives. ECO is interested in developing contacts and cooperation in energy with other subregional organizations in the ESCAP region. At the tenth Consultative Meeting of the Executive Heads of Subregional Organizations and ESCAP, held in September 2005, ESCAP and ECO were designated as the promoters of further subregional energy cooperation.

A major challenge for Asia and the Pacific lies in developing a rural energy infrastructure to serve those who live in rural areas, who constitute the vast majority of the population, many without access to electricity. As the technology of some new renewable energy sources matures and its cost comes down, energy systems based on locally available resources are rapidly becoming a good alternative for rural energy supplies.

3. POSSIBLE ROLE OF ESCAP

As a neutral body, ESCAP has a comparative advantage in catalysing and supporting regional and subregional energy cooperation. Initially, this could be through consultative mechanisms to explore options for improving energy security. Coordinated planning could supplement bilateral cooperation and strengthen infrastructure development within national boundaries as well as between neighbouring countries. It could also lead to synergies and collaboration with other multilateral cooperation initiatives (box V.1).

ESCAP may provide forums for the sharing of intra- and interregional experiences and practices with emphasis on practical applications. This may include facilitating policy dialogues between Governments and other partners, including the business community and international development agencies.

ESCAP may support and play a catalytic role in carrying out studies towards an integrated trans-Asian energy system to enhance energy security for the region.

Box V.1 Towards an integrated trans-Asian energy system

Background

In order to ensure continued economic and social growth in the Asian and Pacific region, reliable and affordable supplies of energy are critical. As mentioned in chapter V, the region is a net importer of commercial energy. The region's dependency on fossil fuels and biomass is expected to continue, comprising up to 97 per cent of the total supply in the year 2030. With the rising price of oil and other energy products and over one billion people without access to electricity, the region is facing ever increasing threats to energy security and reaching out to other parts of the world to meet its growing energy need.

Fortunately, the region is endowed with significant commercial and renewable energy resources. This situation provides an excellent opportunity for transboundary energy cooperation aimed at optimum utilization of these as yet untapped resources by developing, sharing and trading them for the mutual benefit of the countries concerned. Indications are very positive as evidenced by initiatives taken by or being promoted in some subregions.

A major policy change that has been observed in the energy sector, particularly in electricity, is in the investment and ownership pattern: private sector participation is increasingly seen as a source of funding in developing countries. With the rapid social, political and economic changes in the region, many Governments are now increasingly opening up their State-owned economic sectors to private sector participation. The globalization process offers a good opportunity for enhancing cross-border energy trade so that all stakeholders can benefit.

The development of interconnected energy systems, including oil, gas and electric power systems, is a worldwide phenomenon. It started long ago in North America and Western and Eastern Europe and has now spread to all the other continents. In the ESCAP region, there are some small, limited interconnected systems operating between a few neighbouring countries on a bilateral basis, but only recently have some subregions begun studying integrated networks.

In the light of the above, there is a need for a policy impetus aimed at a greater **initiative for an integrated trans-Asian energy system**, for example through the **Asian Gas Grid and Asian Electric Power System Network**. A regional approach can support and build on ongoing and planned initiatives and promote linkages and synergies towards greater energy system integration across the region. Opportunities are also abundant for cooperation in alternative energy, including renewable energy development and decentralized energy systems. Member countries are already beginning to recognize the benefits of cooperation in technology transfer and capacity-building that accrue to energy security.

Objective

The objective of the trans-Asian energy system would be to promote enhanced energy security through greater coordination and integration of the regional energy system in support of sustainable development.

Modality

To have an in-depth analysis of the feasibility of such an initiative, a regional **energy strategy study group** comprising selected national, regional and subregional institutions/organizations, ESCAP, interested financing institutions and organizations may be formed to explore the potential for energy cooperation and propose a mechanism for such collaboration.

The **terms of reference of the group** could initially include carrying out a series of studies, including an assessment of the energy supply options, an energy market survey, the energy trade potential and possibilities of public-private strategic partnerships. This could be followed by policy dialogues to identify the next steps, such as the formation of a framework for cooperation or a collaborative mechanism. To obtain the greatest benefit from such a system, the involvement of a variety of stakeholders will be necessary. ESCAP has experience in facilitating a dialogue among countries and organizations to develop common strategies to promote energy cooperation. For example, ESCAP has been involved in facilitating the development of a collaborative mechanism in North-East Asia.

Expected impact or outcome

An integrated **trans-Asian energy system** will enable much greater coordination of energy development projects to help countries develop economically and socially for poverty alleviation. Such coordination could also be beneficial in dealing with environmental issues, such as climate change and transboundary pollution, and recognizing the opportunities of sustainable development.

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Challenges

One initial but critical challenge will be to secure political and financial commitment, followed by extensive multi- and bilateral negotiations so that responsibilities are clearly identified and shared by stakeholders. ESCAP, as an independent and neutral body, could play a catalytic role in facilitating the process, including facilitating policy dialogues and negotiations. ESCAP could also serve as a catalyst for developing linkage and synergies among the ongoing and planned subregional initiatives.

It may not happen overnight, but certainly such a system can eventually bring together greater coordination and sustainable energy security. For example, in the power sector, as confidence is built among the stakeholders, cooperation can take place in forms ranging from only the exchange of experience to the complete integration of two or more utilities. Cooperation modalities may include: power cooperation with common or unilateral sharing of spare capacity; power exchange with short-term and long-term energy exchange; and power exchange with common construction of power stations.

ESCAP can also promote various mechanisms for investment in energy infrastructure, such as public-private partnerships, along with information on ways for Governments to provide an environment conducive to investment.

ESCAP supports the proposed APEC-PEG initiative on the Asian Gas Grid and, if requested, could also provide technical support and guidance to intergovernmental subregional institutes and/or their members.

Every opportunity should be considered to enhance development and utilization of renewable energy resources

ESCAP, relevant United Nations and other international organizations can also support the trend towards greater cooperation on renewable energy. Given the rising price of oil and the inevitable depletion of fossil fuels, every opportunity should be considered to enhance the development and utilization of renewable energy resources and to increase their share in the region's energy supply.

VI. WATER INFRASTRUCTURE

A. INTRODUCTION

Water infrastructure can be defined as a stock of facilities and installations needed to develop and manage water resources, including delivery, treatment, supply and distribution of water to its users as well as for the collection, removal, treatment and disposal of sewage and wastewater.

Water has always played a central role in human societies, but in order to sustain that role, it needs to be harnessed and managed to increase its productive impact and to reduce the risk of destruction, while protecting aquatic ecosystems which is crucial for the environment. This could be achieved by developing adequate hydraulic infrastructure concomitantly with legal and institutional frameworks for water management.

The General Assembly, recognizing the urgency of addressing water issues, proclaimed the period 2005-2015 the International Decade for Action, “Water for Life”, to emphasize the importance of water for sustainable development and the eradication of poverty and hunger, and its indispensability for human health and well-being.¹

The objective of this chapter is to analyse the current status of water infrastructure development and future infrastructure needs and to identify ways to enhance regional cooperation in managing water resources. Section B provides a brief account of the current status of water resources development. Section C analyses water infrastructure development. Future infrastructure development needs are analysed in section D. Section E concludes and proposes the way forward.

*The General Assembly
proclaimed the period
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significance of water
for sustainable
development and
poverty eradication*

B. CURRENT STATUS OF WATER RESOURCES DEVELOPMENT

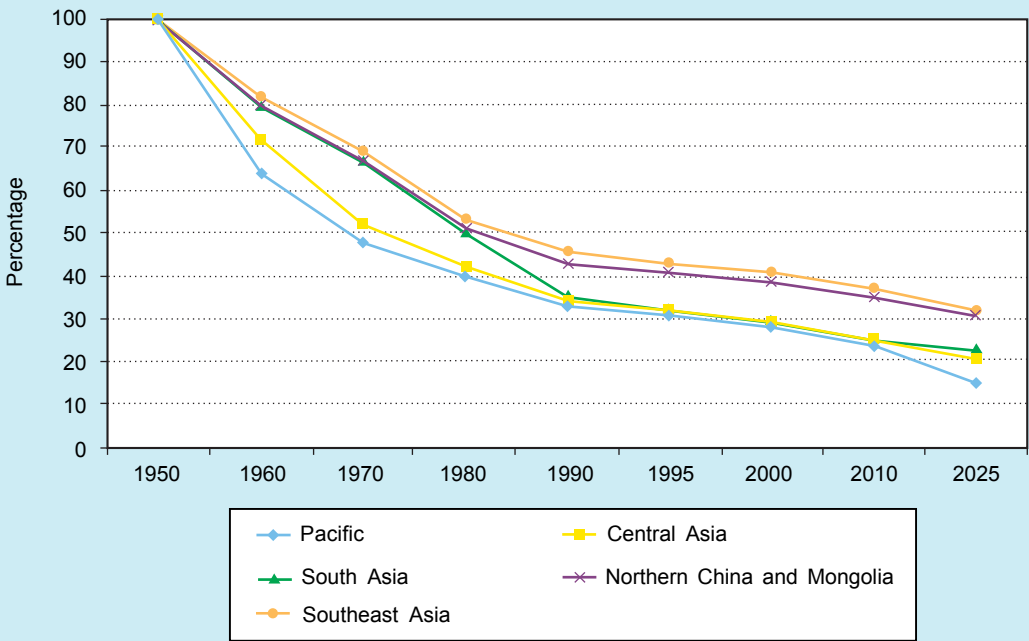
The physical geography of the Asian and Pacific region varies from arid deserts to some of the most humid areas in the world, with correspondingly uneven distribution of precipitation and water resources. Moreover, a large part of the region has a monsoon climate in which the rainy season may bring severe floods that cause tremendous damage in many river basins. A prolonged dry season, however, may cause temporary water shortages in the same river basins.

¹ See General Assembly resolution 58/217 of 23 December 2003.

The most meaningful measure of freshwater resources is the total annual flow of rivers and the recharge to aquifers, which constitute the annual volume of renewable water resources. The Asian and Pacific region, not including the Asian part of the Russian Federation, accounts for around 13,000 cubic kilometres, or some 23 per cent, of the global run-off, estimated at 43,000 cubic kilometres.

Overall, the average per capita availability of water in the region, with a population of 3.9 billion, is about 3,330 cubic metres per year, which is almost two times less than the world's average. Population growth between 1950 and 1995 caused the per capita availability of water to drop almost 70 per cent in South and Central Asia, 60 per cent in northern China and Mongolia, and about 50 per cent in South-East Asia. In 2025, per capita water availability is expected to be 10 to 15 per cent lower than current levels.²

Figure VI.1. Changes in water resources per capita in Asia and the Pacific (1950-2025)



Source: I.A. Shiklomanov, "Assessment of water resource and water availability in the world", Report prepared for the Comprehensive Assessment of Freshwater Resources of the World, Stockholm, Stockholm Environment Institute, 1997.

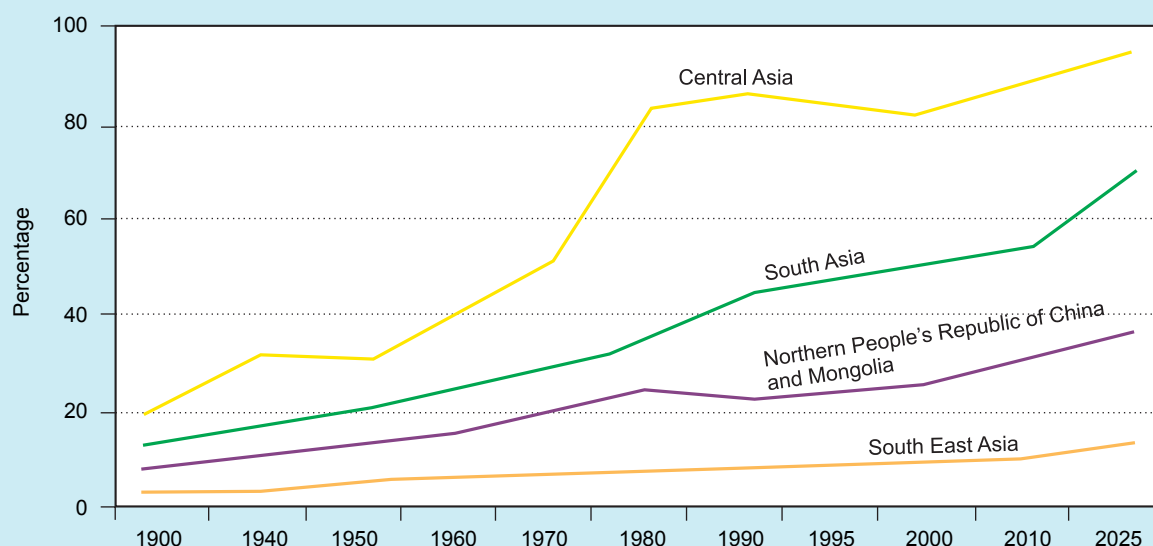
Rising demand necessitates better efficiency in the use of available supplies

At the same time, water use in Asia and the Pacific has increased rapidly due to rising demand from domestic, industrial and agriculture sectors (see figure VI.2). The rate of increase in water withdrawals could exceed the population growth rate 2 to 3 times. The total amount of annual water withdrawal in the region is very roughly estimated at 2,000 cubic kilometres, or 510 cubic metres per capita per year, accounting for about 15 per cent of the regional renewable water resources. Water withdrawals are highest in Central Asia (85 per cent), followed by South Asia (48 per cent), and

² Asian Development Bank, *Water for All: The Water Policy of the Asian Development Bank* (Manila, ADB, 2001), p. 4.

Mongolia and northern China (25 per cent). These regions suffer from serious water scarcity and have experienced serious difficulty expanding economic sectors that use large amounts of water, such as irrigated agriculture. Nevertheless, the demand for water is projected to grow throughout Asia and the Pacific, necessitating more efficiency in the use of available supplies.

Figure VI.2. Water withdrawals as a share of available resources (1900-2025)



Source: I.A. Shiklomanov, "Assessment of water resource and water availability in the world", Report prepared for the Comprehensive Assessment of Freshwater Resources of the World, Stockholm, Stockholm Environment Institute, 1997.

In many parts of the region, the aquatic environment has deteriorated due to over-exploitation of water resources and their contamination by discharges of domestic, municipal, agricultural and industrial wastes, often without proper treatment and often exceeding the capacity of water bodies to accommodate them. As a result, many rivers and aquifers have lost their potential as sources of water of adequate quality for downstream uses. Water resources in many parts of the region are also threatened by loss and degradation of catchments, deforestation and large-scale reclamation of wetlands.

Unsustainable exploitation of water resources characterized by diminishing water availability per person, increasing water abstraction from surface and groundwater sources and depletion of the aquatic environment is causing a growing scarcity of water throughout the ESCAP region. It already hampers socio-economic development in large areas of some countries which lack enough water for all domestic, industrial, agricultural and other purposes.

Unsustainable exploitation of water resources already hampers the socio-economic development of some ESCAP member countries

1. THE ROLE OF WATER INFRASTRUCTURE

Adequate water infrastructure (mostly dams and reservoirs) is required to ensure the sustainability of water resources and overcome scarcity problems. Physical infrastructure is also required to provide water-related services, primarily water supply and sanitation, for the population, agriculture and

industry, as well as for treatment and disposal of wastewater. Hydraulic infrastructure provides other benefits, such as hydroelectric power and navigation. In addition, water infrastructure is intended to supplement the natural ability of aquatic ecosystems to cope with drought and floods as well as to accommodate a certain pollution load.

Water infrastructure, needed as a platform for economic growth, is mature in the region's developed countries, but remains grossly underdeveloped in many developing countries

Such water infrastructure is widely considered as a platform for economic growth but is unevenly developed throughout Asia and the Pacific: it is mature in developed countries and grossly underdeveloped in many developing countries. There is a great need, therefore, to prompt and support accelerated water infrastructure development in many parts of the region. Countries also need to recognize that, while it is urgent and important to meet the Millennium Development Goals for drinking water supply and sanitation, this should not detract from the needs of the broader water infrastructure sector, including flood control, industrial and commercial water supply, hydropower, wastewater treatment and irrigation.

C. CURRENT STATUS OF WATER INFRASTRUCTURE DEVELOPMENT

Each country needs adequate water infrastructure to regulate the flow of its rivers and to create water storage in order to meet the need for water of suitable quality on a sustainable basis

Each country needs adequate infrastructure to regulate the flow of its rivers and to create water storage to meet reasonable requirements for water of suitable quality from its population and economy on a sustainable basis. This physical infrastructure is also needed for inter-basin transfers to move water from regions of excess to regions of scarcity. Man-made reservoirs play a particularly important role where natural precipitation is erratic or seasonal because during wet periods they store flood water, which would otherwise be lost, and make it available during prolonged dry periods. Countries with dry climates or intensive rainfall seasons therefore need such infrastructure more than countries with moderate climates.

Developed countries invested heavily in water infrastructure during the twentieth century to provide their increasing populations with drinking water supply, food through irrigation, energy through hydropower and transport through navigation, and to protect them from floods. In all developed countries, including those in Asia and the Pacific, the flows of major rivers are regulated and managed, reducing peak flows, increasing low flows and protecting water quality, thus reducing the risk of water-related disasters and increasing the reliability of water services. In those countries, in general, water infrastructure is mature and the human capacity required to operate and maintain hydraulic facilities is available. Institutional aspects of water management are typically embedded in the political and administrative structure of governments and have often evolved over considerable time. In developed countries, much greater emphasis is placed on water management in order to maximize returns on investment in the water sector and to respond to shifting priorities, and high values are now placed on environmental and aesthetic assets.

Developing countries which are industrializing have made significant investments in water infrastructure and many are successfully addressing catastrophic water risks, but they have not yet achieved the infrastructure and institutional capacity to manage their water resources to optimize sustainable growth and provide universal and reliable water services.

In the least developed economies, inadequate hydraulic infrastructure and water management institutions hampers development. Poor water supply

and sanitation adversely affect the health of the population, food production is unpredictable because lack of irrigation infrastructure leaves it vulnerable to unchecked drought and floods, and electricity supplies are unreliable. The investment climate is also poor in hydraulic infrastructure as water management policies and institutions are not yet sufficiently evolved. In general, the poorest countries have the lowest infrastructure stock and the weakest institutions.

1. INFRASTRUCTURE FOR DEVELOPING WATER RESOURCES (DAMS AND RESERVOIRS)

Dams and reservoirs provide storage for water, including flood water, which can then be supplied for households and irrigation, as well as for generation of power, thus reducing fossil fuel depletion and the negative environmental effects of fossil fuel burning. They often emerge as the priority in strategic planning with respect to water and energy. However, as with other infrastructure projects, there are also adverse environmental and social impacts that must be minimized or mitigated.

The world has around 55,000 large dams, most of them registered by the International Commission on Large Dams (ICOLD).³ About half of them are used solely for supplying water for irrigation purposes and roughly one third of them are multi-purpose. No reliable data exist on the total number of “small” dams, i.e. those not meeting the ICOLD criteria. A very indicative figure is 800,000, almost all of them used for irrigation and water supply.

In the Asian and Pacific region, most dams and reservoirs have been built since 1950. Construction peaked in the 1970s, when hundreds of large dams were put into service each year. At that time, Japan, a flood-prone country with 40 per cent of its population and 60 per cent of economic assets located in vulnerable river plains, invested some 2 trillion yen in hydraulic infrastructure, mostly dams and embankments. With these facilities, annual flood losses that before the 1950s could reach 20 per cent of GDP were reduced to less than 1 per cent of GDP. Even with its large stock of about 2,800 large dams and reservoirs, Japan still spends about \$9 billion of public funds annually on expanding and maintaining hydraulic infrastructure, and another hundred large dams are under construction (see table VI.1).

Asia and the Pacific, led by China and India, has a total of about 36,000 large dams, accounting for about two thirds of the global stock, although the data (table VI.1) are incomplete. The scale of construction of new large dams in the region is still impressive.

A major indicator of water resources development is the ratio between the available storage reservoir capacity and the volume of the annual renewable water resources. The ratio in the Asian and Pacific region (table VI.2) is 0.10, less than the global average of 0.14 and far behind North America (0.33) and Europe (0.16).

However, Asian and Pacific countries vary greatly in their stock of water infrastructure. In Kyrgyzstan and Tajikistan, the reservoir storage capacity is almost equal to the annual volume of their respective renewable

In Asia and the Pacific, total water storage capacity accounts for only about 10 per cent of annual renewable water resources, well behind the rest of the world

³ According to the International Commission on Large Dams, a dam is classified large if it is higher than 15 metres or if it is between 10 and 15 metres high and its reservoir capacity exceeds 1 million cubic metres.

Table VI.1. Large dams in the ESCAP region

Country	Number of existing dams	Number of dams under construction
Afghanistan ^a	2	
Armenia ^a	16	
Australia ^c	508	4 (2001)
Azerbaijan ^a	17	
Bangladesh ^a	1	
Brunei Darussalam ^a	2	
Cambodia ^a	2	
China ^c	25 821	245 (2001)
Democratic People's Republic of Korea ^a	2	
Fiji ^a	2	
Georgia ^a	14	
India ^d	4 525	475 (2002)
Indonesia ^b	104	10 (2001)
Iran (Islamic Republic of) ^d	187	88 (2002)
Japan ^d	2 738	110 (2002)
Kazakhstan ^a	12	
Kyrgyzstan ^a	12	
Lao People's Democratic Republic ^a	1	
Malaysia ^c	52	
Myanmar ^a	7	
Nepal ^a	33	
New Zealand ^d	93	
Pakistan ^d	87	11 (2002)
Papua New Guinea ^a	3	
Philippines ^a	15	
Republic of Korea ^a	65	
Russian Federation ^a	41	
Singapore ^a	3	
Sri Lanka ^a	46	
Tajikistan ^a	7	
Thailand ^d	26	4 (2002)
Turkey ^c	518	230 (2001)
Uzbekistan ^a	14	
Viet Nam ^a	1	
Total	34 977	1 177

Source:

^a International Water Power and Dam Construction, *Water Power and Dam Construction Yearbook 2004* (London, Wilmington Media, 2004).

^b International Commission on Large Dams, ICOLD enquiry 2000, Paris.

^c Ibid., 2001.

^d Ibid., 2002.

water resources due to a number of very large dam and reservoir projects. These include the world's highest dams – the Nurek dam (300 metres) and the Rogun dam (310 metres, not yet completed), built when these countries were within the Union of Soviet Socialist Republics. In many other countries of the region, reservoir storage capacity is much less than their annual renewable water resources.⁴

⁴ W.R. White, *World Water Storage in Man-Made Reservoirs* (FR/R0012), "Review of Current Knowledge" series, April 2005 (Bucks, United Kingdom, Foundation for Water Research, 2005) (available online at www.fwr.org).

Another appropriate indicator of the scale of development of water infrastructure is the volume of water storage capacity per person. The global average is 963 cubic metres (table VI.2); in Asia and the Pacific it is much less, about 380 cubic metres.⁵ Storage volumes vary greatly between the countries of the region. Australia has about 5,000 cubic metres of water storage capacity per person, comparable with the United States (6,500 cubic metres per person), while Afghanistan has only 140 cubic metres per person.

Table VI.2. Water resources and reservoir storage by region

Region	Population (2004) (millions)	Internal renewable water resources (IRWR) (km ³ /year)	IRWR per capita (m ³ /year)	Total reservoir storage (km ³)	Total reservoir storage/ IRWR (percentage)	Total reservoir storage/ population (m ³ /person)
Asia	3 574	11 117	3 111	1 262	11	353
Europe	729	6 592	9 043	1 083	16	1 486
Middle East and North Africa	435	517	1 189	392	76	901
Sub-Saharan Africa	714	3 887	5 444	388	10	543
North America	326	5 650	17 331	1 845	33	5 660
Central America and Caribbean	177	1 211	6 842	148	12	836
South America	367	12 246	33 368	891	7	2 428
Oceania	31	1 694	54 645	107	6	3 452
WORLD	6 353	42 914	6 755	6 116	14	963

Source: Adapted from W.R. White, *World Water Storage in Man-Made Reservoirs* (FR/R0012), "Review of Current Knowledge" series, April 2005 (Bucks, United Kingdom, Foundation for Water Research, 2005) (available online at www.fwr.org).

Exploitation of hydropower potential also reveals significant regional inequalities. Europe and North America have developed more than 70 per cent of their hydropower potential; Asia has harnessed only about 30 per cent. Hydropower, a clean energy source, accounts for about 20 per cent of the region's electric power generation⁶ but there are great differences in the way individual countries use it. The Lao People's Democratic Republic, Myanmar and Nepal, the least developed countries, have huge but practically untapped hydropower potential. Harnessing their hydropower resources to export energy to neighbouring countries with energy shortages could boost their economies enormously.

2. INFRASTRUCTURE FOR DRINKING WATER SUPPLY AND SANITATION

The Asian and Pacific region's lack of sufficient infrastructure denies a large part of its population access to safe water and decent sanitation. In 2002, every sixth person in the region, or an estimated 691 million people, did not have access to safe, sustainable water supplies and almost half the population did not have access to decent sanitation. A huge number of people have gained access to water and sanitation services as a result of the expansion in infrastructure since 1990. However, due to population

Lack of sufficient infrastructure keeps a large part of the region's population from obtaining safe water and decent sanitation

⁵ Ibid.

⁶ Asian Development Bank, *Water for All: The Water Policy of the Asian Development Bank* (Manila, Asian Development Bank, 2001).

Adequately treated sewage is a valuable source of water for many applications; Singapore has invested heavily to create a comprehensive infrastructure that enables it to treat and reuse sewage

growth, the absolute number of people without access to such services remained almost the same. Indeed, coverage of the region's urban population actually decreased due to a population growth rate that outstripped the rate of development of urban water supply and sanitation.

3. INFRASTRUCTURE FOR WASTEWATER TREATMENT

Sewerage and wastewater treatment facilities are much less developed than water supply infrastructure. Moreover, even where such facilities exist, they may not operate properly because of financial and technical problems. Although comprehensive estimates for the Asian and Pacific region are not available, it is assumed that a large share of sewage in most cities in the developing countries of the region is not properly treated and is disposed of in unsanitary ways that endanger public health and pollute the aquatic and marine environment.

However, adequately treated sewage is a valuable source of water for many applications. Sewage is reused mostly for agriculture and industrial applications; with treatment it could be brought up to acceptable drinking water standards. Water-deficient Singapore has invested hundreds of millions of United States dollars to create a comprehensive infrastructure that enables it to treat and reuse sewage.

4. INFRASTRUCTURE FOR INDUSTRIAL WATER SUPPLY AND INDUSTRIAL EFFLUENT TREATMENT

Water supply for small-scale industries located within urban areas is often provided by public water systems, while large-scale industrial projects or industrial zones may have their own infrastructure for water supply and effluent treatment. Although all countries in the region are conscious of the degradation of their water resources due to pollution by industrial effluents, the development of infrastructure for collecting, treating and disposing of industrial wastewater has often lagged behind the pace of industrialization. Infrastructure is not available or not sufficient to treat the effluents to a satisfactory standard.

5. INFRASTRUCTURE FOR IRRIGATION WATER SUPPLY

Despite the region's steady economic growth and the sharp rise in its urban population, water use in Asia and the Pacific is still dominated by agriculture. On average, about three quarters of the water obtained from surface and groundwater sources is used mainly for irrigated agriculture, a key sector for achieving sustainable food production to meet nutritional needs, ensure food security and provide a basis for the livelihoods of rural communities.

Irrigated land accounts for about 40 per cent of all arable land in the region and produces about 70 per cent of the region's food.⁷ A huge stock of physical infrastructure (dams, ponds, wells, major canals and distribution networks, drains and collectors, and pumping stations) exists in the region to provide water for irrigation systems as well as to collect and drain out return irrigation water. However, due to obsolete facilities and incorrect water use in the fields, the efficiency of irrigation is low throughout the region.

⁷ Ibid.

6. TRANSBOUNDARY WATER INFRASTRUCTURE

In continental Asia, most of the large rivers form or cross boundaries between two or more countries. The water resources of such rivers as the Amu Darya and the Syr Darya, the Indus and the Ganges, the Salween and the Mekong are shared by several countries and in many cases are virtually untapped. Countries often seek to develop river segments within their own territories regardless of basin-wide prospects as the complexity of riparian relations obstructs the development of the rivers' full potential for growth and poverty alleviation. In a number of cases, tensions over transboundary rivers effectively halt their management and development. However, the need for such infrastructure as multi-purpose dams or dykes for flood protection is often a major driver in reaching agreements on cooperation in transboundary river basins.

The water resources of several mighty transboundary rivers are shared by several countries and in many cases are virtually untapped

Central Asia has extensive transboundary hydraulic infrastructure for the Amu Darya and the Syr Darya rivers, originally developed during the Soviet era. However, the collapse of the Soviet Union in 1991 led to the creation of five independent Central Asian countries that now share these basins and infrastructure. International boundaries that cross irrigation systems, canals, water reservoirs and even dams enormously complicate the operation and management of these facilities. Although Central Asian countries have concluded a significant number of agreements to manage their shared water resources, the institutional and legal frameworks for such cooperation need improvement (box VI.1).

Box VI.1. Cooperation in operating hydraulic infrastructure in the transboundary Chu and Talas river basins

Under the 2000 Agreement between Kazakhstan and Kyrgyzstan on Utilization of the Water Facilities of Interstate Use on the Chu and Talas Rivers, Kazakhstan pays a part of the operation and maintenance expenses for a number of dams and reservoirs which are located on the territory of Kyrgyzstan but supply water to Kazakhstan. This is a breakthrough in water relations in Central Asia. If this formula were applied to other transboundary river basins in Central Asia, many of its current water problems could be resolved.

In February 2002, Kazakhstan and Kyrgyzstan requested ECE and ESCAP to assist in setting up a bilateral commission on the Chu and Talas rivers as stipulated in the Agreement. In response, ECE and ESCAP initiated a support project in early 2003, financed by Sweden, the United Kingdom and Estonia and implemented under the auspices of the Organization for Security and Cooperation in Europe (OSCE). A statute for the commission agreed by both countries would provide for Kazakhstan's and Kyrgyzstan's parts of the commission to be established on the basis of parity and each part would report to a water management agency in its respective country.

The proposed Chu-Talas Rivers commission is regarded as a model of cooperation for other transboundary river basins in Central Asia and has attracted strong international backing. The European Union has implemented a project to define the scope of water management in the basins of those rivers and the Asian Development Bank has supported establishing the Commission secretariat and retrofitting some hydraulic infrastructure on those rivers.

The Indus basin has extensive infrastructure consisting of 620 km of major canals and several dams and reservoirs with a storage capacity of 20 cubic kilometres. It was developed in the 1970s in order to divide waters in the upper basin between India and Pakistan in accordance with the Indus Basin Treaty, signed in 1960 by both countries and the World Bank on behalf of a group of countries that provided the finance to build the infrastructure. Some attempts to develop transboundary infrastructure in the

region were unsuccessful. For example, the 1970 Indicative Basin Development Plan prepared under the auspices of the Mekong River Committee aimed to build seven major multi-purpose dams across the lower Mekong mainstream. However, the plan was later abandoned.

Transboundary infrastructure has been developed in order to supply water from Malaysia to Singapore and from China to Hong Kong, China and Macao, China. Singapore receives about half of the water it uses by means of a pipeline from Malaysia. Their bilateral agreement on water supply expires soon and is unlikely to be extended, and Singapore has been rapidly developing alternative sources of water, including seawater desalination and reclaimed sewage (box VI.2).

Box VI.2. Singapore's innovative use of water resources

Approximately half of Singapore's land area is used as water catchments. All major traditional surface water resources have been developed. To augment local water supplies, Singapore imports water from Malaysia.

The Government is actively exploring alternative water supply sources. Singapore is desalinating seawater for potable water and recovering good-quality water (called NEWater) from secondary treated effluent for use by clean industries instead of potable water. The fact that water from such new sources will be more expensive highlights the importance of (a) comprehensive water demand management and (b) fully utilizing limited available water resources.

7. WATER MANAGEMENT POLICIES AND INSTITUTIONS

Development of water resources requires investments in both infrastructure and water management institutions

The development of water resources requires investment in both infrastructure and water management institutions. Without the infrastructure to store and deliver water and manage flows, there is neither the need nor the incentive for sophisticated management practices. While developed countries are appropriately focused on refining integrated water resources management, developing countries may do better to lay greater emphasis on infrastructure investment and adopt a principled and pragmatic approach to management.

Developing countries see a major imperative in increasing the productive value of water and reducing the cost of destruction by water to their economies by developing at least basic hydraulic infrastructure. Middle-income fast developing economies show increasing awareness of the need to conserve aquatic ecosystems, although pressure for growth and poverty eradication by further developing required infrastructure is generally stronger. In developed economies, with a mature hydraulic infrastructure platform, a high value is placed on protecting and restoring the aquatic environment.

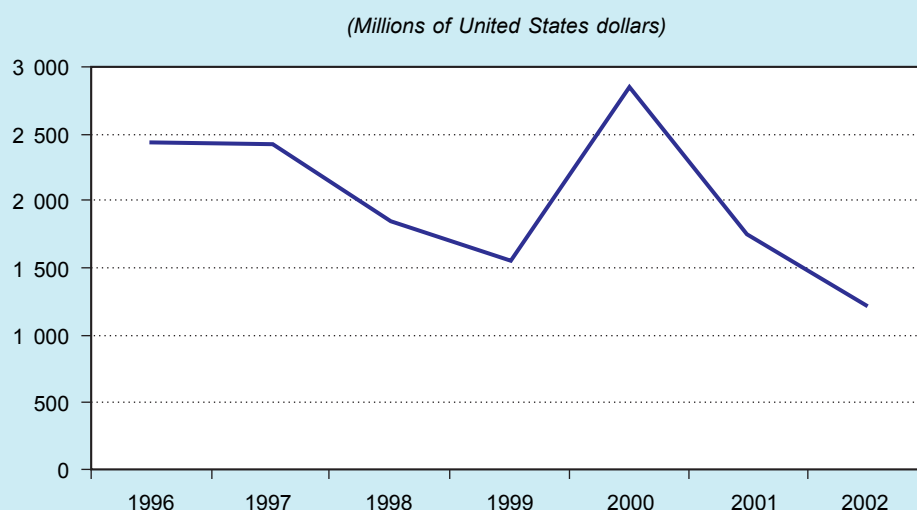
As hydraulic infrastructure is characterized by its longevity, the scale, site selection and operational characteristics of such infrastructure should be planned with a long-term perspective that anticipates such trends and emphasizes adaptability. On the other hand, developing countries must not regard physical infrastructure alone as a panacea. Without the development of appropriate management institutions, badly managed infrastructure will likely not support growth; it may even forestall growth.

8. FINANCING WATER INFRASTRUCTURE

Historically, national Governments have accounted for more than two thirds of investments in hydraulic infrastructure and all Governments, agreeing on the importance of water, subscribe to international commitments such as the water-related Millennium Development Goals. However, most countries give the water sector a disproportionately small share of the budget and low incomes have impeded many developing countries from increasing such investment. Official development assistance (ODA) flows have declined and commercial lending and private investment have been scaled back significantly as the private sector has become more averse to water sector risks (figures VI.3 and VI.4).

National Governments have accounted for more than two thirds of investments in water infrastructure but most give it a disproportionately small share of the budget

Figure VI.3. Official development assistance and official assistance for the water sector



Source: United Nations, “OECD Global Forum on Sustainable Development: financing water and environmental infrastructure for all”, Background Paper No. 6 (DESA/DSD/2004/6) submitted by the Organization for Economic Cooperation and Development to the Commission on Sustainable Development at its twelfth session, New York, 14-30 April 2004, p.8 (available online at www.un.org/esa/sustdev/documents/docs_csd12.htm).

Note: Data present commitments of official development assistance (ODA)/official assistance (OA) to developing countries and countries in transition for the water sector (excluding waste management and river development). It includes aid loans, grants and equity investments from DAC donors, including the European Commission. Other official flows and aid from non-DAC donors and multilateral agencies are excluded. In comparing data across years, it should be noted that coverage has improved over time.

Lack of international recognition of the significance of investment in hydraulic infrastructure also has serious consequences for developing countries. Aid policymakers often are reluctant to support major water infrastructure development in developing countries and there has even been an effective freeze in financing, for example, dams for storage, hydropower or other purposes. However, growing recognition of the need for water storage and hydropower, including dams of all sizes, has brought important changes in aid policy. For instance, the Asian Development Bank recently approved its first loan in 10 years for a hydropower project – the Nam Theun II Hydroelectric Project in the Lao People’s Democratic Republic.

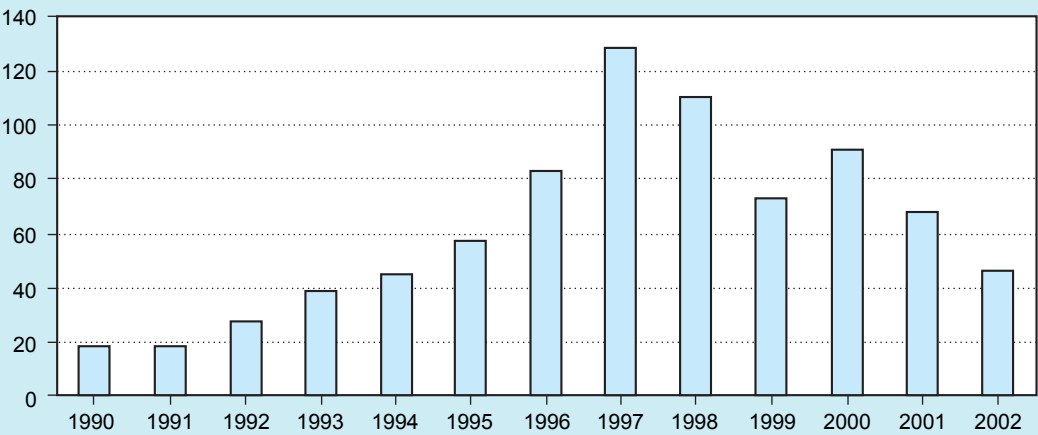
As water infrastructure projects typically involve high initial capital investment and a long payback period, the risk of repayment default is high relative to projects in other sectors

As water infrastructure projects typically involve high initial capital investment and a long payback period, the risk of repayment default is high relative to projects in other sectors. This is particularly true for developing countries as only a few emerging markets have sufficiently high investment ratings that enable them to borrow funds in international markets on attractive terms. When countries borrow in foreign currency, they must repay the debt using revenues generated in the local currency, increasing the risk of repayment default due to possible unfavourable movements in the exchange rate.

Water sector projects often suffer from a confusion of social, commercial and environmental aims. Providing water supply and sanitation, for example, is widely considered to be a social responsibility of Governments, which then charge low tariffs for services that do not cover even the operation and maintenance costs of infrastructure. Failure to charge the economic rate means water utilities are frequently in a poor position, unable to properly maintain their assets or attract the necessary finance.

Figure VI.4. Annual foreign private investment in water infrastructure in developing countries, 1990-2002

(Billions of United States dollars)



Source: J. Saghir, "Financing water and environmental infrastructure for all", opening speech at the OECD Global Forum on Sustainable Development, Paris, 18 December 2003.

Financing sewage and wastewater collection and treatment is even more problematic. Users are even less willing to pay for treating wastewater than for water supply since the benefits accrue to downstream communities. As a result, it is often more difficult to finance major wastewater treatment, especially after drinking water is supplied. This is one reason why there are advantages in developing and managing water supply and wastewater infrastructure in an integrated way – the separation of these functions is generally less efficient.

Poor governance of the water sector is also a major problem in financing water infrastructure. Providers of centralized water and wastewater services are monopolists by nature and require careful regulation as a substitute for market competition. However, in many Asian and Pacific countries, the regulatory framework for the water sector is absent or weak. Decentralization of water services, which is under way in a large number of

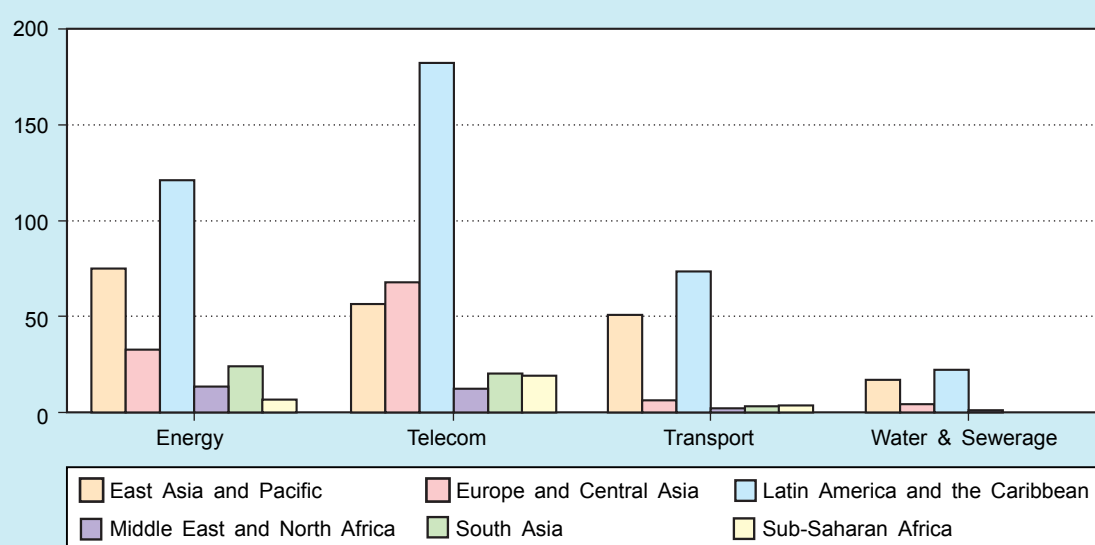
countries of the region, leads to devolution of responsibilities for service to lower levels of government, but often without a commensurate allocation of funding.

9. PRIVATE SECTOR PARTICIPATION

The relatively low rate of return typically provided by water infrastructure projects, particularly water supply and sanitation schemes, has also made the private sector more reluctant to invest in this sector than in other forms of infrastructure (see figure VI.5). Only about 5 per cent of the region's population is served by private sector operators, who mostly went into the water business before 1997.

Figure VI.5. Total international private investment in infrastructure in 1990-2002, by sector and region

(Billions of United States dollars)



Source: J. Saghir, "Financing water and environmental infrastructure for all", opening speech at the OECD Global Forum on Sustainable Development, Paris, 18 December 2003.

10. CHALLENGES

In general, the region's water infrastructure sector needs the urgent attention of all stakeholders. Hydraulic infrastructure is unevenly developed throughout Asia and the Pacific and lags behind the needs of many countries, especially the least developed. Inadequate infrastructure is often coupled with deficient management and a shortage of financial resources. Indeed, the financial situation of the water sector has deteriorated in the last few years.

Nevertheless, there are also positive trends. A regional consensus has emerged on the need for policy and institutional reform, and appropriate action is being taken by many governments, municipalities, companies, and water users associations. The challenge is to spread these successes throughout the region.

Hydraulic infrastructure is unevenly developed in Asia and the Pacific and will need urgent attention to meet the needs of many countries, especially the least developed

D. FUTURE INFRASTRUCTURE DEVELOPMENT NEEDS

Demand for water will grow with the increasing size and consumption of the population and demand for water infrastructure will grow correspondingly

The Asian and Pacific region's demand for water and for infrastructure to deliver it will grow with the increasing size and consumption of its population. The scale of the region's water infrastructure development will largely be determined by China and India. They already account for about 80 per cent of the dams under construction in the region but will have to accelerate the development of their water supply and sanitation infrastructure to support rapid industrialization and to meet their ambitious national targets under the Millennium Development Goals. Hydropower construction will also be a priority in least developed countries, such as Afghanistan, Bhutan, the Lao People's Democratic Republic, Myanmar and Nepal, where hydropower is one of the few options to support long-term growth and reduce poverty.

1. DAMS AND RESERVOIRS

Asian and Pacific countries will need to accelerate the creation of new water storage capacity. The capacity of their existing reservoirs has fallen due to sedimentation while demand for more storage capacity has steadily grown. This need is likely to become even more acute because of global climate change, which could cause extreme deviations in the hydrological regime in many river basins. Indeed, regional demand for storage capacity will outstrip supply in the foreseeable future and a shortfall of several hundred cubic kilometres is anticipated in a couple of decades.

The World Bank, recognizing the need to increase support for dam and water storage development, has adopted a set of safeguard policies to ensure that dams are economically, environmentally and socially sound, but it is focusing more on financing the rehabilitation of existing dams, with an eye on safety, than building new dams.

2. INFRASTRUCTURE FOR WATER SUPPLY AND SANITATION

The Millennium Development Goal target of halving by 2015 the proportion of people without adequate and sustainable access to safe drinking water and improved sanitation presents a formidable challenge

The provision of safe drinking water and improved sanitation has a high priority in the Millennium Development Goals and the Johannesburg Plan of Implementation⁸ as a primary means of eradicating poverty. For Asia and the Pacific, meeting the Millennium Development Goal target of halving, by 2015, the proportion of people without adequate and sustainable access to safe drinking water and improved sanitation presents a particularly formidable challenge. Not only is the region home to the majority of the world's poor, but it also has two thirds of the world's population unserved with safe water and more than three quarters of the world's population unserved by improved sanitation. The drastic increase projected in the region's urban population over the next century will place enormous pressure on urban water infrastructure. The construction, extension and rehabilitation of water supply and sanitation facilities, especially those serving the poor, will need to accelerate.

⁸ Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August-4 September 2002 (United Nations publication, Sales No. E.03.II.A.1 and corrigendum), chap. I, resolution 2, annex.

3. INFRASTRUCTURE FOR SEWAGE AND WASTEWATER

Developing infrastructure to collect, treat and reuse or dispose of sewage and wastewater needs to become a priority in many Asian and Pacific countries in order for them to achieve environmentally sustainable growth. Countries experiencing water scarcity will give more attention to developing infrastructure for the recovery, reuse and recycling of wastewater. As stand-alone wastewater infrastructure projects are less attractive for investment, especially when drinking water is already available, developing and managing water supply and wastewater infrastructure in an integrated way will have a number of advantages.

Developing infrastructure to collect, treat and reuse or dispose of sewage and wastewater needs to become a priority in many Asian and Pacific countries for them to achieve environmentally sustainable growth

4. INFRASTRUCTURE FOR IRRIGATION

More water supplies and new, more expensive, infrastructure will be needed to increase food production and meet the Millennium Development Goal of reducing the number of people who suffer from hunger by half by the year 2015. Irrigation will remain a prime engine of agricultural growth and some estimates say the region's irrigated area will reach 230 million hectares by 2025.⁹

However, the share of water allocated to irrigated agriculture will continue to fall because of rising demand for water from urban areas and industries. Increasing productivity from irrigated agriculture is an optimal way of meeting the challenge of eliminating hunger in the region. This will require good maintenance and in many cases rehabilitation of existing infrastructure.

5. TRANSBOUNDARY WATER INFRASTRUCTURE

Large-scale cooperative projects to exploit the huge but still almost untapped potential of transboundary rivers by riparian countries will become inevitable as internal water resources grow scarcer. Such developments will require broad framework agreements laying down basic principles of co-operation as well as project-specific agreements to apportion costs and provide a basis for joint efforts to mobilize finance.

6. FOCUS ON WATER CONSERVATION AND EFFICIENCY

In order to have enough water and sustain development, Asian and Pacific countries must pay more attention to using existing supplies efficiently and keeping them cleaner. Essential water savings could result from conservation, including the introduction of water saving technologies in agriculture and industry, water loss reduction programmes, wastewater reuse and public awareness campaigns for careful water use. Expensive new projects to develop additional water supply sources could also be shelved or deferred.

7. FINANCING REQUIREMENTS

It is estimated that total spending on water infrastructure by developing countries will need to more than double from the current level of around \$75 billion annually to around \$180 billion annually, of which \$99 billion is required for Asia and the Pacific. Countries of the region will need to at least double investment in water infrastructure to achieve the targets for this sector.

Asian and Pacific countries will need to at least double investment in water infrastructure to achieve the targets for this sector

⁹ Asian Development Bank, *Water for All: The Water Policy of the Asian Development Bank* (Manila, Asian Development Bank, 2001).

To do this, they will need to mobilize finance from all sources. Governments are likely to remain the major source of finance, particularly capital investment, in the foreseeable future, but it is equally important to provide for recurring expenditure on operations, maintenance and administrative overheads. Shortfalls in repairs and maintenance eventually lead to a need for a higher level of investment, but adequate budgeting for recurrent spending can minimize future investment needs.

The private sector is likely to be mainly a source of managerial and technical know-how rather than investment in water infrastructure in developing countries. However, more can be done to engage the private sector, particularly by improving the access of municipalities to capital and financial markets. Borrowing from commercial banks or issuing municipal bonds could be important mechanisms for developing municipal infrastructure.¹⁰ However, the substantive involvement of the private sector is also feasible.¹¹

Nearly all the increase in financing for household water-related services should be for sanitation, with by far the largest increase in funds going for the treatment of wastewater from both households and industry, now grossly underfinanced. The item “environmental protection” includes flood control and water resources management in its various forms. However, the annual flow of investment in drinking water supply for the past decade has proved sufficient only to keep the number of people without adequate access to drinking water almost at the same level. The estimate in table VI.3 regarding drinking water could therefore be significantly underestimated.

Table VI.3. Indicative annual investment in water services for developing countries

Purpose of infrastructure	Annual costs (Billions of United States dollars)	
	Approximate 2000	2002-2025
Drinking water	13	13+
Sanitation and hygiene	1	17
Municipal wastewater treatment	14	70
Industrial effluent	7	30
Agriculture (mostly irrigation)	32.5	40
Environmental protection	7.5	10
Total	75	180
Estimated total infrastructure requirement for the developing countries of the Asian and Pacific region ^a	41.2	99

Source: Global Water Partnership, “Towards Water Security: a Framework for Action” (Stockholm, Global Water Partnership, 2000); and J. Briscoe, “The financing of hydropower, irrigation, and water supply infrastructure in developing countries”, *International Journal of Water Resources Development*, vol. 15, No. 4, 1999, pp. 459-91. Figures include 15 per cent allowance for operation and maintenance and author's calculations.

Note: Investment in hydropower (about \$15 billion) is not separately identified. Because larger schemes are usually multi-purpose, some of this cost would be included in the “agriculture” and “environmental protection” categories, and the remainder should be attributed to the power sector.

^a ESCAP estimate based on the Asian and Pacific proportion in the global investment requirement, calculated from M. Fay and T. Yepes, “Investing in infrastructure: what is needed from 2000 to 2010?”, World Bank Policy Working Paper 3102 (Washington D.C., World Bank, July 2003).

¹⁰ United Nations, “OECD Global Forum on Sustainable Development: financing water and environmental infrastructure for all”, Background Paper No. 6 (DESA/DSD/2004/6) submitted by the Organization for Economic Cooperation and Development to the Commission on Sustainable Development at its twelfth session, New York, 14-30 April 2004, p. 8 (available online at www.un.org/esa/sustdev/documents/docs_csd12.htm).

¹¹ Global Water Partnership, World Water Council and Third World Water Forum, “Financing water for all: report of the world panel on financing water infrastructure”, Kyoto, Japan, March 2003, p. 17 (available online at www.inbo-news.org/wwf).

The costs of meeting the 2015 water supply and sanitation targets depend crucially on assumptions about the type and level of service. In the Asian and Pacific region, using the most basic standards of service and technology, the 2015 goals could be attained at an annual investment cost of about \$8 billion, or \$2 per person. Providing access to improved water and sanitation services for all the unserved people of Asia and the Pacific would cost about \$16 billion per year.¹² However, providing full water and sewerage connections and primary wastewater treatment as well would bring total investment to about \$85 billion per year. The total infrastructure financing requirement, including water and sanitation as well as agriculture and environmental protection, is estimated at \$99 billion annually.

E. THE WAY FORWARD

Infrastructure in the Asian and Pacific region is insufficient to meet rising demand for water; a large part of its population is deprived of access to safe drinking water and improved sanitation, creating an acute need for new capacity. Asian and Pacific countries will need to spend almost \$100 billion per year on water infrastructure. Although some regional cooperation initiatives have emerged, particularly when transboundary infrastructure is necessary, there remains considerable scope for enhancing regional cooperation in developing water infrastructure, but finding innovative means to engage the private sector is also vital.

The report of the World Panel on Financing Water Infrastructure comprehensively addresses issues of governance and financing. Some key findings of the report generally applicable to the Asian and Pacific region are the following:¹³

- (a) Attainment of the internationally agreed water targets should be the main focus of national and international efforts;
- (b) Financial flows into the water sector from all sources would need to roughly double in order to achieve these targets;
- (c) While mobilizing much larger volumes of finance will be a prerequisite for achieving the targets, fundamental problems in the governance of the sector will also need to be addressed if it is to generate and to attract this finance;
- (d) Better cost recovery from users is vital. The Panel endorsed “sustainable cost recovery”, consisting of improved efforts to raise revenues from users, with residual subsidies applied in a predictable, transparent and targeted manner. A first target should be for user fees to cover operational and maintenance costs, gradually increasing to recover capital investments and ultimately reflecting environmental costs as well, but full cost recovery is unlikely to be achieved easily or quickly;¹⁴

Attainment of the internationally agreed water targets should be the main focus of national and international efforts

¹² Asian Development Bank, *Asia Water Watch 2015: Are Countries in Asia on Track to Meet Target 10 of the Millennium Development Goals?* (Summary) November 2005 (Manila, ADB, 2005).

¹³ United Nations, “OECD Global Forum on Sustainable Development: financing water and environmental infrastructure for all”, Background Paper No. 6 (DESA/DSD/2004/6) submitted by the Organization for Economic Cooperation and Development to the Commission on Sustainable Development at its twelfth session, New York, 14-30 April 2004, p. 5 (available online at www.un.org/esa/sustdev/documents/docs_csd12.htm).

¹⁴ Ibid., p. 11.

- (e) National public funding is, and for the foreseeable future will remain, the main source of investment finance for this sector in many countries. Governments should raise the priority of the water sector in their national investment strategies and make their funding of it more reliable;
- (f) Governments should also establish the policy and institutional framework to enable subnational entities, such as municipalities, regional water boards and water utilities, to generate and attract finance for investment;
- (g) The choice of organizational model for the water sector (public, private, or the various permutations involving both) is a matter for local decision. The key issue is how to establish the conditions for effective and efficient delivery of water services;
- (h) More could be done to promote local capital and financial markets as sources of finance for investments in the water sector. This would avoid foreign exchange risk, which is one of the main deterrents to the use of external finance;
- (i) Donor governments and external agencies should aim to make substantial increases in the share of the water sector in their total commitments, improve coordination of their activities and use their funds as catalysts to mobilize other flows;
- (j) International financial institutions (IFIs) could provide more support to mitigate the risks of investment in the water sector and take steps to remove obstacles to their lending to sub-sovereign entities;
- (k) Governments, agencies and other key players should be held to account for their commitments and performance against the internationally agreed water targets.

1. THE ROLE OF ESCAP

(a) Mainstreaming water issues

ESCAP could support regional and subregional cooperation in formulating and implementing strategies and policies that accord appropriate priority to water infrastructure development and management and incorporate them into overall socio-economic planning. New forms of cooperation could be developed to strengthen and reform the institutions that deal with water infrastructure development and management in developing countries.

(b) Promoting efficiency in water use

ESCAP could promote efficiency in water use and improvements in water productivity and conservation, thus helping at least to delay the need to build costly infrastructure for developing new water sources. Asian and Pacific countries inevitably will face growing water scarcity and need to be drastically more efficient water users. ESCAP could capitalize on a number of its projects to strengthen national capacities in formulating and implementing water conservation policies and programmes.

(c) Water infrastructure in the basins of transboundary rivers

ESCAP could promote cooperation in developing and maintaining hydraulic infrastructure in the basins of the region's transboundary rivers by offering advisory services on institutional and legal frameworks for such

ESCAP could support regional or subregional cooperation in formulating and implementing strategies and policies for water infrastructure development and management

cooperation. Of the major rivers in continental Asia, only the Indus River in South Asia, the Amu Darya and Syr Darya in Central Asia and, to a certain extent, the Mekong River in South-East Asia, are covered by international agreements dealing with development and management of their water-related resources. The catalytic role ESCAP could play in fostering cooperation on transboundary rivers would be especially appropriate in light of the failure of the 1997 Convention on the Law of the Non-navigational Uses of International Watercourses¹⁵ to win ratification. ESCAP could seek to replicate the role that ECE played in preparing the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes¹⁶ and its assistance to member countries on implementing the Convention.

(d) Central Asian subregional cooperation on water infrastructure

Countries need catalytic projects and greater cooperation at the subregional level to help them pursue sustainable development. The development of Central Asia as a hydroelectricity supplier to Asia and Europe presents just such an opportunity. In the Islamic Republic of Iran, the Russian Federation and several other countries, the Government and the private sector have shown an interest in completing giant multi-purpose projects that were initiated in Kyrgyzstan and Tajikistan in the 1980s but have remained at a standstill since 1991. Completion of these projects, some of which are for hydropower, would benefit both the power-generating countries and their neighbours and contribute to the resolution of water-sharing issues in Central Asia. ESCAP could support this initiative by facilitating the creation of a subregional consortium under the auspices of the United Nations Special Programme for the Economies of Central Asia (SPECA) for the joint operation of major hydropower and water storage facilities in Central Asia. The Heads of State of Central Asian countries recently appealed for international assistance in setting up such a consortium.

(e) Asian water infrastructure investment forum

ESCAP could also assist in the creation of an investment forum on water infrastructure to help countries to assess their needs, exchange experiences, establish contacts with the business community and mobilize funds for the development of hydraulic infrastructure. Such a forum could also raise the profile of the water infrastructure sector and facilitate the access of developing countries to potential sources of technical assistance and finance.

ESCAP could assist in the creation of an investment forum on water infrastructure to help countries

¹⁵ General Assembly resolution 51/229 of 21 May 1997, annex.

¹⁶ For more information, see www.unece.org/env/water.

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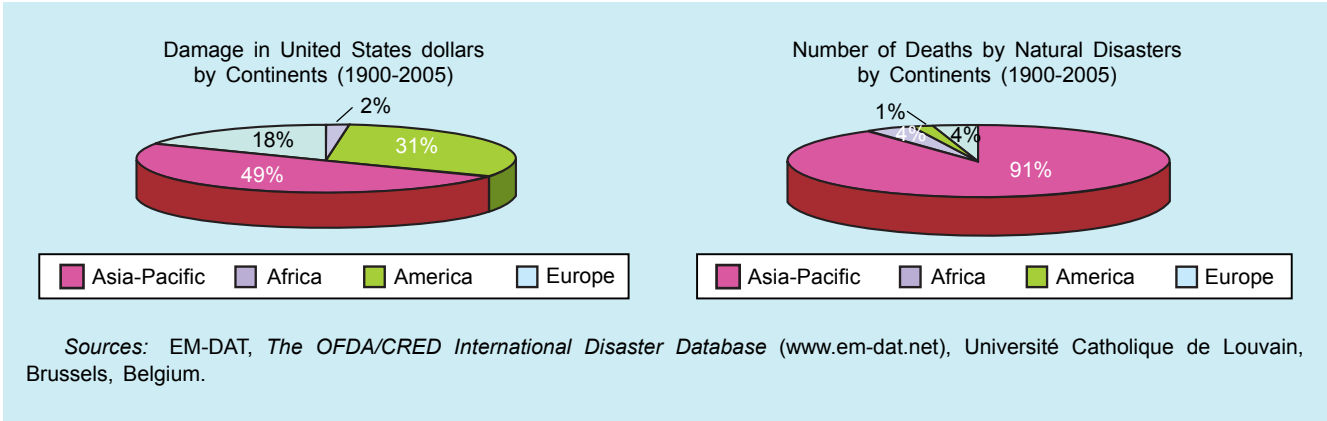
VII. INFRASTRUCTURE DEVELOPMENT RELATING TO DISASTER MANAGEMENT

A. INTRODUCTION

Asia and the Pacific is the world's most disaster-prone region, accounting for 91 per cent of deaths from natural disasters in the past century and 49 per cent of the resulting economic damage (figure VII.1). Each year for the past 15 years, an average of 41,000 people have died in the region from natural disasters, which annually inflicted \$29 billion worth of damage. Of the world's 10 most severe natural disasters in 2004, five occurred in the Asian and Pacific region, causing damage amounting to \$55 billion, about 70 per cent of the total damage, estimated at \$80 billion.

Asia and the Pacific is the world's most disaster-prone region, accounting for 91 per cent of deaths from natural disasters in the past century and 49 per cent of the resulting economic damage

Figure VII.1. Impacts of natural disasters in the period 1900-2005



Natural disasters have a profound impact on the quality of life through their destruction of food crops and livestock, shelter and other aspects of the built environment, and forced dislocation of households and communities. Their most devastating impact, however, is their toll on lives and the instant poverty they create.¹ The effect of natural hazards on the loss of human lives is directly related to the poverty levels in a given country. National and regional efforts for natural disaster reduction should therefore be closely linked with poverty alleviation and economic and social development activities.

¹ ESCAP, *Natural Hazards and Natural Disaster Reduction in Asia and the Pacific* (ST/ESCAP/1574), 1995.

Losses resulting from natural disasters are particularly damaging in the Asian and Pacific region, depriving countries of resources which could otherwise be used for economic and social development. The toll is most severe and tragic in the least developed and developing countries of the region, which have sometimes had their development goals set back years and even decades as a consequence of major disasters. Regional cooperation for disaster management, including infrastructure development, is essential, not only to cope with the impacts but also to help ensure that the region sustains its economic growth.

The objective of this chapter is to analyse the impact of natural disasters in the Asian and Pacific region and its relationship to infrastructure development with a view to identifying how regional cooperation could help address issues relating to disaster management. Section B provides a brief analysis of the causes of natural disasters. An analysis of infrastructure relating to disaster management is given in section C. A discussion on enhancing regional cooperation in infrastructure development for disaster management is provided in section D. Section E provides a summary of findings and proposes a way forward.

B. CAUSES, DAMAGE AND TRENDS

1. CAUSES OF NATURAL DISASTERS

Asian and Pacific countries experience a wide variety of natural hazards that include floods, cyclones, earthquakes, drought, tornadoes, debris flows, hailstorms, storm surges, tsunamis and haze

Recent surveys conducted by ESCAP have shown that Asia and the Pacific is one of the regions of the world most vulnerable to disasters, experiencing a wide variety of natural hazards that include floods, cyclones, earthquakes, drought, tornadoes, debris flows, hailstorms, storm surges, tsunamis and haze. Table VII.1 presents the relative intensity of most serious natural hazards faced by some vulnerable countries in Asia and the Pacific.

Tropical cyclones occur more frequently in the Asian and Pacific region than in any other part of the world and are usually accompanied by severe flooding. Riverine flooding continues to be a common occurrence in the region that causes substantial damage every year. The impact of flash floods is also becoming increasingly important. Urban flooding has become a major potential hazard in terms of its economic and social impact as a result of the rapid urbanization process and uncoordinated infrastructure development. Coastal flooding and storm surges have the potential to cause substantial loss of life and property damage in large and heavily populated deltaic areas, such as those of Bangladesh and Viet Nam, and tsunamis generated by underwater earthquakes can also be very destructive, as experienced in December 2004 in the Indian Ocean and South-East Asia.

Cyclone-related disasters were rated as the most severe in many survey responses. Ranked in order of severity, they included (1) floods, (2) strong winds, (3) landslides, including mudslides, and (4) storm surges. Floods were also the most common disaster experienced in almost all countries in the region.

Rapid population growth in Asian and Pacific countries is driving people, mostly the poor, to settle in squatter areas in large cities, usually inhabiting low-lying flood-prone areas, unstable hillsides or other disaster-prone marginal locations owing to the high cost of suitable alternatives and the extremely high cost of new infrastructure and services. In Bangladesh, for example, over a million people are living on islands formed by silt deposits and in vulnerable flood plains and coastal areas. Over 85 per cent of the population of China lives on alluvial plains or along river basins concentrated in one third of the

Table VII.1. Relative intensity of natural hazards faced by selected countries in Asia and the Pacific

COUNTRY	Cyclone	Flood	Drought	Landslide	Tsunami	Earthquake	Volcano	Fire
Australia	S	S				L		S
Bangladesh	S	S	S	L	L	L		L
China	M	S	S	L	L	S		M
Cook Islands	M	L	S	L	M	L		
Fiji	S	S	M	S	S	M		
Hong Kong, China	M	L		M				M
India	M	S	S	L		M		M
Indonesia	L	M	M	L	L	S	M	M
Iran (Islamic Republic of)		M	S			S		
Kiribati	L	S ^a	S	L	S	L		
Lao People's Democratic Republic		M	L					
Malaysia	M	M	S	L	M			L
Marshall Islands	M	S ^a	S	L	M	L		
Micronesia (Federated States of)	M	S ^a	S	L	S	L		
Myanmar	M	M	M	M		S		S
Nepal	M	L ^a	M	L		M		M
Niue	M	L ^a	M	L		L		M
Pakistan	M	M ^a	M	L	M	S		L
Palau	M	M ^a	M	L	M	L		
Papua New Guinea	L	S	M	S	S	S	S	L
Philippines	S	S	L	S	S	S	M	M
Samoa	M	S	L	S	S	M	L	L
Solomon Islands	S	S	L	S	S	S	S	L
Sri Lanka	M	S	S	L				L
Thailand	M	S ^a	S	L		L		L
Tokelau	M	S ^a	S	L	S	L		
Tonga	S	M	M	L	S	S	S	
Tuvalu	L	S ^a	M	L	S	L		
Vanuatu	S	S	L	S	S	S	S	L
Viet Nam	M	S	L	S	S	L		L

Source: Asian Disaster Preparedness Center, United Nations Office for the Coordination of Humanitarian Affairs; and ESCAP secretariat.

Notes:

S: Severe, M: Moderate, L: Low

^a Coastal flooding.

country's total land area. The situation is similar in Viet Nam, where the dykes providing protection along rivers are sometimes breached by flood waters, causing extensive inundation. In consequence, the number of persons vulnerable to natural hazards is increasing rapidly.

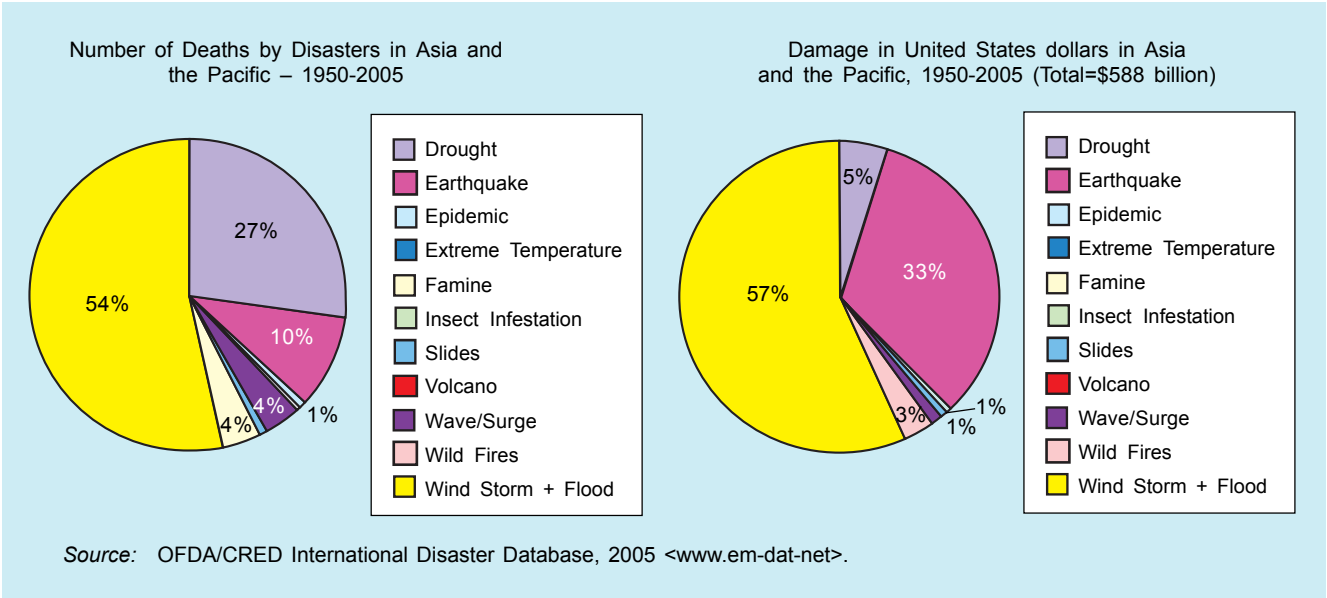
Environmental degradation taking place in many countries of the region only intensifies the damage inflicted by natural disasters. Deforestation, erosion, overgrazing, overcultivation and incorrect agricultural practices and the degradation of natural buffers amplify the effects of natural hazards. Land degradation and desertification pose a serious threat in the region in the wake of growing populations and enhanced food demand. Indeed, a comparison of desertification in different continents indicates that the Asian and Pacific region is most severely affected by loss of land productivity and agricultural output, although Africa has the highest percentage of desertified dry land.

2. PATTERNS OF NATURAL DISASTERS

Cyclone-related disasters accounted for most of the loss of life and economic damage

According to various ESCAP surveys, natural disasters had the most impact at the local level, followed by the regional and national levels. Impacts of floods are particularly significant at the regional and national levels. These surveys confirmed the analysis of the impacts of natural disasters in the region during the period from 1950 to 2005, based on the OFDA/CRED International Disaster Database, which showed (figure VII.2) that cyclone-related disasters (wind-storms and floods) accounted for most of the loss of life and economic damage (54 per cent of deaths and 57 per cent of economic damage).

Figure VII.2. Impacts of natural disasters in the period 1950 – 2005



Over the past five decades about 100,000 people have died annually as a result of natural disasters... over the past 15 years, however, only 41,000 people, on average, have died annually... but the amount of damage has nearly tripled

However, the pattern of death and damage has changed substantially. Over the past 50 years, about 100,000 people have died annually as a result of natural disasters, and the related damage has amounted to \$10.6 billion. Over the past 15 years, however, only 41,000 people, on average, have died annually as a result of natural disasters, but the amount of damage has nearly tripled, to \$29 billion annually.

A survey conducted by ESCAP in 2000 for the Typhoon Committee Area revealed that several members of the Typhoon Committee had attempted to quantify the annual economic losses caused by cyclone-related disasters in monetary terms; they ranged from \$5.5 million in Hong Kong, China, to \$1.96 billion in Japan. Attempts were also made in several countries to rank the severity of these cyclone-related hazards according to the magnitude of the impacts. Table VII.2. contains such information for Malaysia and the Philippines.

River floods were found to have a significant impact in many countries and urban floods had a serious impact in such countries as Japan and Malaysia. Flash floods were also found to be frequent in many countries, but data on coastal floods, particularly storm surges, were not readily available.

The ESCAP region covers a total area of about 35 million square kilometres, or 26 per cent of the world's land area but, with nearly 60 per cent of the world's population and over 60 per cent of the total irrigated land,

Table VII.2. Impact of cyclone-related hazards in Malaysia and the Philippines

(Millions of United States dollars)

Economic loss	Flood	Strong winds	Land slides	Storm surges
Malaysia ^a	50	2	3	1
Philippines	1 829	1 691	1 290	No data

Source: Survey conducted by ESCAP secretariat, 2000.

Note:

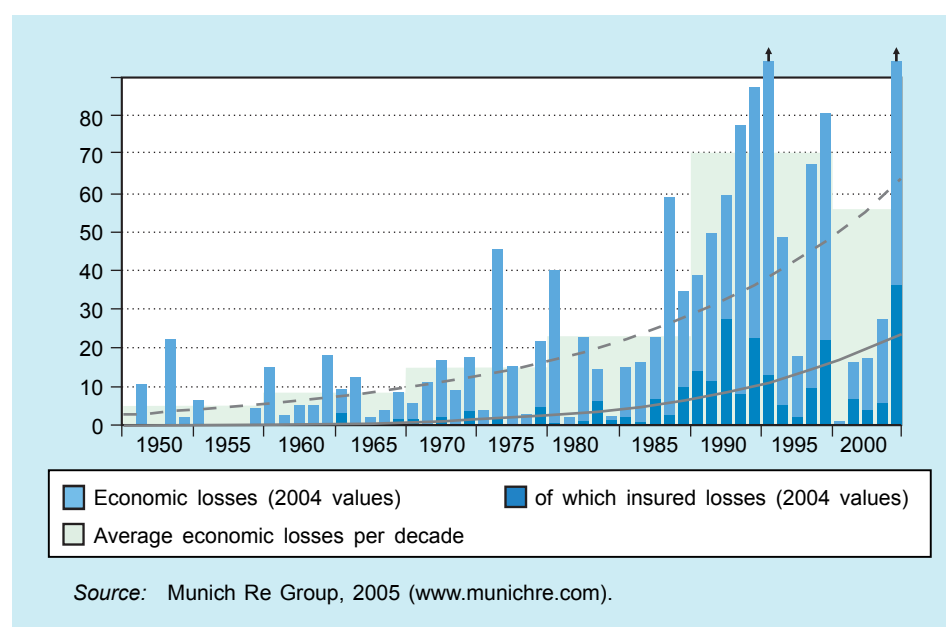
^a Indication of the order of magnitude only.

it is the world's most densely populated and most intensely cultivated region. The potential for devastating natural disasters is much greater in the countries of Asia and requires particular attention if the severe toll of these events on life and property is to be significantly reduced.

3. DAMAGE TRENDS IN SELECTED COUNTRIES

According to statistics issued recently by Munich Re, the world's largest reinsurer, economic losses caused by natural disasters have increased sharply in the past three decades (figure VII.3). Five of the world's 10 most severe disasters in 2004 occurred in the Asian and Pacific region and they accounted for \$55 billion or 70 per cent of the total damage, estimated in 2004 at \$80 billion.

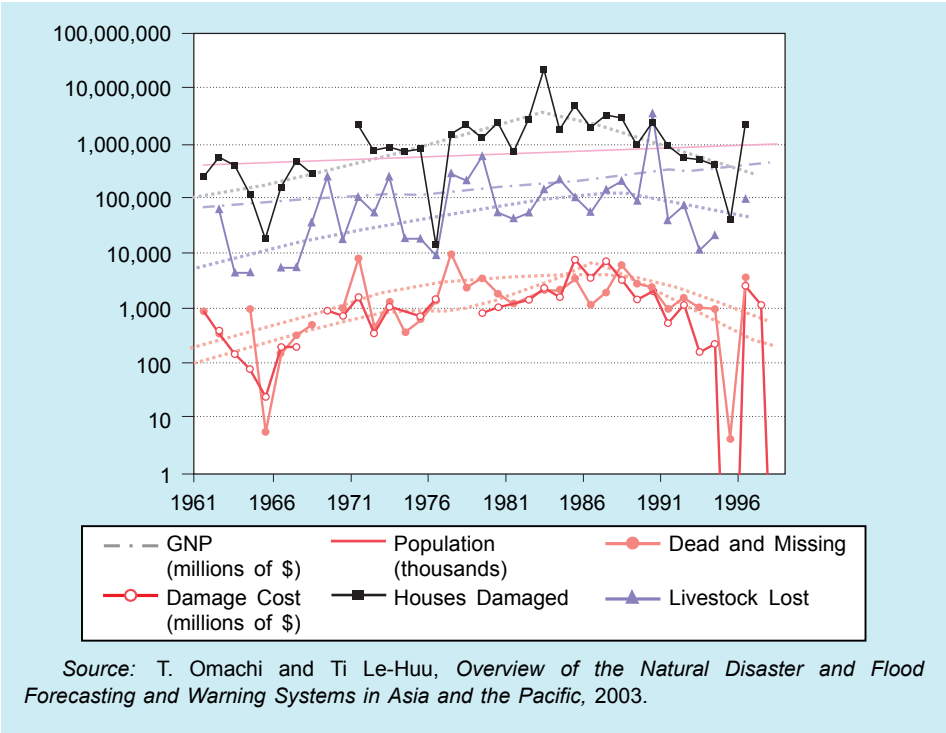
According to statistics issued by the world's largest reinsurer, economic losses caused by natural disasters have increased sharply in the past three decades

Figure VII.3. Trends of economic losses by natural disasters

(a) India

India is one of the Asian countries with a well-developed statistical survey system. Indices show that damage caused by wind and water has decreased since 1982 (figure VII.4) but is still higher than in 1961. Whether the decrease in recent years is a trend or a statistical fluctuation is unclear.

Figure VII.4. Damage trends in India

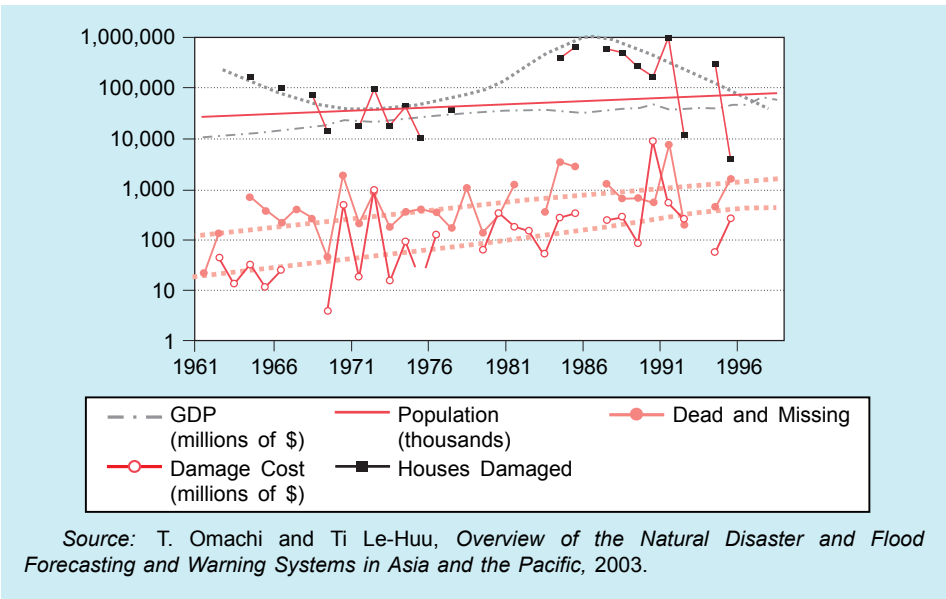


(b) Philippines

In the Asian and Pacific region, there are some variations in the intensity of the loss

In the Philippines, the number of deaths and missing persons and the amount of damage to housing are on the increase (figure VII.5). Damage to houses is relatively high because the Philippines lies in the path of cyclones, which the houses are not strong enough to withstand.

Figure VII.5. Damage trends in the Philippines

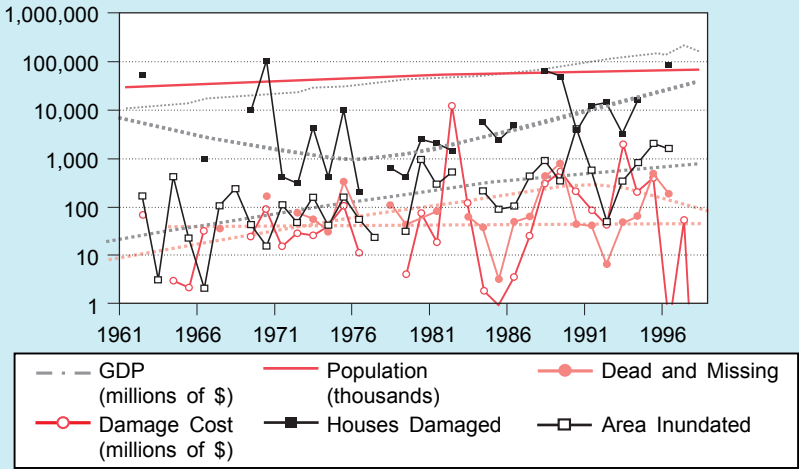


(c) Thailand

Thailand has relatively few disasters, but flooding in the Bangkok metropolis is becoming a serious problem (figure VII.6). This type of flood

results in few human losses and buildings are not apparently damaged; however, its effect on the economy is significant.

Figure VII.6. Damage trends in Thailand



Source: T. Omachi and Ti Le-Huu, *Overview of the Natural Disaster and Flood Forecasting and Warning Systems in Asia and the Pacific*, 2003.

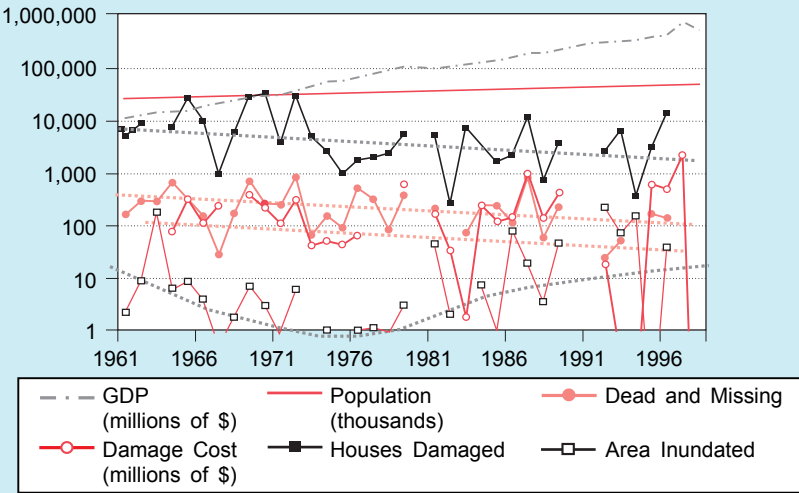
4. IMPORTANCE OF INVESTING IN INFRASTRUCTURE

The experiences of the Republic of Korea and Japan demonstrate the importance of investing in infrastructure in order to mitigate the effects of disasters.

Figure VII.7 shows the damage trends from 1961 to 1996 in the Republic of Korea, which is next to Japan in achieving rapid economic

The experiences of the Republic of Korea and Japan demonstrate the importance of investing in infrastructure in order to mitigate the effects of disasters

Figure VII.7. Damage trends in the Republic of Korea



Source: T. Omachi and Ti Le-Huu, *Overview of the Natural Disaster and Flood Forecasting and Warning Systems in Asia and the Pacific*, 2003.

development. The fact that damage to agricultural land shows no statistical trend may be a statistical matter, but a decrease in housing and human losses may be attributed to disaster prevention efforts.

Since the 1950s, Japan has spent about 1 per cent of GDP on disaster countermeasures, leading to a significant reduction in annual economic damage

In Japan, in contrast to other countries, the index of damage has decreased one order since 1961 (figure VII.8). Economic damage has not decreased in Japan in absolute terms, but as a proportion of national income the impact has decreased (figure VII.9).

Behind these figures lies the fact that, since the 1950s, Japan has spent about 1 per cent of GDP on disaster countermeasures (figure VII.9), leading to a significant reduction in annual economic damage. Despite the unpredictability of natural disasters, the damage sustained can be greatly reduced by continued effort.

Figure VII.8. Damage trends in Japan

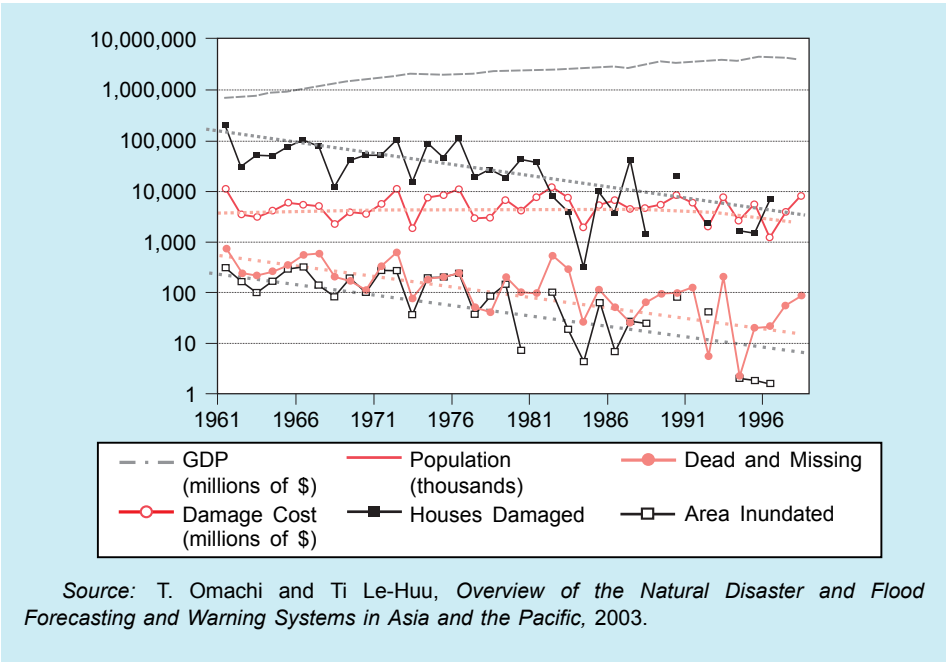
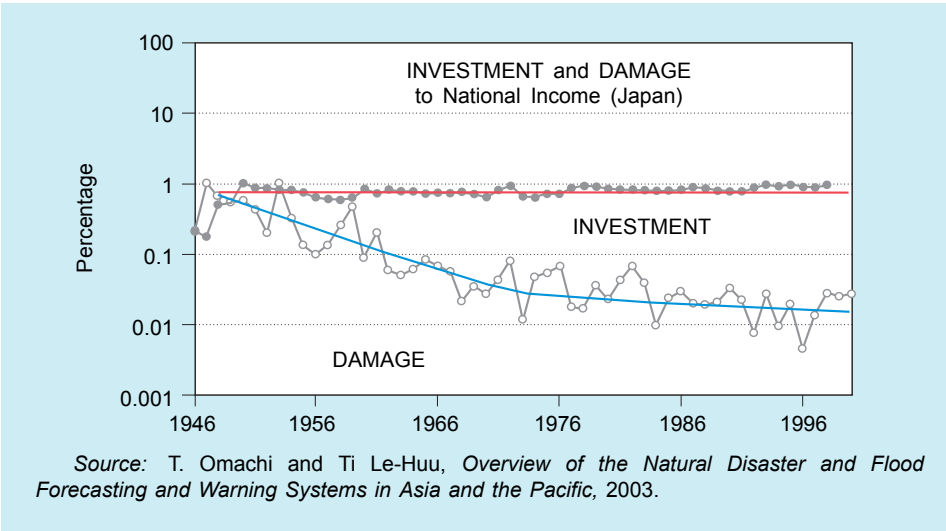


Figure VII.9. Trends of investment and damage in Japan



C. INFRASTRUCTURE AND THE MANAGEMENT OF NATURAL DISASTERS

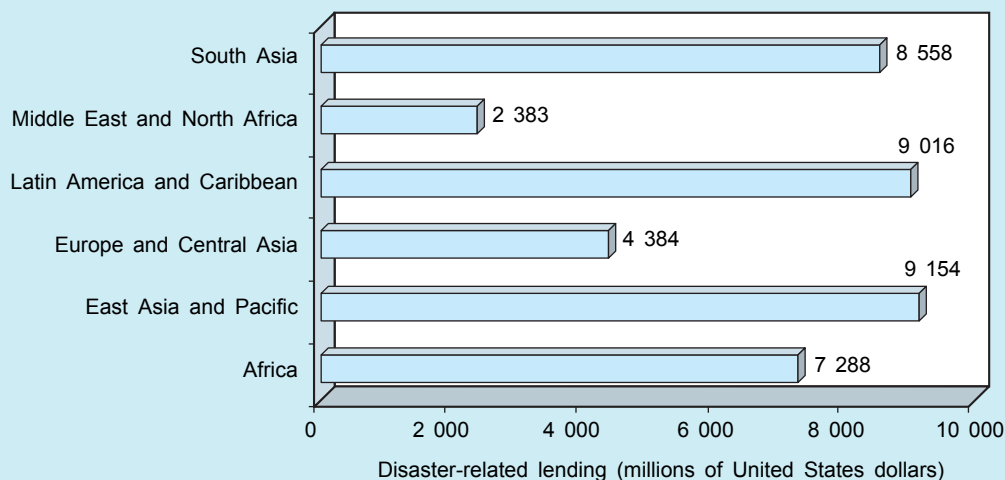
1. PHYSICAL INFRASTRUCTURE

As mentioned above, investment in infrastructure for the management of water-related disasters, such as cyclones, floods and drought, has significantly reduced loss of life, from an annual average of 100,000 during the past 50 years to 41,000 during the past 15 years.

However, investment in disaster management infrastructure falls into two categories: (a) investment in infrastructure to support sustainable socio-economic development; and (b) investment in infrastructure for reconstruction and recovery. Recent World Bank data² showed that the level of Asian and Pacific investment in infrastructure development during the past 15 years has been much lower than the economic value of the infrastructure damaged by natural disasters. The level of investment required was estimated at \$224 billion or about \$15 billion per year. The annual damage in the Asian and Pacific region was equivalent to about two-thirds of global annual lending by the World Bank. Disaster-related lending by the World Bank over the past 25 years has totalled only \$20 billion for Asia and the Pacific (figure VII.10).

The level of Asian and Pacific investment in infrastructure development during the past 15 years has been much lower than the economic value of the infrastructure damaged by natural disasters

Figure VII.10. Disaster-related lending by the World Bank, 1980-2005



Source: Saroj Kumar Jha, a presentation entitled "Mainstreaming disaster reduction in poverty reduction: attaining and sustaining MDGs", Washington D.C., World Bank, September 2005.

Recent studies by ESCAP in seven pilot countries of Asia also indicate the vulnerability of infrastructure to natural disasters.³ The loss of infrastructure, including housing facilities, was estimated to be three quarters of total

² Saroj Kumar Jha, a presentation entitled "Mainstreaming disaster reduction in poverty reduction: attaining and sustaining MDGs", Washington D.C., World Bank, September 2005.

³ Case studies on the application of ECLAC methodology to the assessment of the socio-economic impact of natural disasters in Asia, presented at the Concluding Regional Workshop, held in Bangkok from 11 to 14 October 2005. The countries studied were China, the Lao People's Democratic Republic, Pakistan, the Philippines, Sri Lanka, Thailand and Viet Nam.

damage, and about 70 per cent of the damaged infrastructure belonged to the private sector. A study by the Asian Disaster Preparedness Center on the impact of the 2004 tsunami estimated infrastructure losses at about \$4 billion, about 70 per cent of total damage of \$5.6 billion.

2. REGIONAL EXPERIENCES

The priority for enhanced regional cooperation in disaster management will be on rebuilding infrastructure and investing in infrastructure for disaster prevention and preparedness. Regional cooperation in developing the physical infrastructure for disaster management has so far been limited, but there has been more significant cooperation in building an institutional infrastructure.

The main effort at regional cooperation in physical infrastructure development was made under the auspices of ESCAP in 1957, when the United Nations embarked on a major flood control project in the Lower Mekong River Basin. Important outcomes included the Ubolratana Reservoir in the north-eastern part of Thailand, the Nam Ngum Reservoir in the Vientiane Plain of the Lao People's Democratic Republic, and the dyking system in the Vientiane Plain and Nong Khai Province on the Lao-Thai border along the Mekong River. The experience building these key physical assets offered a model for cooperation in developing transboundary river basins, but little progress has been made.

There has been increasing cooperation, however, among countries of the region with a view to developing an institutional infrastructure at the national and regional levels for dealing with disasters. Paralleling these efforts, several regional and international organizations have also increased their assistance to the developing countries in this sector. This section focuses on the experience and important achievements of the regional programme initiated by ESCAP on natural disaster risk management.

Countries in the region have put increasing emphasis on institutional infrastructure development at the national and regional levels

Since establishing the Bureau for Flood Control in 1949, ESCAP has adopted a two-pronged approach to building up regional cooperation and promoting technical cooperation and regional network-building. Over the past 50 years, ESCAP has advised and assisted its members with regard to natural disaster preparedness and mitigation, especially those aspects related to integrated water resources management. The concept of network-building figured as a main aim from the early stage of its programme and has developed into several components, of which the most effective are subregional and include the Mekong Committee, established in 1957, the Typhoon Committee, established in 1968 and the Panel on Tropical Cyclones, established in 1972.

The Mekong Committee has led to cooperation in building physical and institutional infrastructure contributing to integrated river basin development. It is important to note the achievements of the Typhoon Committee and the Panel on Tropical Cyclones in developing institutional cooperation.

The Typhoon Committee has covered a wide range of disaster reduction activities. These include the Typhoon operational experiment (TOPEX) programme, initiated in the early 1970s. The objective of TOPEX was to carry out, through cooperation in the prompt and reliable collection and exchange of observational data, an operational test of the functioning of various systems used for typhoon analysis, forecasting and warning. TOPEX consisted of three components: the meteorological, hydrological and warning dissemination and information exchange components. The programme tested

Table VII.3. Membership of the Typhoon Committee, the Panel on Tropical Cyclones and the Mekong River Commission

Name of Organization	Members
Typhoon Committee	Cambodia, China, Democratic People's Republic of Korea, Hong Kong, China, Japan, Macao, China, Malaysia, Lao People's Democratic Republic, Philippines, Republic of Korea, Singapore, Thailand, United States of America, Viet Nam
Panel on Tropical Cyclones	Bangladesh, India, Maldives, Myanmar, Oman, Pakistan, Sri Lanka, Thailand
Mekong River Commission	Cambodia, Lao People's Democratic Republic, Thailand, Viet Nam

the effectiveness of a system built up over more than a decade for flood warnings, typhoon warnings and dissemination of information to the public. Over the years, this subregional cooperation programme has continued to strengthen. An initial assessment revealed the following major achievements:

(a) A good network of modern facilities has been established with investments by the members and assistance from donors which produce good data sets on typhoons that are now available for research, particularly for typhoon and flood forecasting and warning;

(b) From the experience of joint experimental programmes related to designing typhoon and flood warning systems and developing proper techniques of warnings, a good guide has been established for improving existing forecasting systems and designing new ones in the subregion;

(c) Past joint activities, particularly those for mobilizing facilities intensively over a short period of time, have provided good lessons in the maintenance of facilities and the training of personnel. These lessons were considered to be instrumental in the smooth operation of the existing systems and the Typhoon Committee's cooperation programme on typhoon-related disaster risk management;

(d) Member countries made good progress in installing new typhoon and flood forecasting and warning systems and upgrading existing systems. As a result of the close cooperation, forecasting systems were successfully established for several pilot river basin projects in some member countries. New forecasting standards and modern equipment were introduced, including telemetry systems.

Among the latest developments, the Typhoon Committee has formulated a strategic plan on typhoon-related disaster risk management and has, since 2001, implemented it under the framework of regional cooperation among its members.

The World Meteorological Organization (WMO) and ESCAP jointly established the intergovernmental Panel on Tropical Cyclones in 1972 in recognition of the importance of an efficient cyclone warning service in the Bay of Bengal. It was noted that the loss of life and property and human suffering caused by tropical cyclones in coastal areas were sometimes severe in the area. The northern part of the Bay of Bengal was known for its potential to generate dangerously high storm tides, a major killer when associated with cyclonic storms. Out of 10 recorded cases in the world of tropical cyclones causing very heavy loss of life (from about 40,000 to well over 200,000 lives lost), eight were in the Bay of Bengal and the Arabian Sea (five in Bangladesh and three in India). The world's highest recorded storm tide, of 41 feet,

Member countries made good progress in installing new typhoon and flood forecasting and warning systems and upgrading existing systems

occurred in this region (1876, Bakherganj cyclone near Meghna Estuary, Bangladesh). Original panel members included Bangladesh, India, Myanmar, Pakistan, Sri Lanka and Thailand. The Maldives joined in 1983.

The Panel has adopted a comprehensive cyclone operational plan to provide the most effective tropical cyclone warning system possible with the existing facilities. The plan defined the sharing of responsibilities among Panel countries for the various segments of the system and recorded the coordination and cooperation achieved. It specified arrangements for standardizing operational procedures, the efficient exchange of various data related to tropical cyclone warnings, the issuance of cyclone advisories from a central location having the required facilities for the purpose, the storage of data in archives and the issuance of a tropical weather outlook for the region. The plan set out detailed procedures for preparing, distributing and exchanging information and warnings on tropical cyclones. Experience has shown that it is of great advantage to have a detailed statement of the regional procedures to be followed in the event of a cyclone. The operational plan was also designed to serve as a valuable reference tool for forecasters and other users, particularly under operational conditions.

The Panel has drawn up a technical plan aimed at developing and improving the region's cyclone warning system, which could also strengthen the operational plan. The plan is evolutionary in nature and is expected to be updated or revised from time to time by the Panel. Cooperation plans have included developing national expertise and the capacity of the member countries to predict, simulate and evaluate storm surges associated with the occurrence of tropical cyclones. The continuity in the Panel's operations since its establishment in 1972 underlines the political will to cooperate and confirms the commitment to work jointly to reduce annual disasters caused by cyclones and to improve disaster risk management.

3. TECHNICAL COOPERATION ON DEVELOPING PHYSICAL INFRASTRUCTURE FOR DISASTER PREVENTION AT THE NATIONAL LEVEL

ESCAP, in cooperation with various member countries and international organizations, has developed guidelines for better management of resources as well as effective integration of risk management into the socio-economic development process

The increased frequency of major disasters, such as the December 2004 tsunami and earthquakes in Gujarat, India; Bam, Islamic Republic of Iran; and most recently along the India-Pakistan border, has underlined the importance of technical cooperation in the region for developing better physical infrastructure. ESCAP, in cooperation with various member countries and international organizations, has developed guidelines for better management of resources as well as effective integration of risk management into the socio-economic development process. Among the most recent guidelines produced by ESCAP are:

Guidelines and Manual on Land-use Planning and Practices in Watershed Management and Disaster Reduction (1997)

Guidelines on Participatory Planning and Management for Flood Mitigation and Preparedness (2003)

D. ENHANCING REGIONAL COOPERATION IN DISASTER MANAGEMENT THROUGH INFRASTRUCTURE DEVELOPMENT

Regional cooperation in disaster risk management in the twenty-first century is expected to respond to regional and subregional development needs in a much more flexible manner. A recent regional survey and

previous assessments by ESCAP have identified a number of key issues to be addressed.

First, regional cooperation is expected to focus on emerging natural hazards of increasing intensity or to be incorporated into the disaster risk management process of regional, subregional or national development programmes. Disaster management infrastructures will need to be appropriate to a country's or subregion's level of development, capable of delivering appropriate services in a timely manner when urgent needs arise, and sustainable in the future. The gross national income (GNI) of developing countries of the region was estimated by the Asian Development Bank in 2003 at \$4 trillion⁴ and investment in disaster management infrastructure would require about 1 per cent of the region's GNI or \$40 billion per year. Regional cooperation will be essential in order to mobilize the necessary financial resources. Moreover, investment on this scale will have a long-term impact, necessitating regional cooperation to ensure that the new infrastructure is eco-efficient and contributes to sustainable economic growth in the region.

Second, the increasing socio-economic impact of regional disasters necessitates the development of knowledge-based disaster management. The great disparity in levels of development in the region calls for the use of state-of-the-art information and technologies, and for establishing regional priorities that would enable the strengthened framework of cooperation to respond better to the different needs of the subregions. One possibility for regional cooperation involves the use of satellites, as described in box VII.1.

Investment in disaster management infrastructure in the region would require about 1 per cent of the region's GNI, or \$40 billion per year

Box VII.1. Utilizing satellites for natural disaster reduction

Effective disaster management requires accurate and timely information, which is utilized for a number of vital tasks: risk assessment and preparedness before a disaster; mitigation, response and rescue operations during a disaster; and relief and rehabilitation after a disaster. It has been shown that Earth observation satellites can make a significant contribution in this regard, and efforts have been made to address the gaps between the experimental and operational uses of such information and relevant decision-making tools. Already recognized by spacefaring countries, this has become a priority area for international cooperation, and attention has been focused on providing near real-time satellite information free of charge during major disasters.

As current Earth observation satellites were launched to fulfil various mission objectives with different orbit characteristics and different types of equipment, they could not meet the operational requirements for disaster management, particularly consistency and timeliness. The concept of a satellite constellation for disaster management was then proposed with the objective of building a dedicated information-gathering infrastructure for effective and informed disaster management. Developing and maintaining such a satellite constellation would involve investing and sustaining a steep level of financial, human, technical and institutional resources. Broad international cooperation would be indispensable.

An implementation concept proposed by China in 2001 envisioned a constellation comprising eight satellites positioned in low earth orbits. Four of the satellites would be equipped with optical remote sensors and, orbiting at 650 km above the Earth, would be capable of revisiting any spot on the planet at 12-hour intervals. The other four satellites would be equipped with imaging radar capable of penetrating clouds for all-weather monitoring of the Earth's surface at 24-hour intervals. The comprehensive disaster-monitoring capability of the constellation might enable a shortening of the interval, perhaps to fewer than 12 hours at the equator and even shorter in higher latitude areas; at 40 degrees, for example, the interval might be only 6 hours. The constellation's usefulness would not be confined to supporting operations in the midst of a disaster or in its wake. The

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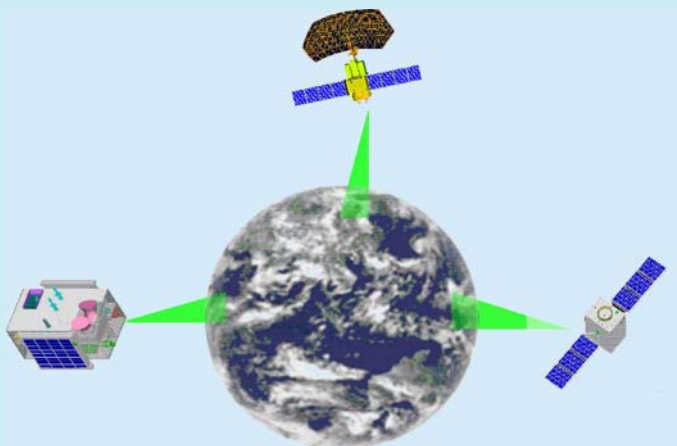
⁴ ADB, *Key Indicators of Developing Asian and Pacific countries 2005*, (Manila, ADB, 2005)

(Continued from preceding page)

constellation's consistent information and application models could enable it to contribute greatly to efficient pre-disaster risk assessment and preparedness, the absence of which was highlighted after the Indian Ocean tsunami occurred in December 2004.

With a view to deploying the constellation in the near future through regional and international cooperation, China has begun to work on a baseline system, which it hopes to complete by 2007. The baseline system consists of two optical satellites and one radar satellite, three receiving stations in China, and an application system under the coordination of the National Disaster Reduction Center of China (see figure). It is believed that, after the baseline system is deployed, relevant application models can be developed in interested countries through regional cooperation, the preliminary benefits of the constellation will be recognized and the functions and capabilities of the constellation as a tool and an infrastructure for disaster management will be well demonstrated. Substantive cooperation towards full deployment of the constellation can then be initiated.

China has suggested that the cooperation modes could be flexible at different levels. Individual countries could, according to their intentions and capacity, produce satellites for the constellation, develop satellite subsystems jointly, establish application systems or make financial contributions. ESCAP could extend support for such cooperation by providing a forum for dialogue and by serving as a facilitator in the development of the satellite system.



1. PERSISTENT TRENDS IN DISASTER RISKS IN THE SUBREGIONS

From 1950 to 2005, the disasters that had the most lasting socio-economic impact in the region were caused by cyclones, floods, earthquakes and drought, according to an analysis by the Centre for Research on the Epidemiology of Disasters at the Université Catholique de Louvain in Belgium. However, the impacts appear to have varied among the subregions.

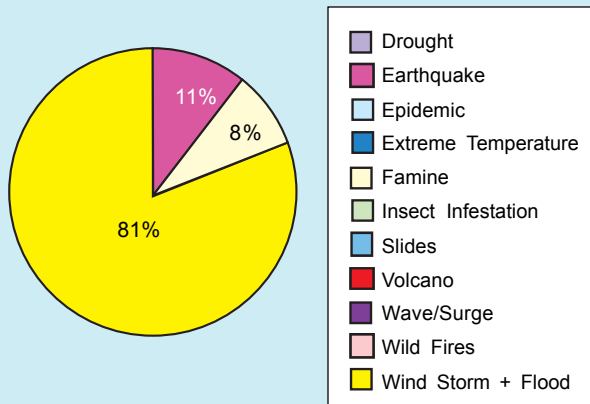
(a) North-East Asia

In North-East Asia, typhoons and floods were found to have caused the most damage during the period from 1950 to 2005 (figure VII.11), accounting for about 81 per cent of deaths and 60 per cent of the total damage. In contrast, disasters caused by earthquakes accounted for only 11 per cent of the total number of deaths (or nearly 300,000 people) and 39 per cent of the economic damage (or about \$150 billion) during this period.

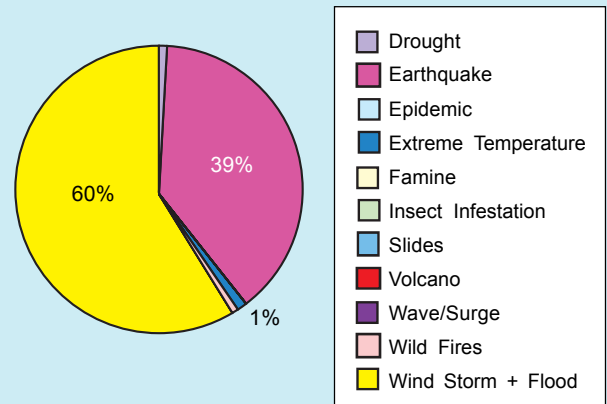
From 1950 to 2005, the disasters that had the most lasting impact in the region were caused by cyclones, floods, earthquakes and drought

Figure VII.11. Impact of natural disasters in North-East Asia

Number of Deaths by Disasters in North-East Asia
(without Russian Federation) (Total: 2,649,275: 1950-2005)



Damage in United States dollars in North-East Asia (without Russian Federation) 1950-2005 (Total=\$386.6 billion)



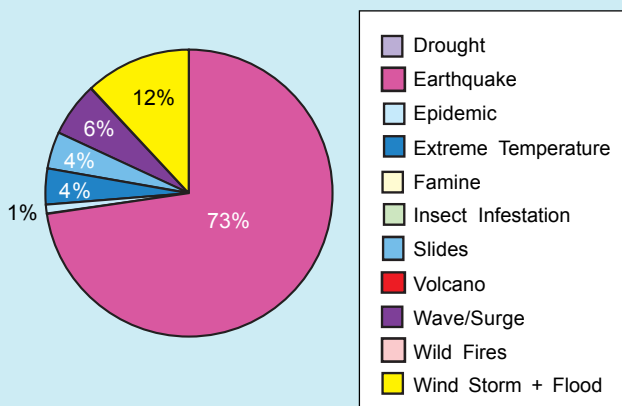
Source: EM-DAT, the OFDA/CRED International Disaster Database (www.em-dat.net), Université Catholique de Louvain, Brussels, Belgium.

(b) Central Asia

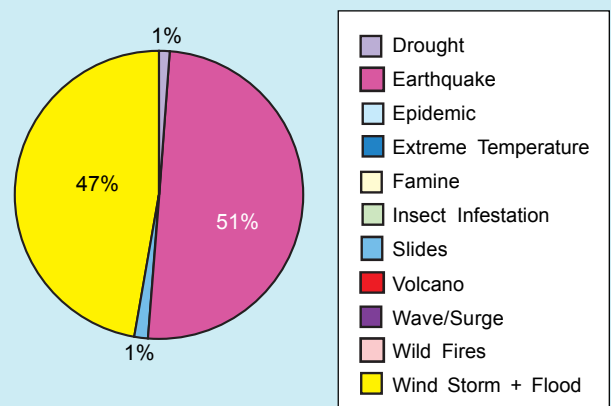
In Central Asia, earthquakes were the most damaging disasters (figure VII.12), resulting in nearly 73 per cent of the loss of life and 51 per cent of the economic damage. Wind storms and floods appeared to have economic impacts comparable to those of earthquakes but have resulted in far fewer deaths.

Figure VII.12. Impact of natural disasters in Central Asia

Number of Deaths by Disasters in Central Asia + Russia (Total: 38,200: 1950-2005)



Damage in United States dollars in Central Asia + Russia, 1950-2005 (Total=\$47.8 billion)

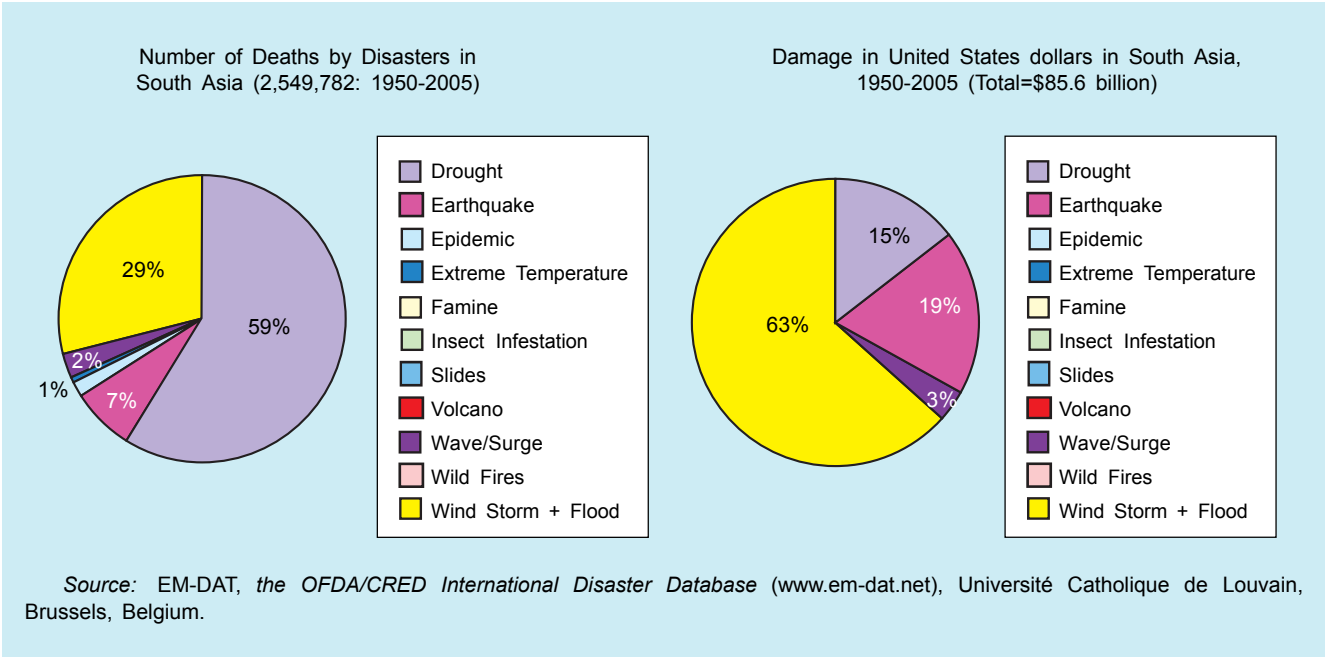


Source: EM-DAT, the OFDA/CRED International Disaster Database (www.em-dat.net), Université Catholique de Louvain, Brussels, Belgium.

(c) South Asia

In contrast to the other subregions, most deaths in South Asia during the past 55 years were caused by drought (59 per cent), followed by cyclones and floods (29 per cent) (figure VII.13). Earthquakes also caused a considerable number of deaths (50,000, 7 per cent). The greatest economic damage was caused by cyclones and floods (63 per cent), followed by earthquakes (19 per cent) and drought (15 per cent).

Figure VII.13. Impact of natural disasters in South Asia



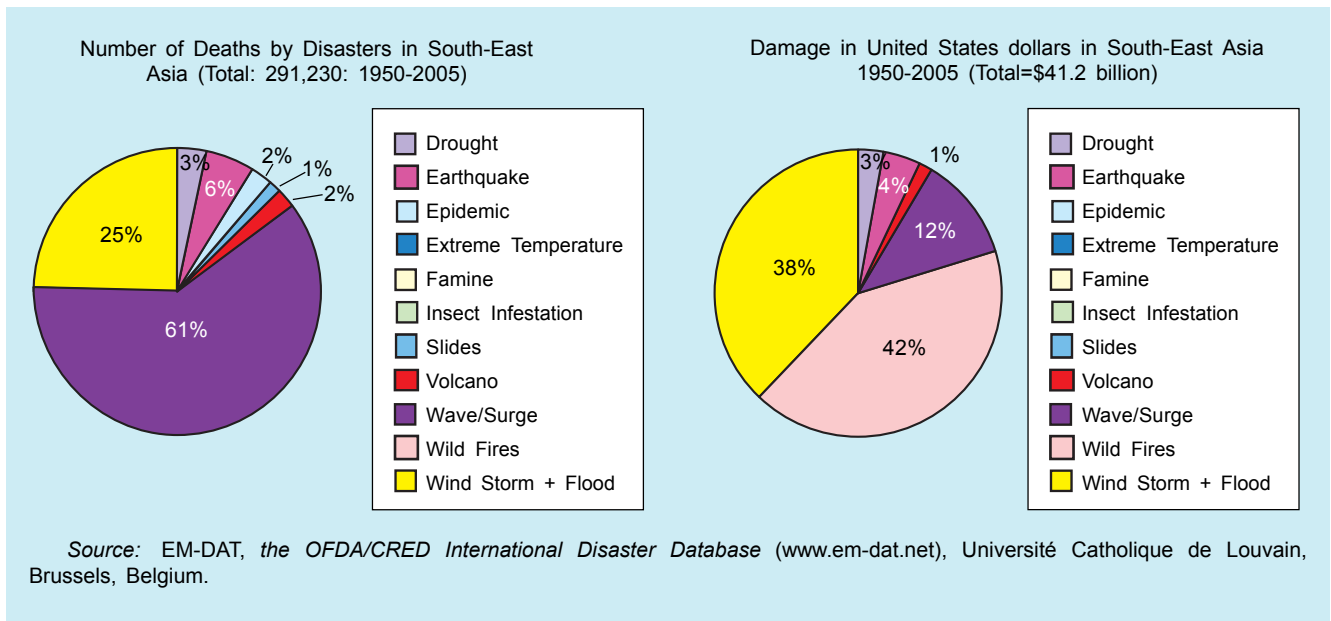
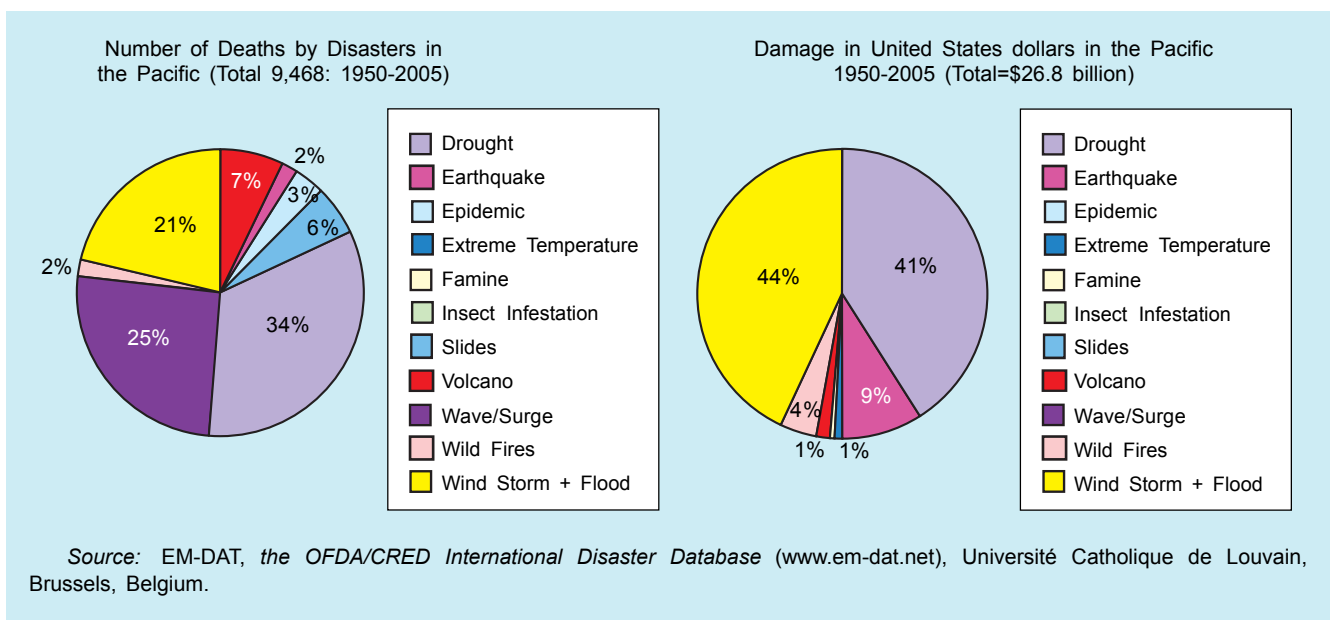
(d) South-East Asia

The December 2004 tsunami disaster appears to have completely changed the pattern of deaths resulting from natural disasters. Waves and surges now account for 61 per cent of the total number of deaths, followed by wind storms and floods (figure VII.14). The worst economic damage resulted from wild fires (42 per cent), followed by wind storms and floods (38 per cent) and waves and surges, including the tsunami (12 per cent). This has prompted enhanced cooperation in tsunami early warning in the region.

(e) The Pacific

The pattern of impacts of natural disasters in the Pacific (figure VII.15) appears to be quite different from that of the other subregions. Drought, wave/surges and wind storm/floods had almost similar impacts in terms of loss of lives, accounting for 34, 25 and 21 per cent of deaths respectively. However, wind storms/floods and drought had a much more severe economic impact (causing 44 and 41 per cent of damage respectively).

The level of investment needed annually for disaster preparedness and recovery and reconstruction in developing countries of the Asian and Pacific region is estimated at \$55 billion

Figure VII.14. Impact of natural disasters in South-East Asia**Figure VII.15. Impact of natural disasters in the Pacific**

2. INVESTMENT IN INFRASTRUCTURE IN THE CONTEXT OF DISASTER MANAGEMENT

The annual investment needed for disaster preparedness in developing countries of the Asian and Pacific region is estimated at \$40 billion or 1 per cent of the region's GNI, and reconstruction of infrastructure and economic recovery would require an estimated \$15 billion, for a total infrastructure financing requirement estimated at \$55 billion per year. These estimates are based on recent ESCAP studies and the damage sustained in disasters in developing countries, which has averaged about \$21.3 billion per year over the past 15 years.

3. PRIORITY AREAS FOR ENHANCED REGIONAL COOPERATION IN INFRASTRUCTURE DEVELOPMENT

Beyond the overall objective of reducing the number of deaths and the extent of economic loss from natural disasters across the region, plans for infrastructure development need to reflect the varying priorities of the different subregions. It is important to develop multi-hazard early warning systems to ensure the efficiency and sustainability of programmes, but in each subregion these could focus on the main threats in order to maximize the benefits of synergy. Regional infrastructure should also aim at facilitating the exchange of information on best practices for disaster risk management at different levels, including the community level, as well as hazard monitoring technology.

The priority areas listed in table VII.4 are therefore recommended to enhance regional cooperation in the development of disaster infrastructure.

Table VII.4. Priority areas in enhancing regional cooperation on disaster infrastructure development

Scale	Type of infrastructure	Scope	Goals
Regional	Mechanism for effective investment	Investment in infrastructure for disaster prevention and recovery	- Promoting of risk transfer (insurance) - Assisting the private sector of developing countries in reconstruction and rehabilitation - Mobilizing of resources for investment in disaster prevention
Regional	Networks for information sharing on best practices	Disaster risk management	- Monitoring hazards - Community-based disaster risk management - Building resilience to communities and nations to natural disasters
Subregional	Multi-hazard early warning system	Monitoring and forecasting tsunami and tropical cyclones	- Reducing the number of deaths - Minimizing socio-economic impacts - Providing a framework for economic development: tourism development
South-East Asia	Centre for regional haze monitoring and prevention	Forest fires management	- Preventing and reducing impact of forest fires - Resource utilization - Emergency response
South Asia	Centre for earthquake monitoring and disaster mitigation	Information sharing	- Monitoring hazards - Best practices in community-based disaster risk management
Pacific	Subregional centre on disaster risk management	Resource sharing	- Economies of scale - Supporting economic development
North-East Asia	Research centre	Identifying emerging trends of natural hazards	- Reduce the impact of global climate change - Reduce the impact of sand-storms

E. CONCLUSION

1. SUMMARY

The level of regional investment in infrastructure development during the past 15 years has been much lower than the economic value of the infrastructure damaged by natural disasters in developing countries, estimated at \$224 billion or about \$15 billion per year. Private sector infrastructure accounted for more than 70 per cent of all infrastructure damage. The loss of infrastructure resulting from the December 2004 tsunami disaster was about 70 per cent of the total damage.

Countries in the region have placed increasing emphasis on building up institutional infrastructure at the national and regional levels. Regional investment in effective disaster prevention in developing countries would require about 1 per cent of GNI, or about \$40 billion per year, with a further \$15 billion for rehabilitation and recovery.

Regional cooperation for better disaster management would need to reflect the priorities of each of the five subregions: typhoons and floods in North-East Asia; earthquakes in Central Asia; drought and cyclones in South Asia; waves (tsunamis), wild fires and storms/floods in South-East Asia; and drought, wave/surges and wind storms/floods in the Pacific. Apart from the physical infrastructure mentioned earlier, the following types of institutional infrastructure were identified as possible priority areas for regional cooperation: (a) a mechanism for effective investment in physical infrastructure; (b) networks for information sharing on best practices; (c) multi-hazard early warning systems; (d) a centre for regional haze monitoring and prevention in South-East Asia; (e) a centre for earthquake monitoring and disaster mitigation for South Asia; (f) a subregional centre on disaster risk management in the Pacific, and (g) a research centre on climate change for North-East Asia.

2. WAYS FORWARD

Four regional initiatives can be undertaken to enhance regional cooperation on infrastructure development relating to disaster management reflecting the priorities identified.

- **Establishment of a regional mechanism for effective post-disaster recovery investment:** In view of the large requirement of the private sector for post-disaster reconstruction and rehabilitation and disaster preparedness in the region, estimated at \$55 billion per year, the establishment of an effective mechanism to mobilize resources and to implement a regional strategy of risk transfer is necessary to ensure achievement of the Millennium Development Goals and the sustainable socio-economic development of the region.
- **Promotion of regional multi-hazard early warning and monitoring systems:** The regional trust funds on tsunami early warning could be further promoted to cover other regional hazards for specific subregions, such as sandstorms for North-East Asia, drought for South Asia, meteorological hazards for the Pacific, forest fires for South-East Asia and earthquakes for Central Asia. Proposals for this extension need to be submitted to the Commission for consideration.

Four regional initiatives can be taken to enhance regional cooperation on infrastructure development relating to disaster management and reflecting the priorities identified

- **Development of institutional infrastructure for subregional co-operation on disaster management:** Institutional infrastructure for subregional cooperation can be initiated on the basis of early warning and monitoring as mentioned above. ESCAP may require a clear mandate to study the feasibility for each subregion as well as for the region. Proposals have been made by a number of countries in the region to establish various centres, such as the proposal for a regional centre for disaster management or a subregional centre for disaster risk management in the Pacific.
- **Regional cooperation on integrating the eco-efficiency of physical infrastructure into decision making:** Incorporating the green growth concept is desirable for the development of physical infrastructure not only for disaster management but also for socio-economic development. Regional cooperation is therefore proposed to develop guidelines, including procedures and criteria for physical infrastructure development.

VIII. ENHANCING REGIONAL COOPERATION IN FINANCING INFRASTRUCTURE INVESTMENT

A. INTRODUCTION

Asian and Pacific countries in the region face huge annual infrastructure investment requirements and an equally huge gap in available financing, as indicated in chapter II. Any effort to narrow the gap would require a collaborative effort among all stakeholders, including the private and public sectors both within and across countries. Infrastructure also has a number of cross-border implications. In this context, enhancing regional cooperation in financing infrastructure investment would play a critical role in infrastructure development in the region.

Sound infrastructure is necessary for a country to benefit fully from openness to trade and investment. A general belief is that openness to international capital flows, which ushers substantial foreign direct investment into many countries, would provide countries with the opportunity to make use of regional capital markets in particular and international markets in general to finance infrastructure investment through regional financial intermediation. However, this has not happened so far. Is that a result of something inherent in international capital markets, or of inadequate institutional arrangements that have precluded countries and regional institutions from being able to access capital markets adequately for infrastructure development? The Asian and Pacific region is somewhat unique in the sense that there is a massive amount of resources in surplus savings and foreign exchange reserves available intraregionally. Is there scope for using these resources through regional cooperation in financing of the infrastructure gap? What has been done so far? Is there a need for institutional innovations to help close the region's infrastructure gap, and if so, what kind of innovations? These are some of the questions explored in this chapter.

Chapter II introduced the issues of infrastructure investment needs, the availability of financial resources and the gap they leave. The present chapter is organized as follows. Section B revisits and further analyses infrastructure investment needs and the financing gap. Section C examines various sources of financing of infrastructure, both domestic and international, including FDI and international and regional capital markets. Section D explores regional cooperation in infrastructure finance. Is there scope for an institution similar to the European Investment Bank, i.e., an Asian investment bank which could finance capital investment projects in Asian and Pacific countries using funds raised from private capital markets? What are the possible alternatives to such a bank? In particular, should there be a few subregional banks or funds rather than a single large financing entity, or would it be preferable (or practicable) to consider expanding the role of an existing institution such as the Asian Development Bank in some manner? Section E concludes with a brief action plan to further the effort to effectively address the region's financing gap in infrastructure investment.

Infrastructure has cross-border implications; therefore, enhancing regional cooperation in financing infrastructure investment would play a critical role in infrastructure development in the region

B. INFRASTRUCTURE FINANCING GAP

Attempts to estimate the infrastructure needs of individual countries, let alone those of the developing Asian and Pacific region as a whole, are fraught with many difficulties. Foremost among these is the lack of data on certain areas/scales and issues relating to a notional target for infrastructure investment. The study therefore relies on adapting existing estimates from other sources. This section provides analysis of three different sources of estimates on infrastructure financing:

- (a) Estimates by the World Bank, Asian Development Bank (ADB) and Japan Bank for International Cooperation (JBIC)¹
- (b) Sectoral estimates by ESCAP based on its own and various other sources and information
- (c) Estimates by ESCAP based on item (a) above plus new information

Table VIII.1 below provides a summary of infrastructure financing needs for Asia and the Pacific as estimated by the World Bank, ADB and JBIC (see annex VIII.1 for some details of how the estimates were produced). Based on their studies it is indicated that developing Asian and Pacific countries need investments annually of \$228 billion from 2006 to 2010, nearly half of it for the energy sector.

Table VIII.1. Estimates of infrastructure financing needs for Asia and the Pacific

Sector		Annual average infrastructure needs during the period 2006-2010 (Billions of United States dollars)		Percentage
Energy			107.3	47.1
Telecommunications	Main lines	30.8		15.8
	Mobile	5.2	36.0	
Transportation	Paved roads	56.4		26.6
	Railroads	4.3	60.7	
Water and sanitation	Water	13.0		10.6
	Sanitation	11.1	24.1	
Total			228.1	100
Sources: Marianne Fay and Tito Yepes, "Investing in infrastructure: what is needed from 2000 to 2010?", World Bank Policy Research Working Paper 3102 (Washington, D.C., World Bank, July 2003) and Tito Yepes, "Expenditure on infrastructure in East Asia region, 2006-2010", background paper for Asian Development Bank, Japan Bank for International Cooperation, World Bank, East Asia Pacific Infrastructure Flagship Study (Washington, D.C., World Bank, 2004).				

¹ Marianne Fay and Tito Yepes, "Investing in infrastructure: what is needed from 2000 to 2010?", World Bank Policy Research Working Paper 3102 (Washington D.C., World Bank, July 2003) and Tito Yepes, "Expenditure on infrastructure in East Asia region, 2006-2010", background paper for Asian Development Bank, Japan Bank for International Cooperation and World Bank, East Asia Pacific Infrastructure Flagship Study (Washington, D.C., World Bank, 2004).

All "estimates" are based on a set of assumptions and thus have their strong points and weak points. The strong point of the estimate that the region's infrastructure requires an annual investment of \$228 billion is that the figure is derived from transparent and consistent methodology. The estimate assumes that the model incorporates constant and stable stock-flow proportionality in infrastructure, but this is based on demand-side variables and suffers from the usual statistical and data limitations. Moreover, the methodology uses data pertaining to infrastructure assets, which are clearly and consistently defined over time and space. However, the shortage of time series data covering a fairly long period (1960-2000), which is needed to generate stable and reliable econometric estimates, imposed a bias towards underestimating the infrastructure investment required. The estimate takes account of only a limited number of infrastructure sectors (railways and roads, electricity, mobile and land telephones and water and sanitation). It did not include many areas which have shown phenomenal growth in the recent years, such as oil, city and urban transportation (underground and elevated trains) and the Internet, especially broadband, in information and communication technology. The above figure also does not include the investment required for disaster management facilities or the infrastructure investment requirements for Central Asia, owing to the difficulties in segregating Central Asian countries from European countries. As a result, the \$228 billion per year estimate significantly understates the region's infrastructure investment needs.

Studies indicate the Asian and Pacific region will need infrastructure investment of \$228 billion per year from 2006 to 2010, but this is the "lowest benchmark estimate"

By comparison, the Asia-Pacific Infrastructure Forum estimates the region's investment requirements at \$300 billion per year.² Agarwala and De (2005)³ estimated Asia's infrastructure investment needs at \$377 billion annually during the next five years.⁴ Furthermore, a summary of the estimates of sectoral investment needs, provided in chapters III to VII (see table VIII.2) brought forward to reflect current prices and assuming a very conservative discount rate of 2 per cent per annum for United States dollar assets,⁵ estimates total infrastructure investment needs at \$608 billion at 2004 prices. Not surprisingly, energy and transport account for the major share of this total, as in the estimates of Fay and Yepes (2003) and Yepes (2004).⁶

Total infrastructure investment needs could be as high as \$608 billion per year

An estimate of \$430 billion per year, which is higher than \$228 billion also emerges when annual infrastructure financing needs are calculated as a percentage of GDP for each subregion, as computed by Fay and Yepes (see table VIII.3)⁷ and supplemented by financing needs (at 2004 prices) for disaster preparedness and infrastructure recovery from disasters.

² The Asia-Pacific Infrastructure Forum 2004 website, <www.infrastructureforum.com.au/>.

³ Ram Agarwala and Prabir De, "Financial cooperation for infrastructure development in Asia", paper presented at the Fourth High Level Conference on Asian Economic Integration: Towards an Asian Economic Community, held in New Delhi on 18 and 19 November 2005.

⁴ Ibid.

⁵ See chapters III to VII for sectoral estimation methodologies. A discount rate of 2 per cent was assumed based on a 10-year inflation indexed treasury coupon rate of 1.875 per cent and a yield of 2.05 per cent (available at <www.bloomberg.com/markets/rates/>, accessed on 11 January 2006). Implicit GDP deflator during the past four years averaged 2.175 per cent.

⁶ Fay and Yepes, op. cit., and Yepes, op. cit.

⁷ Fay and Yepes, op. cit.

Table VIII.2. Sectoral estimates for developing countries in Asia and the Pacific

Sector	Annual average infrastructure financing need (Billions of United States dollars)			Percentage
	Period	Amount (at 2000 prices)	Amount (at 2004 prices)	
Energy	2006-2015	185.4*	200.7	33.0
Telecommunications	2001-2030	19.1	20.6	3.4
Transportation	2006-2015	206.9**	224.0	36.8
Water and sanitation	2002-2025	98.9	107.0	17.6
Subtotal		510.3	552.3	91.8
Add: disaster preparedness and rehabilitation		51.8***	56.1	9.2
Total		562.1	608.4	100

Source: Assumptions and sources of data are explained in Chapters III to VII of the present publication.

* Data relating to the Republic of Korea are not included.

** Data relating to transport in 2004 prices (estimated at \$224 billion) are discounted at the rate of 2 per cent to obtain data at 2000 prices.

*** Data relating to disaster preparedness and rehabilitation (estimated at \$55 billion in 2003) discounted at the rate of 2 per cent to obtain data at 2000 prices. The same discount rate has been used to convert data at 2004 prices.

Table VIII.3. Infrastructure financing needs revisited

Subregion	Annual average infrastructure investment needs as a percentage of GDP (2006-2010)	Annual investment needs at 2004 prices (billions of United States dollars)
East Asia and the Pacific	6.57	237.0
South Asia	6.87	90.7
Central Asia	6.92	46.1
Subtotal		373.8
Add: disaster preparedness and infrastructure recovery		56.1
Total		429.9

Source: ESCAP estimates based on annual infrastructure investment needs as a percentage of GDP in Marianne Fay and Tito Yepes, "Investing in infrastructure: what is needed from 2000 to 2010?", World Bank Policy Research Working Paper 3102 (Washington, D.C., World Bank, July 2003).

The infrastructure financing gap could be in the range of \$180 billion to \$220 billion per year

A summary of the infrastructure financing needs based on different sources is given in table VIII.4. It may be observed that there are significant differences in the infrastructure financing gaps mainly because of differences in estimation methodologies, coverage (both country and infrastructure types under a particular sector), data availability and the number of countries reporting.

Three points can be highlighted. First, ADB, JBIC and World Bank estimate of \$228 billion is the lowest among all estimates and hence can be used as the lowest benchmark. Assuming that assured resources available to finance infrastructure investment would stand at \$47.8 billion annually (see chapter II), the resulting financial gap would be \$180 billion per year.⁸

⁸ The amount of \$47.8 billion is the average over the period 2000-2003 of government investment on transport, ICT and energy, as reported by major countries in IMF Government Financial Statistics and private investment as reported by the World Bank.

Table VIII.4. Summary of infrastructure financing needs from different estimates

Source	Amount (Billions of United States dollars)	Financing gap (Billions of United States dollars)	Remarks
Asian Development Bank, Japan Bank for International Cooperation and World Bank (2000 prices)	228	180	Estimates are based on aggregate demand
Estimates derived from sectoral studies by ESCAP (2004 prices)	608	220	Estimates are based on sectoral demand
Sources: Asian Development Bank, Japan Bank for International Cooperation and World Bank, <i>Connecting East Asia: A New Framework for Infrastructure</i> (Manila, Asian Development Bank, Japan Bank for International Cooperation and World Bank, 2005) and ESCAP estimates.			

Second, according to the sectoral estimates, the total infrastructure investment requirement is estimated to be \$608 billion (at 2004 prices). Based on national and other sources, the actual total investment in infrastructure in developing countries of the Asian and Pacific region is estimated to be about \$388 billion per year in recent years, most of which has been mobilized through the banking system and capital markets. Using this estimate (\$388 per year) as the assured resources, the financing gap is estimated to be \$220 billion annually. The gap corresponding to the ESCAP estimate exceeds the \$180 billion computed in the study by ADB, JBIC and the World Bank. Third, the huge dimensions of the resource gap would require similar extensive efforts by Asian and Pacific countries to cooperate in addressing the gap.

C. SOURCES OF FINANCING IN INFRASTRUCTURE

In view of these large financing requirements, from where is the supply of funds expected to come? The Asian and Pacific region has resorted to various sources of financing for infrastructure ranging from government budgets to foreign direct investment.

1. GOVERNMENT BUDGETS

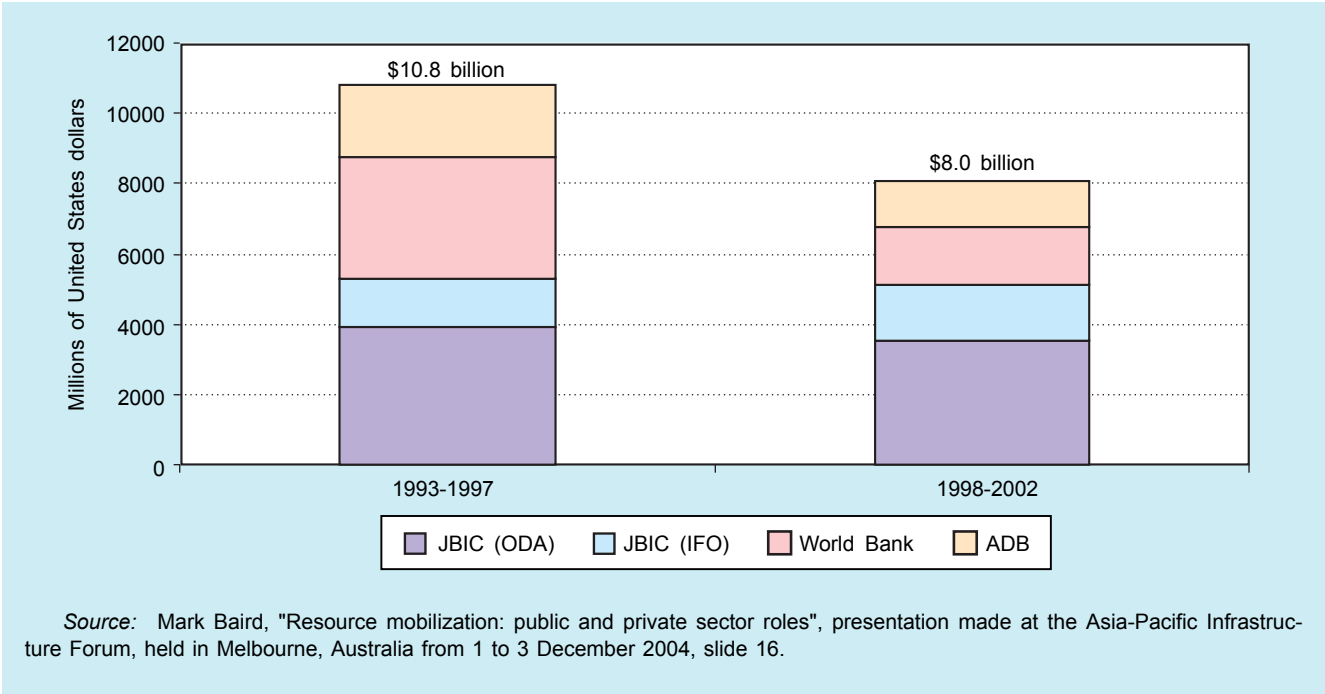
Many infrastructure projects have public good characteristics in terms of increasing the number of people who can use them at no significant additional cost. In addition, because infrastructure projects have significant forward as well as backward linkages in the economy, externalities inevitably occur in their production and consumption. Marginal social benefits often exceed marginal private ones, in which case the market provision of public goods may be less than optimal. Incomplete markets and imperfect and asymmetrical information also cause the market to fail at times. All these factors help to explain government intervention in the ownership and provision of infrastructure goods.

The high asset specificity of infrastructure (including long gestation periods, high incremental capital output ratios, low returns and lumpiness of capital) saddles infrastructure with financing risks that create serious disincentives to private investors. As a result, infrastructure projects have generally been publicly financed. In the early 1990s, 70 per cent of the infrastruc-

High asset specificity saddles infrastructure with financing risks that tend to deter private investors and give Governments a key role in infrastructure development

ture investments were publicly financed, while about 22 per cent were privately funded and the remaining 8 per cent were funded by ODA.⁹ However, public financing of infrastructure has declined over the years from 60 per cent in 1995 to 54 per cent by 2003.¹⁰ Funding of infrastructure in all developing countries by multilateral organizations also declined by 47 per cent between 1993 and 2002.¹¹ This, combined with the growing fiscal stress faced by Governments in this era of globalization, has led economists and policymakers to consider alternative, mainly private, sources of funding to fill the large and burgeoning infrastructure gap.

Figure VIII.1. Official lending for infrastructure projects in the Asian and Pacific region, 1993-2002



2. DOMESTIC BANKING SYSTEM

A number of countries have funded large-scale infrastructure projects with domestic savings intermediated via the banking system. China has used this modality extensively and such directed lending at relatively low rates has ensured that infrastructure projects have been comparatively well funded. In 2002, 31 per cent of infrastructure investment in China was financed by banks' corporate loans.¹²

⁹ See World Bank, Private Participation in Infrastructure website, <www.worldbank.org/infrastructure/ppi/index.html>.

¹⁰ IMF, Government Finance Statistics August 2005 CD-ROM; International Financial Statistics August 2005 CD-ROM; World Bank, World Bank annual reports (various years), World Development Indicators 2005 CD-ROM, Private Participation in Infrastructure Database, <<http://ppi.worldbank.org>>, accessed on 2 September 2005.

¹¹ World Bank, *Global Development Finance 2004: Harnessing Cyclical Gains for Development* (Washington, D.C., World Bank, 2004), p. 163.

¹² D.H. Scott and Ivan Weber, "China's corporate bond market: creating new options for infrastructure finance", mimeo (June 2004).

Although such a policy of directed credit can work well for a limited period, concerns persist about the impact on the domestic banking system (large non-performing loans), off-balance-sheet liabilities of the Government and possible over-investments in fixed capital in some areas. As China continues to reform its domestic banking system, directed credit policies will be used less. Most other Asian and Pacific developing countries do not have the quantum of domestic savings to emulate the experience of China or have financial systems that are more market-based; therefore, they are unable to channel funds (bank deposits) into infrastructure projects. Countries in Asia and the Pacific thus need to consider diversifying domestic sources of financing from banks to other more innovative (non-bank) forms of financing.

There is a need to consider diversifying domestic sources of finance away from banks to other more innovative forms of financing

For countries that are unable to enhance public funding for infrastructure investment because of high consolidated fiscal deficit, special instruments and other innovative means have been used to tap domestic resources and to enhance public-private partnerships for infrastructure development. India created the "special purpose vehicle" (SPV) in its Union Budget (2005-2006) to finance infrastructure projects that had difficulty raising private resources. SPV will offer long-term loans for selected projects in key areas, including roads, seaports, airports and the tourism sector in order to supplement loans from banks and financial institutions.

The SPV, called "Infrastructure Development Finance Company Ltd." is under the purview of the Finance Ministry but is to be distinct from the fiscal budget. It will be allowed to raise long-term funds from the domestic as well as international capital markets. The Government of India will provide at least a partial guarantee, thus reducing the credit risk. This in turn should help to keep the cost of borrowing by the SPV fairly low, although conversely, it effectively raises the Government's contingent or off-budget liabilities.¹³ This hidden deficit is one of the main reasons why fiscal authorities in India and elsewhere generally seem to prefer using the indirect means of capital expenditure financing (via an SPV) rather than selling bonds directly to the central bank in return for reserves. However, while the SPV scheme is an innovative accounting device, for all intents and purposes, the economic consequences could be similar to running an actual fiscal deficit. The Government has decided not to offer any guarantees for exchange rate risks and not to compensate the SPV for depreciation of the rupee, but in the event of a major default by the SPV, the Government may have to bail it out to avoid the type of adverse nationwide impacts that arose as a result of the 1997 Asian financial crisis. Such concerns have led to suggestions that most funding for SPVs comes from domestic sources rather than external borrowing, which will raise the country's overall indebtedness. This issue is discussed further in the next section.

Special purpose vehicles are gaining momentum as an instrument of infrastructure financing

3. USE OF FOREIGN EXCHANGE RESERVES

Many countries in the region have been contemplating using part of their foreign exchange reserves to fill at least partially their infrastructure

¹³ See Ashoka Mody, "Contingent liabilities in infrastructure: lessons of the East Asian Crisis", mimeo, the World Bank (May 2000) and Timothy Irwin, "Fiscal support for infrastructure: toward a more effective and transparent approach", based on a background paper written with Hana Bixi, presentation made at the Infrastructure in East Asia and the Pacific: Bali Workshop, Bali, Indonesia, 29 June 2004 for discussions on contingent liabilities in infrastructure, with particular reference to the East Asian crisis of 1997-1998 and its aftermath.

The possible use of reserves for financing infrastructure investment has been prompted by growing recognition of the high opportunity costs of holding reserves

financing gap prompted by growing recognition of the high opportunity costs of maintaining reserves compared with the yield from safe assets such as United States treasury bonds.¹⁴ At first glance, this appears to be an attractive proposition, but there are specific concerns about channelling reserves to fund infrastructure. In particular, countries need to be wary of the potentially inflationary consequences, as the proposal effectively implies that additional liquidity will be released into the economy. To the extent that improved infrastructure raises the supply capacity of the country, the inflationary consequences of excess liquidity may be short-lived, but the risk is that those consequences can last for quite some time in view of the long gestation period of infrastructure projects. One seemingly ingenious method of limiting the potential inflationary effects is to require that most of the intermediate inputs needed for local infrastructure projects (steel, cement, machinery, technology) be imported. The logic for such action is that imports do not add to domestic demand and can thus ease immediate inflationary pressures. The rise in imports will also reduce the size of the country's balance of payments surplus, hence moderating the pace of future reserve buildup. The problem is that the import-intensity of infrastructure development, and therefore the extent of its inflation-neutrality, is unclear.

4. PRIVATE INTERNATIONAL INVESTMENT: FOREIGN DIRECT INVESTMENT

New technologies have made it feasible to unbundle large-scale projects and to introduce a degree of competition into some infrastructure projects that were in the past considered natural monopolies. For instance, the development of wireless telephony and fibre-optic cable has increased the scope for competition even in basic line networks.¹⁵ Changes in the regulatory environment in many countries, including innovations in contractual arrangements, such as build, operate and transfer and build, own and operate have further increased the feasibility of private sector involvement in, and ownership of, infrastructure projects in a number of areas.¹⁶ A large variety of public-private partnerships (PPPs) have surfaced to facilitate provision of infrastructure services in both traditional areas, such as small water and power systems, along with newer ones, such as mobile telecommunications and airlines (see figure VIII.2¹⁷ and annex tables VIII.1 and VIII.2).¹⁸

A large variety of public-private partnerships have emerged to facilitate provision of infrastructure services

¹⁴ In order to promote a better allocation of Asia's official reserves, there has been strong support and conceptual justification for the establishment of an Asia investment corporation, as documented in Geneva Report on the World Economy (see Hans Genberg, Robert N. McCauley, Yung Chul Park and Avinash Persaud (2005). *Official Reserves and Currency Management in Asia: Myth, Reality and the Future*, Geneva Reports on the World Economy 7, International Center for Monetary and Banking Studies and Centre for Economic Policy Research).

¹⁵ The World Bank, *Global Development Finance 2004: Harnessing Cyclical Gains for Development* (Washington, D.C., World Bank, 2004), pp. 151-154 elaborates on the technological changes that have occurred in various sectors including telecommunications, power, water and sanitation and transport.

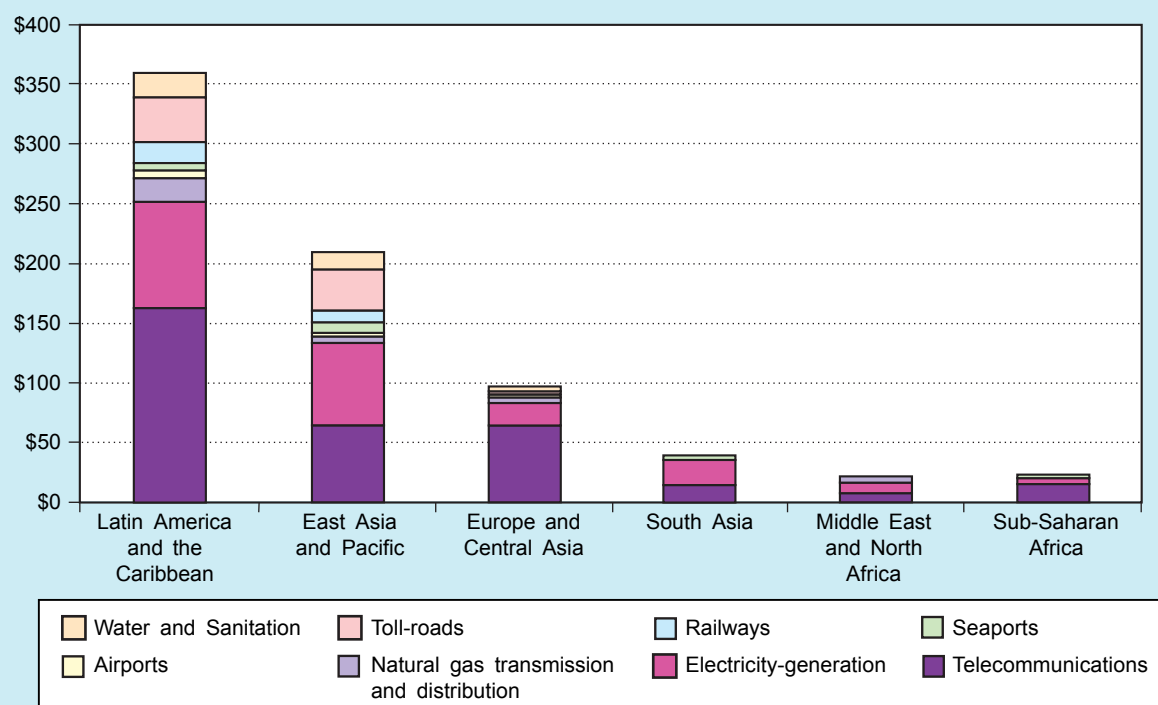
¹⁶ See Frank Sader, "Attracting foreign direct investment into infrastructure: why is it so difficult?", *FIAS Occasional Paper No. 12*, (Washington, D.C., Foreign Investment Advisory Service, World Bank and International Finance Corporation, 2000).

¹⁷ There can be various gradations of ownership ranging from service contract to outright divestiture.

¹⁸ Despite technical advances, there could be political sensitivities and affordability issues for low-income countries that in some instances necessitate public sector ownership and provision.

Figure VIII.2. Investment in developing country infrastructure with private participation, by sector, 1995-2002

(Billions of United States dollars)



Source: World Bank, *Private Participation in Infrastructure Database*, <<http://ppi.worldbank.org/book/>>.

Consistent with the growing interest in PPPs, until mid-1997 there was considerable interest shown by foreign direct investors in regional infrastructure projects, particularly in East Asia.¹⁹ However, their interest declined sharply following the regional financial crisis and it has failed to rebound despite the return of regional growth. International investments in Asian and Pacific infrastructure shrank from a peak of about \$47 billion in 1997 to \$16 billion in 1998 and has remained stagnant since then (see figures VIII.3, VIII.4a and VIII.4b).²⁰ It is instructive to note that international investments as a share of total gross capital formation in the Asian and Pacific region peaked at 6.2 per cent in 1997, fell to 5 per cent during the crisis, and has remained at less than 4 per cent since 2001, even dipping below 3 per cent in 2002 (see annex table VIII.3). The pertinent point here is that the decline in international infrastructure investment in the region has been more sustained than the overall decline in gross capital formation.

The lack of foreign direct investment interest in regional infrastructure is at least partly attributable to concerns over the "bankability" of projects as

Foreign direct investors showed considerable interest in regional infrastructure projects until 1997

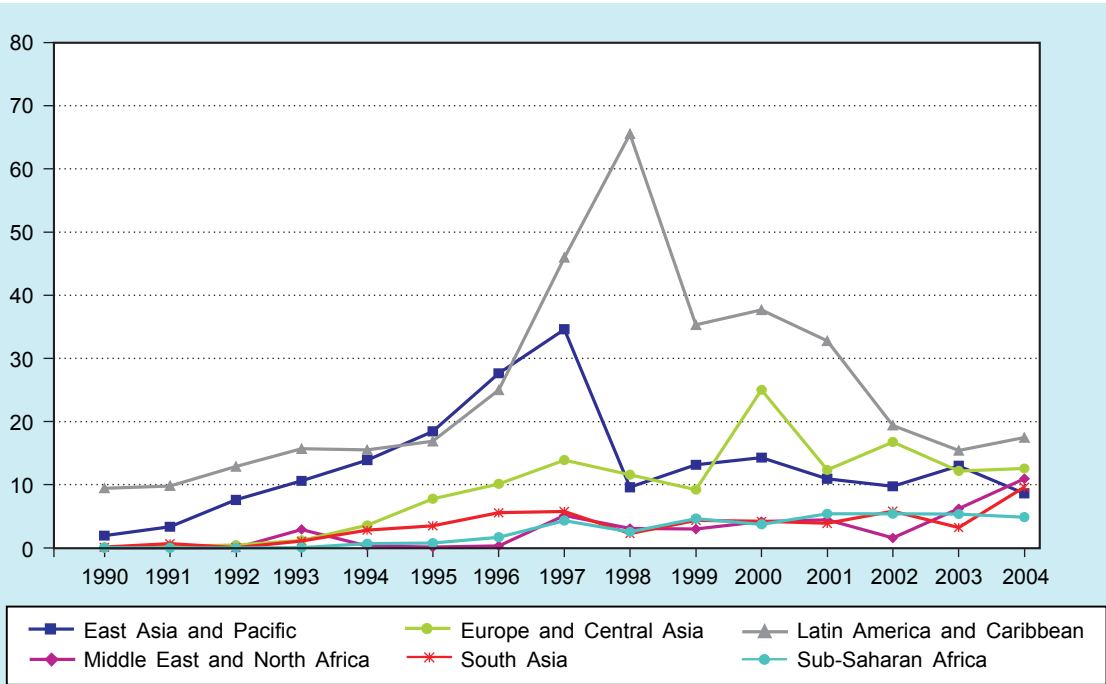
Lack of interest in foreign direct investment in infrastructure since 1997 is due partly to concerns about the "bankability" of projects

¹⁹ See Sader op. cit. Chapter 7 for a discussion of the impact of the 1997-1998 regional crisis on financing of private infrastructure projects in the region.

²⁰ Chapter I of the present study estimates that private sector (domestic plus international) investment in infrastructure in the Asian and Pacific region has been about \$21 billion annually between 2000 and 2003.

Figure VIII.3. Annual investment in developing country infrastructure with private participation by region, 1990-2004

(Billions of United States dollars)



Source: World Bank, *Private Participation in Infrastructure Database*, <<http://ppi.worldbank.org/book/>>.

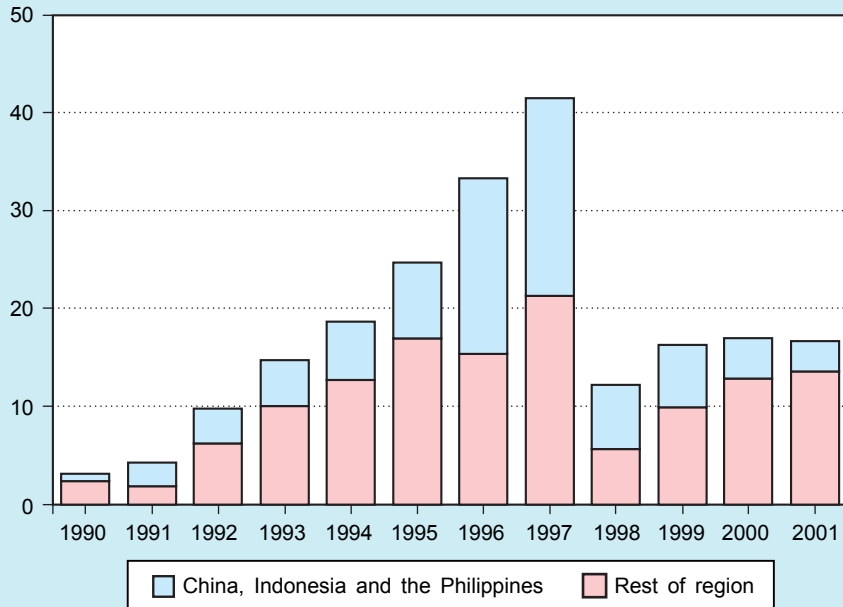
well as to heightened risk aversion in a period when the region's credit ratings declined and then stagnated (see annex figure VIII.1). Leaving aside the sharp contraction in the telecommunications sector worldwide in 2001,²¹ many infrastructure projects in developing countries are viewed as being financially non-viable for private investors because of perverse or uneconomic pricing policies, ineffective delivery systems, uncertain regulatory frameworks and a slow-moving bureaucracy, which hinders quick decision-making.²²

Investors in middle and higher-income Asian and Pacific economies are showing greater interest in providing foreign direct investment infrastructure opportunities

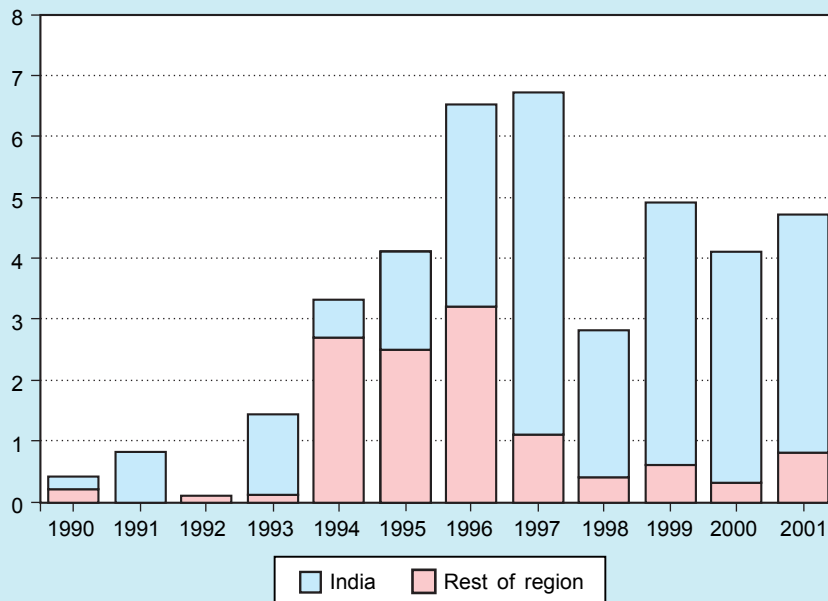
Anecdotal evidence suggests, however, greater interest in providing FDI in infrastructure is being shown by investors in middle and higher-income Asian and Pacific economies. Both Malaysia and Singapore have recently been heavily involved in housing and road projects in China and India. Nonetheless, increased FDI flows into the region have not been able to offset the overall decline in FDI in the Asian and Pacific region. It is therefore incumbent on Governments of countries in the region and development institutions to try to infuse greater interest among foreign investors.

²¹ See John Ure, "FDI in telecommunications services in Asia", presented at High-level Policy Seminar on Services, FDI and Competitiveness in Asia, UNCTAD and ASEAN, Ritsumeikan University, Kyoto, 2-4 March 2004, and "Infrastructure in East Asia and the Pacific – the way forward: telecom note", mimeo (July 2004) for discussions on FDI in Asia's telecommunications sector.

²² See also Asian Development Bank, Japan Bank for International Cooperation and World Bank, *Connecting East Asia: A New Framework for Infrastructure* (Washington, D.C., World Bank, 2005), p. 63.

Figure VIII.4a. Annual investment in East Asian infrastructure with private participation, 1990-2001*(Billions of United States dollars)*

Source: World Bank, *Private Participation in Infrastructure: Trends in Developing Countries in 1990-2001 Energy, Telecommunications, Transport, Water* (Washington, D.C., World Bank, 2003), based on World Bank, *Private Participation in Infrastructure Database*, <<http://ppi.worldbank.org/book>>.

Figure VIII.4b. Annual investment in South Asian infrastructure with private participation, 1990-2001*(Billions of United States dollars)*

Source: World Bank, *Private Participation in Infrastructure: Trends in Developing Countries in 1990-2001 Energy, Telecommunications, Transport, Water* (Washington, D.C., World Bank, 2003), based on World Bank, *Private Participation in Infrastructure Database*, <<http://ppi.worldbank.org/book>>.

Box VIII.1 provides a summary of what needs to be done to create a more enabling environment for private investments in infrastructure and to mitigate the risks inherent in investing in infrastructure, including the provision of guarantees. Box VIII.2 highlights the types of guarantees that Governments or other institutions can offer.²³

Box VIII.1. What Governments need to do to create an enabling environment for the private sector	
Transparency of process	Private sector investment opportunities are conditioned on the existence of specific government policies and programmes that encourage private sector entry and a transparent system of evaluating bids and awarding contracts.
Competitiveness of bids	Transparency and public accountability are best achieved by using a competitive bidding process to select contractors for infrastructure projects.
Appropriate allocation of risk	Risk-sharing among the Government, utility, lenders and developers is at the heart of most reservations or debates about private sector build, operate and transfer/build, own and operate projects.
Developer returns commensurate with risks	Quantifying the risk inherent in, and, by extension, the acceptable equity return on, large infrastructure projects is difficult but essential.
Stable policy regime	Private investors in infrastructure, whether they are domestic or foreign, seek a policy regime (including such elements as the tax and investment frameworks) that is both stable and predictable.
Government guarantees and credit enhancements	Bilateral and multilateral guarantees and credit enhancements are often critical to the successful financing of infrastructure (including, among others, independent power provider) projects, particularly during their early years and the transition from State dominance to a more market-oriented economic system.

Source: Anil K. Malhotra, "Private participation in infrastructure: lessons from Asia's power sector", *Finance & Development*, December 1997, pp. 33-35.

5. DEBT MARKETS

Since the 1997 Asian financial crisis commercial banks have remained highly averse to the risk involved in financing long-term infrastructural projects

Many investment projects require significant financing in the form of international debt. A typical build, operate and transfer type of infrastructure project requires about three quarters of its overall cost to be financed with debt. However, since the financial crises, in 1997 and 1998 commercial banks have remained highly risk averse and are more reluctant to fund long-term infrastructural projects or they are unable to do so because of problems such as high non-performing loans and loan-to-capital adequacy. Accordingly, Governments of countries in the region could more actively access regional and international capital markets to help to fund large-scale infrastructure projects.²⁴

²³ Of course, there is a trade-off in the sense that failure to undertake necessary reforms to make a project commercially viable might require Governments to offer guarantees (implicit subsidies) in order to attract private sector financing.

²⁴ World Bank, *Global Development Finance 2004: Harnessing Cyclical Gains for Development* (Washington, D.C., World Bank, 2004), p. 163, p. 149. The World Bank has stated that "global capital markets have the depth, maturity, size, and sophistication potentially to fund all viable investments and projects in developing countries' infrastructure".

Box VIII.2. Types of support arrangements

Grants, subordinated loans or equity participations	In such cases the Government or other institutions could have substantial up-front exposure by providing a direct cash injection to the project. These mechanisms tend to be applied for public-private partnerships, which are otherwise commercially non-viable projects.
Debtor equity guarantees	Governments or other institutions can also provide direct guarantees for the annual debt service or a minimum return on equity. The guarantees can be general or limited to specific risk categories. Generally, it is needed to maintain a project's debt service or exercise a buyout option at a pre-determined return. This option tends to be a high-risk contingent liability and is rarely used.
Exchange rate guarantees	They can range from full guarantees against exchange rate movements to guarantees on the convertibility and transferability of domestic currency earnings. The latter are common, but full volatility guarantees present potentially substantial contingent liabilities.
Cash-flow guarantees	These are guarantees for support when minimum revenue or consumption targets are not being reached. They are frequently used in toll road projects in the form of minimum traffic guarantees.
Government counter guarantees	These are generally the most talked-about form of guarantee. The host government promises to assume liability in case a public sector contractual party fails to meet its financial obligations towards the project company.
Revenue enhancements	Enhancements can take the form of direct government expenditures, such as the construction of complementary and adjacent facilities (transmission lines, feeder roads etc.), or give investors the right to develop ancillary facilities and other services (i.e., land development rights). They can also be in the form of guarantees, such as limiting the construction of new, or the use of existing, competing facilities.
Concession term extensions	Many Governments allow for the possibility of extending the concession term in order to lengthen the investment recovery period in case unforeseen events adversely affect a project's revenue stream.
Change-of-law guarantees	General guarantees can be issued by the host government against any changes in legislation, regulation and administrative practices that might change the operating environment. These guarantees may exempt the project company from such future changes, or the government may commit itself to making compensatory payments.

Source: Adapted from Frank Sader, "Attracting foreign direct investment into infrastructure: why is it so difficult?" *FIAS Occasional Paper No.12* (Washington, D.C., Foreign Investment Advisory Service, World Bank and International Finance Corporation, 2000).

There has already been some movement in this direction. For instance, countries in the region have been actively developing their bond markets in order to reduce their overdependence on bank flows and reduce maturity mismatches.²⁵ Initiatives have also been taken by ASEAN+3²⁶ and the Asian Development Bank to promote bond markets in the region. Indeed, the pace of domestic bond market development from 2000 to 2004 outper-

Bond financing has improved but there is still a long way to go

²⁵ See Takatoshi Ito and Yung Chul Park, eds., *Developing Asian Bond Markets: Challenges and Strategies* (Canberra, Asia Pacific Press, 2004); see also Barry Eichengreen, "The unintended consequences of the Asian Bond Fund", mimeo (May 2004), for a critical evaluation of reasons behind the lack of depth and liquidity of Asian bond markets.

²⁶ ASEAN+3 Comprises the 10 member countries of the Association of Southeast Asian Nations (ASEAN) plus China, Japan and the Republic of Korea.

formed that of the world (see table VIII.5). The size of the regional bond market grew by 18 per cent during that period when the global market grew by less than 2 per cent. However, notwithstanding the recent growth, the size of the region's domestic market is very small except in a few countries such as Japan. Furthermore, most of the region's domestic bond markets, given their small size, have serious limitations in terms of liquidity, efficiency and growth. As such, proactive measures are needed to develop the bond market in the region considering the importance and benefits of a robust and dynamic bond market for infrastructure development.

Table VIII.5. Size and composition of domestic bond markets in selected Asian and Pacific economies, by sector and residence of issuer

(Percentage of GDP)

Country or area	Sovereign issues		Financial institutions		Corporate issuers		Total	
	2000	2004	2000	2004	2000	2004	2000	2004
Australia	20.5	13.0	16.8	20.2	12.3	13.3	49.6	46.5
China	14.9	17.4	7.2	8.6	0.3	0.7	22.5	25.6
Hong Kong, China	9.4	9.5	12.9	14.8	2.5	3.4	24.9	27.8
India	23.5	30.3	0.0	0.2	5.9	0.3	29.5	30.8
Indonesia	..	19.7	..	1.2	..	1.5	..	22.4
Japan	102.6	137.3	15.8	26.2	15.8	16.3	134.2	179.9
Malaysia	26.5	36.3	5.2	12.7	37.4	37.4	69.1	86.4
Republic of Korea	16.1	21.4	19.2	28.3	22.8	22.1	58.1	71.8
Singapore	22.3	34.9	..	14.8	2.2	5.0	24.5	54.7
Thailand	..	18.4	..	5.1	..	11.5	..	35.0
Turkey	24.9	46.9	..	..	..	..	24.9	46.9
Total	68.9	80.4	13.0	19.0	12.5	11.8	94.4	111.1
United States	85.1	45.3	46.9	88.1	29.3	22.0	161.3	155.4
World^a	65.6	54.3	29.0	43.2	15.3	14.3	109.9	111.8

Sources: Bank for International Settlements, *BIS Quarterly Review*, December 2004 and December 2005 (Basel, Switzerland, BIS, 2004 and 2005) and World Bank, *World Development Indicators Database*.

^a "World" in this table comprises Argentina; Australia; Austria; Belgium; Brazil; Canada; China; the Czech Republic; Denmark; Finland; France; Germany; Greece; Hong Kong, China; Hungary; India; Ireland; Italy; Japan; Malaysia; Mexico; the Netherlands; Norway; Poland; Portugal; the Republic of Korea; Singapore; South Africa; Spain; Sweden; Switzerland; Thailand; Turkey; the United Kingdom; and the United States.

Debt instruments, in particular bonds, are better placed for weathering financial storms

Debt instruments such as bonds are widely used because of their specific characteristics. For example, bonds are considered a relatively more stable source of debt financing, as bond yields do not vary much on the basis of changing market circumstances. On the other hand, bank loans are primarily illiquid, fixed-price assets in the sense that the bank interest rate, which is the price of a loan, reflects general macroeconomic factors and is set by monetary authorities. Thus, almost all the adjustment has to take place via rises and falls in the quantity of bank lending, which in turn leads to sharp "booms" and "busts" in bank flows.²⁷ These sudden reversals in bank flows had adverse and long-lasting effects on the domestic financial systems of

²⁷ Martin N. Bailey, Diana Farrell and Susan Lund, "The Color of Hot Money", *Foreign Affairs*, March/April 2000, pp. 79, 99-109; and Ramkishan S. Rajan and Reza Siregar, "Private capital flows in East Asia: boom, bust and beyond", in Gordon de Brouwer, ed., *Financial Markets and Policies in East Asia* (London, Routledge, 2002).

several Asian countries in 1997 to 1998. It is acknowledged that compared with the bank market, bond markets offer some advantages in terms of longer maturities, tradability and back-weighted repayment structures that help to support equity returns. Infrastructure project bonds appeal in particular to institutional investors, such as insurance companies and pension funds, for which the long-term nature of investment projects is an advantage, as they can generate stable, long-term cash flows to match long-term liabilities.²⁸

Improvements in institutional frameworks for protecting creditors' rights have enabled some countries in the region to raise capital successfully by issuing infrastructure bonds, domestically and internationally.²⁹ However, international bonds carry the risk of a currency mismatch (between debt and interest payments in foreign currencies and assets and revenue streams in local currencies). Countries in Asia and the Pacific have tended to issue longer-term bonds denominated in foreign currencies (usually United States dollars), exposing themselves to exchange risks. To try to allay the risks of foreign currency exposure, some countries in the region have recently undertaken a regional initiative called the Asian Bond Fund, which is aimed at developing regional bond markets.³⁰ The merits and potential limitations of the Fund will be discussed in section D.

6. EQUITY MARKETS AND EQUITY FUNDS

In addition to helping to develop local capital markets, multilateral organizations and national Governments have started to pay more attention to equity funds. India created the Infrastructure Development Finance Corporation (IDFC) in 1997 in order to raise funds for infrastructural projects in the country.³¹ Since then IDFC has approved loans totalling Rs 250 billion (roughly \$6 billion) for 198 projects. The exposure of IDFC to infrastructure projects was Rs 124 billion (about \$3 billion) with approvals for energy projects accounting for 34 per cent of that amount, followed by telecommunications at 27 per cent and transportation at 26 per cent. A number of other private equity funds, such as the Macquarie Group in Australia, have been actively financing infrastructure in the Asian and Pacific region and elsewhere.³²

*Greater emphasis
needs to be placed on
equity-market
financing of some
infrastructure projects*

By and large, however, IDFC and other equity funds have not been nearly as successful as had originally been hoped. Part of the problem appears to be that private equity investors have demanded high rates of return as a result of heightened post-crisis risk aversion. Going forward, however, equity markets offer a promising potential source of finance for infrastructure that should, and are likely to receive more attention. China, for example, reportedly plans to fund at least part of a \$240 billion project to upgrade and expand its railroad system by restructuring some of its State-owned railway companies and listing them on the stock market.³³

²⁸ By ensuring more "objective" (i.e., market-based) and closer monitoring, bond financing also ought to help to mitigate some of the moral hazard and adverse selection problems that arise from bank financing.

²⁹ The issue of bond market development is discussed in ESCAP, (2005). *Implementing the Monterrey Consensus in the Asian and Pacific Region: Achieving Coherence and Consistency*, United Nations publication, Sales No. E.05.II.F.8, pp. 20-25.

³⁰ Also see Robert Sheppard, "Capital markets financing for developing-country infrastructure projects", *DESA, Discussion Paper No.28*, DESA, United Nations, 2003.

³¹ For details see IDCF private equity website, <www.idfc.com/>.

³² For details on MacQuarie's infrastructure vehicles, see <www.macquarie.com.au/au/corporations/sfpc/infrastructure_funds/overview.htm>.

³³ *Bangkok Post*, 10 September, 2005.

Incentives for regional cooperation in infrastructure investments include the availability of a substantial pool of funds within the region, the transboundary nature of many projects and avoiding the negative impact of inadequate infrastructure on growth and development

There are four possible options: expand the role of the Asian Development Bank in infrastructure financing, expand the Asian Bond Fund, establish or reinvigorate subregional banks/funds and set up a new institution such as an Asian investment bank

An institution similar to the European Investment Bank could be effective in promoting infrastructure

D. REGIONAL COOPERATION IN INFRASTRUCTURE FINANCE

It would be inefficient for individual countries in the Asian and Pacific region to attempt to access the limited pool of investable funds independently in order to finance their own infrastructure needs. This is where intensified regional cooperation takes on added significance. Three other factors highlight the advantages of cooperation:

- (a) A substantial pool of funding available within the region in search of better yields;
- (b) Certain projects cross national boundaries and require cooperation and coordination among one or more countries;
- (c) Failure to alleviate transborder infrastructure bottlenecks will hinder the development and intensification of regional supply networks (i.e., integrated vertical chains of production) which have fuelled trade and income growth in the region, especially in East Asia.

1. WHAT ARE THE OPTIONS?

The limited range of effective cooperative initiatives and the need for financing of intraregional, cross-border infrastructure projects underline the need to consider innovative institutional arrangements for funding infrastructure in the region. The possible cooperative initiatives to intermeditate the region's surplus savings for infrastructure investment include the following:

- (a) Expanding the involvement of ADB in infrastructure financing by refocusing its mandate on infrastructure development (rather than development in general) or by setting up a subsidiary such as the International Finance Corporation that focuses on raising funds from private capital markets;
- (b) Expanding the Asian Bond Fund to include most of Asia and the Pacific and making it infrastructure financing-friendly;
- (c) Establishing or reinvigorating subregional banks/funds such as the proposed northeast Asian development bank³⁴ and the South Asian Development Fund;
- (d) Setting up a new institution, such as an Asian investment bank, similar to the European Investment Bank (EIB), for cross-border financial intermediation.

The experience of Europe suggests that an institution similar to the European Investment Bank (EIB) could be quite effective in promoting infrastructure and related development by raising the necessary financing directly, as well as by catalysing private investments. Indeed, the EIB provides a significant amount of financing, amounting to more than 43 billion euros (about \$55 billion) in 2004, for projects in transport, telecommunica-

³⁴ See annex VIII.1 to this chapter.

³⁵ EIB lent additional \$8 billion to projects in research and development, innovation, communication and information technology networks and human capital formation.

tions, energy, water, sanitation, health and education in 2004.³⁵ In contrast, ADB lent a little over \$5 billion, of which amount about \$2.8 billion went to projects in transport, communications, energy, water and sanitation. JBIC provided loans totalling about \$16.5 billion in 2003, of which amount about \$5 billion was for financing infrastructure, mainly in Asia.³⁶ The World Bank lent \$11 billion worldwide in 2004 through the International Bank for Reconstruction and Development (World Bank), \$9 billion through the International Development Agency about \$5 billion through the International Finance Corporation and \$1 billion through the Multilateral Investment Guarantee Agency. Even more worrying for Asia is the fact that the financing provided by ADB, JBIC and World Bank shows no sign of increasing significantly in the near term (and in some cases has actually declined). It is clear that maintaining the status quo cannot be an option; new avenues to finance infrastructure clearly need to be sought with some urgency.

However, even if one were to accept the need for an institution specialized in infrastructure financing and development, one is left with a series of questions. Should such an institution be self-standing? Should an existing institution such as ADB refocus its objectives and mandate specifically towards meeting the region's infrastructure financing needs, or create a subsidiary to deal with these new objectives? Should one eschew the thought of a single institution (self-standing or otherwise) altogether and instead consider creating a few subregional banks or even funds? These alternatives are briefly evaluated below.

2. EXPANDING THE ROLE OF THE ASIAN DEVELOPMENT BANK IN FINANCING REGIONAL INFRASTRUCTURE

A valid concern about creating an entirely new institution is the high transaction costs of setting it up and the possibility that its objectives and functions would overlap with those of existing development institutions.³⁷ To avoid such overlap, ADB might have to refocus its objectives and functions towards its primary objective of raising and channelling long-term financing to good quality infrastructure projects in the region.

An expanded Asian Development Bank could reduce initial operational costs and overlapping objectives

Although ADB has been involved in infrastructure financing, unlike the EIB, its comparative advantage and core focus do not appear to lie in being able to access private capital markets and function as an investment bank. Since its establishment, ADB has invested over \$113 billion in developing Asia and the Pacific, over half of it being invested in transportation and communications infrastructure, energy provision and water and sanitation services.³⁸ However, there has been a steady decline since its inception as it has redirected attention to social and poverty programmes, and more recently, subregional monetary, trade and financial cooperation (ASEAN+3) as well as addressing the avian influenza outbreak. In other words, ADB appears to have multiple and ever-growing objectives compared with the single-minded focus on infrastructure of the EIB (see Box VIII.3).

³⁶ The remaining \$11.5 billion lent by JBIC financed "international finance operations", including export and import loans, guarantees, overseas investment loans and untied loans.

³⁷ It should be noted that similar concerns were raised at the initial stages of setting up of ADB.

³⁸ Liqun Jin, "Sustainability and developing Asia", statement at the FIDIC Annual Conference, Beijing, 4-8 September 2005.

**Box VIII.3. The Asian Development Bank, European Investment Bank
and European Investment Fund at a glance, 2004**

Asian Development Bank (Millions of United States dollars)		European Investment Bank (Millions of United States dollars)	
Operational activities		Operational Activities	
Total lending (<i>amount</i>)	5 293	Loans signed	53 573
Ordinary capital resources:		Loans approved	56 767
Loan approvals	4 501	Loans disbursed	47 914
Loan disbursements	2 508	Resources raised (after swaps)	61 834
Public	2 399		
Private	109		
Asian Development Fund:		Resources (end of 2004)	
Loan approvals	1 242		
Disbursements	1 055		
Government and government-guaranteed loans	4 947	Own funds	36 751
Private sector loans	347	Balance sheet total	319 637
Equity investment	185	Net profit for year	1 712
Technical assistance	197	Subscribed capital	202 931
Co-financing and guarantees	2 441		
Guarantee	75		
Loans to infrastructure sectors		2.8 billion/year	
		European Investment Fund	
		<i>Activity in 2004</i>	
Resources (end of 2004)		Venture capital (15 funds)	444
		Guarantees (40 operations)	1 794
Ordinary capital resources		<i>Situations as at 31 December 2004</i>	
Subscribed capital stock (<i>at the end of period</i>)	54 162	Subscribed capital	2 480
Annual borrowings	1 629	Net profit for year	27
Outstanding borrowings	24 212	Reserves and provisions	237
Source: Annual reports of the Asian Development Bank and European Investment Bank.			

The Asian Development Bank has been quite active recently, in accessing capital markets to raise funds for infrastructure development, but it has not raised enough to meet the region's needs

However, apart from offering concessional country loans, ADB has attempted to raise finance for infrastructure development by accessing capital markets and in 2004 raised \$1.6 billion in this manner. ADB has, up to now, invested in over 30 regional infrastructure funds and mobilized about \$4 billion in investment capital for Asia. Its more notable initiatives include the Asian infrastructure (equity) funds of the American International Group (AIG) and the Asia Infrastructure Development Company (AIDEC), which offers debt financing.

AIG Asian Infrastructure Fund (Asia I) is a \$1.08 billion fund established in 1994 to invest in infrastructure and related industries in Asia. The fund is fully invested, with its investments structured primarily as direct private placements of shares and equity-related securities in infrastructure projects and companies. AIG Asian Infrastructure Fund II (Asia II) started operations in 1997 and has raised \$1.67 billion in private equity capital. In addition to being its sponsor, AIG is also a significant investor in the Fund. An affiliate of the Government of Singapore Investment Corporation is the

principal investor and the International Finance Corporation (IFC)³⁹ of the World Bank Group is also a key investor. More than half its investments are in the transport, power and telecommunications sectors. The Fund's investments have taken the form of equity, quasi-equity and convertible instruments, usually placed directly with the invested company. Asia II's focus economies in the region are China, the Philippines, the Republic of Korea, and Thailand as well as India, Malaysia and Taiwan Province of China.⁴⁰

ADB has made an initially approved equity investment of \$30 million in AIDEC, which expects to raise total equity of about \$1 billion. Other shareholders are the Overseas Economic Fund of Japan, IFC and other regional private institutional investors. The aim of AIDEC is to provide debt financing to selected projects in the Asian and Pacific region and those investments are to be managed by AIDEC Management Company Private Limited, a Singapore-based, wholly-owned subsidiary of the company.⁴¹

ADB has also been an active participant in the Public-Private Infrastructure Advisory Facility, which is a multi-donor technical assistance facility established jointly in 1999 by the World Bank and the Governments of Japan and the United Kingdom. The Facility broadly aims to channel technical and financial assistance into public infrastructure projects in developing countries. Particular attention is focused on water and sanitation, energy, transport and telecommunications.⁴²

While these initiatives are important and suggest that ADB is willing to look at more creative mechanisms to fill the gap in infrastructure financing, the aim is limited to raising finance, which is insufficient. A specialized infrastructure institution needs to:

- (a) Closely monitor the manner in which investments are channelled to complement national regulatory frameworks as well as to help countries to implement regulatory reforms, which are key to attracting private investments;
- (b) Work effectively with the private sector by co-financing and facilitating the lowering of project risk premiums (through direct or indirect guarantees);
- (c) Help to promote long-term financing instruments and sources of funds that can be effectively channelled into infrastructure as well as to formulate projects in such a way that they are attractive to capital markets.

To be effective in the area of infrastructure financing, ADB needs to refocus its attention on the goals of infrastructure development and on catalysing private sector capital flows and participation. Moreover, infrastruc-

If ADB is to specialize in infrastructure financing, it needs to refocus its attention on infrastructure development and on catalysing private sector capital flows and participation

³⁹ Established in 1956, IFC, is the largest multilateral source of loan and equity financing for private sector projects in the developing world. Its stated mandate is to "promote sustainable private sector development primarily by financing private sector projects located in the developing world; helping private companies in the developing world mobilize financing in international financial markets and providing advice and technical assistance to businesses and governments". See www.ifc.org/.

⁴⁰ Information based on Emerging Market Partnerships, <www.empwdc.com/EMPAisial2.htm> and Emerging Market Partnerships, <www.empwdc.com/EMPAisial12.htm>.

⁴¹ Another notable debt fund established by ADB is the Asian Infrastructure Mezzanine Capital Fund. To date, this fund has made investments in telecommunications and power projects in China and India.

⁴² Details available at the Public-Private Infrastructure Advisory Facility website, <www.ppiaf.org/>.

ture financing and development require a singular institution and specialized personnel.⁴³ One possibility would be to create a subsidiary along the lines of IFC to focus exclusively on infrastructural financing. Such a subsidiary could benefit directly from the institutional knowledge and human capital of its parent institution and it may be more cost effective than creating an entirely new institution. On the other hand, a subsidiary is unlikely to offer many advantages over a self-standing institution and in some cases could actually be negative as it may be burdened by the constraints and tensions plaguing its parent institution.

Infrastructure financing is far too important and massive a task to be left to a subsidiary of an existing institution

The question of whether there needs to be an entirely new institution or whether such a role could be taken on by one or more existing institutions requires in-depth knowledge and discussion of individual institutional constraints, mandates and related issues. However, it is instructive to note that the largest and oldest institution in Europe is one that is focused almost solely on infrastructure development. The European experience appears to be to allow existing institutions to focus on specific objectives, while establishing new, albeit smaller, ones if there is a need to fulfil additional objectives.⁴⁴ Importantly, the main institution, namely the EIB, has been a significant shareholder of newer institutions (European Investment Fund and European Bank for Reconstruction and Development). Financing infrastructure development has remained central to the objective of EIB. Given the magnitude of the problem in the Asian and Pacific region, infrastructure financing is far too important and massive a task to be left to a subsidiary of an existing institution.

3. ENLARGING THE ASIAN BOND FUND

Establishment of bond markets provides Asian investors with relatively easy access to bankable investment projects

Asia accounts for the bulk of the world's savings; it had an estimated savings surplus averaging about \$200 billion annually between 2000 and 2003 (see chapter II). The excess of savings over investment along with quasi-managed exchange rates have given rise to large current account and overall balance of payments surpluses in Asia. Historically, the lack of sufficiently liquid financial instruments has led to too much of Asia's savings being rechannelled outside the region. The establishment of bond markets provides Asian investors with relatively easy access to bankable investment projects in Asia without posing much concern about illiquidity.⁴⁵

Eleven regional economies that are members of the Executives' Meeting of East Asia-Pacific Central Banks (EMEAP)⁴⁶ have been working to

⁴³ Montek S. Ahluwalia, "Financing private infrastructure: lessons from India", in Harinder S. Kohli, Ashoka Mody and Michael Walton, eds., *Choices for Efficient Private Provision of Infrastructure in East Asia* (Washington, D.C., World Bank, 1997), pp. 87-106.

⁴⁴ See Griffith-Jones, Jenny Kimmis, M. Gama. Santos and Ana Fuzzo de Lima (2003). "Financial mechanism for accession: the European experience and lessons for the WHFTA", mimeo, Institute of Development Studies, University of Sussex (May) for a discussion of European Union regional policy evolution and the concomitant creation of various intraregional financing mechanisms, including EIB.

⁴⁵ Of course, bond markets may also be illiquid and some bonds may not be easily tradable.

⁴⁶ EMEAP is a cooperative organization of central banks and monetary authorities in the East Asia and Pacific subregion. The 11 members of EMEAP are Australia; China; Hong Kong, China; Indonesia; Japan; Malaysia; New Zealand; the Philippines; Republic of Korea; Singapore and Thailand. There have been other regional bond market initiatives, such as the Asian Bond Market Initiative by the ASEAN+3 members, along with initiatives by Asia-Pacific Economic Cooperation and the Asian Cooperation Dialogues as well as the private sector Asian Bond Market Forum. These are not discussed here; for a summary of these initiatives, see <<http://aric.adb.org/asianbond/index.htm>>.

intensify regional financial cooperation with particular emphasis on the bond market. The first phase of the Asian Bond Fund (ABF1), established by EMEAP on 2 June 2003 essentially involved Governments of 11 countries in the region voluntarily contributing about 1 per cent each of their reserves to a fund dedicated to purchasing regional sovereign and semi-sovereign bonds denominated in United States dollars.⁴⁷ The initial value of ABF amounted to about \$1 billion, passively managed by the investment management unit of the Switzerland-based Bank for International Settlements. In a noteworthy next step, the Fund's second stage, ABF2, was established in December 2004. The quantum of funds involved was doubled to \$2 billion and the mandate was to invest in selected domestic currency, sovereign and quasi-sovereign bonds in various countries.

More specifically, ABF2 comprises two components (\$1 billion each): the Pan-Asian Bond Index Fund and a Fund of Bond Funds. The Index Fund is a single bond fund while the Fund of Bond Funds is a two-layered structure with a parent fund investing in eight single market subfunds. The benchmark indices for all nine funds have been created by the International Index Company, a joint venture between ABN AMRO, JP Morgan and Morgan Stanley. The funds are passively managed to match the benchmark index. The seed money for the single bond fund was divided on predetermined criteria and local fund managers were appointed to manage it.⁴⁸ The parent fund is limited to investments by EMEAP member central banks only. While the initial phase of the Index Fund was confined to investments by EMEAP central banks only (\$1 billion), it was opened up to investments by other retail investors in phase 2.

In broad terms, the objectives of ABF are as follows:

- (a) Develop regional financial/capital markets by reducing supply-side constraints, introducing low-cost products and raising investor awareness and by broadening the investor base on the demand side;
- (b) Encourage a convergence in financial and capital-market policies and accelerate improvements in financial-market infrastructure;
- (c) Recycle regional funds intraregionally;
- (d) Reduce currency and maturity mismatches.

All of these, particularly the latter two, are important in infrastructure funding.

While ABF is a welcome move for regional financial cooperation, it remains an open question whether or not this initiative will become a significant source of regional infrastructure funding. Apart from the fact that ABF is focused exclusively on bonds, not equities or other such instruments, three factors appear to be compelling:

- (a) The quantum of funding available is rather limited. The current \$2 billion funding of ABF II is less than 1 per cent of the estimated infrastructure financing requirements of the region. Policymakers in

It remains an open question whether or not the Asian Bond Fund will become a significant source of regional infrastructure funding

⁴⁷ The mandate is to invest in bonds in 8 of the 11 member countries of EMEAP. The developed countries of Australia, Japan and New Zealand are the sole lenders to ABF.

⁴⁸ Guonan Ma and Eli M. Remolona, "Opening markets through a regional bond fund: lessons from ABF2", *BIS Quarterly Review*, June 2005, pp. 81-92.

the region will need to commit themselves to massively scaling up this amount if ABF is to be viewed as a significant instrument of regional infrastructure financing.

- (b) If the supply of good quality sovereign and quasi-sovereign paper is limited, which appears to be the case, this situation could merely crowd out private bond purchases, hence leading to no additional net financing taking place.⁴⁹ This in turn implies the need to support providers of infrastructure services in achieving commercial standards of creditworthiness to access capital markets on a sustainable basis over the long term.⁵⁰
- (c) As noted, ABF is limited to a small number of countries; it needs to be significantly expanded to include other countries in South Asia, South-East Asia and the Pacific which have thus far been excluded.

4. REINVIGORATING SUBREGIONAL BANKS AND FUNDS

Subregional initiatives for financing infrastructure are not new, but political will is needed to put them into action

There appears to be a growing degree of implicit political support for an EIB-type institution among Governments in the region.⁵¹ To cater to Asia's heterogeneity and minimize the risk of duplicating the functions of existing development institutions, an alternative to creating a pan-Asian entity might be to set up subregional banks (North-East Asian, South-East Asian, South Asian investment or development banks). Such a bank was proposed during a meeting of the Northeast Asia Economic Forum, which agreed to create an ad hoc committee for the establishment of "Northeast Asian development bank"; but the proposal has not been pursued further (see annex VIII.2).⁵²

An Asia-wide investment fund has also been proposed to promote workable public-private partnerships for infrastructure development.⁵³ It is useful to keep in mind that a handful of regional and international funds already exist.⁵⁴ These include the ADB-sponsored AIG Infrastructure Funds

⁴⁹ See Stephany Griffith-Jones, Alfred Steinherr and Ana Teresa Fuzzo de Lima, "The European Investment Bank: useful inspiration for emerging countries?", paper presented at Seminar on Regional Financial Arrangements, Economic Commission for Latin America and the Caribbean and United Nations Department of Economic and Social Affairs, 14 and 15 July 2004, for a more detailed and forceful critique of such regional bond initiatives.

⁵⁰ World Bank, *Global Development Finance 2004: Harnessing Cyclical Gains for Development* (Washington, D.C., World Bank, 2004), p. 161.

⁵¹ The proposed northeast Asian development bank would raise funds from capital markets to finance infrastructure projects in member countries.

⁵² Stanley S. Katz, "The role of the northeast Asian development bank in northeast Asia's future development", *Proceedings of the Ninth Meeting of the Northeast Asia Economic Forum (Tianjin, China, 26-29 October 1999)*.

⁵³ Yung Chul Park, "An Asian investment fund: what it will do and why needed?" mimeo (17 May). Malaysia has also suggested the creation of an Asian infrastructure development fund, although no details of this proposal are available. It should be noted that the Asian investment fund (AIF) envisioned here is somewhat different from suggested by Park who has drawn inspiration from the European Investment Fund (EIF). Park notes that similar to EIF, AIF could focus primarily on the development of SMEs in Asia and its role in financing infrastructure should be limited to guaranteeing projects bonds.

⁵⁴ For instance, there is the rather little-known United Nations Capital Development Fund which lends capital to local development programmes and microfinance institutions in 28 least developed countries. A well-known fund is the Latin American Reserve Fund, which is more a mechanism to aid member countries in the event of a balance of payments crisis and to assist in correcting payment imbalances rather than to finance development projects. For details, see Rajan and Siregar, op. cit.

previously discussed and the South Asian Development Fund (SADF), which was proposed at the Sixth SAARC Summit in Colombo in 1991.⁵⁵ It is aimed at mobilizing external funds for the development of South Asia. The basic objective of SADF is to provide finance for industrial and infrastructure development, institutional and human resources development, poverty alleviation, protection of the environment and promotion of development projects in the SAARC region. After receiving the endorsement of the Eighth SAARC Summit in 1995,⁵⁶ SADF was created in 1996 by the merger of two SAARC funds, namely, the SAARC Fund for Regional Projects and the SAARC Regional Fund. Members of SADF are Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. As of 2003, it had \$5.8 million in capital. SADF has financed 17 projects so far, drawing up feasibility reports and provided training in order to fine-tune the skills of human resources. However, SADF has not made much progress owing to a lack of capital, formal structure and operating guidelines. At the September 2005 Meeting of SAARC Finance Ministers in Kathmandu, financial experts recommended reconstituting SADF and creating a SAARC development fund.⁵⁷ It also underlined the need to mobilize funds from within and outside the region, and examined proposals for creating a poverty alleviation fund, an infrastructure fund and the prospects for creating a South Asian development bank.

Such subregional banks and funds have the advantage of being more intensively focused and may give smaller countries greater opportunities for participating in their ownership, but they also give rise to concern about the possible lack of coordination with other subregions, the absence of economies of scale, overstretching of resources and competition for a limited pool of funds in capital markets. A more cost-effective option may be to start with a pan-Asian bank but initially limiting its membership. As such an institution gains expertise and sorts out such critical issues as operating boundaries and responsibilities with existing multilateral institutions,⁵⁸ it could expand its membership and the scope of its activities.⁵⁹

5. EXPLORING THE POSSIBILITY OF AN ASIAN INVESTMENT BANK

There appears to be a basic conundrum. On the one hand, the involvement of ADB and the World Bank is essential for any new institution involved in infrastructure development finance in the Asian and Pacific region. On the other hand, it may be useful to create a distinct, i.e., operationally independent, institution to focus on regional infrastructure financing and development using private capital.

The region's challenge is essentially finding how to intermediate regional resources for the development of the region

⁵⁵ SAARC, The Colombo Declaration of the Heads of State or Government of the Member Countries of the South Asian Association for Regional Cooperation, Sixth SAARC Summit, Colombo, Sri Lanka, 21 December 1991.

⁵⁶ SAARC, Delhi Declaration on Strengthening Regional Economic Cooperation in Asia and the Pacific towards the Twenty-first Century, Eighth SAARC Summit in New Delhi, 4 May 1995.

⁵⁷ SAARC, "SAARC considers a new financial mechanism", Meeting of Financial Experts, Kathmandu, Nepal, 1-2 September 2005.

⁵⁸ For instance, an Asian investment bank might provide financing that encourages private sector participation and deal with project evaluation and monitoring, while multilateral institutions provide partial guarantees.

⁵⁹ For a discussion of membership issues surrounding Asian regionalism, see Ramkishan S. Rajan, "Asian economic cooperation and integration: sequencing of financial, trade and monetary regionalism", in *Asian Economic Cooperation and Integration: Progress, Prospects and Challenges* (Manila, ADB, 2005), pp. 77-92.

In other words, the case for establishing a new institution may arise for the following reasons:

- (a) The lack of financing has seriously constrained infrastructure development in Asia and the Pacific. The region's challenge is how to intermediate financial resources for development. The region is a big saver, with savings in some countries exceeding 40 per cent of GDP. The region's foreign exchange reserves are mainly invested outside the region at low rates of return. However, the region's investment rate is relatively low and the amount currently available for financing regional infrastructure stands at only \$48 billion a year,⁶⁰ far short of what is required. A new institution of the caliber of EIB could help to address this problem;
- (b) Existing mechanisms, including the domestic banking systems and foreign direct investment, have limited scope owing to a host of issues including limited savings in many countries and possible destabilizing effects;
- (c) Existing regional cooperation mechanisms such as ADB and ABF do not have the mandate or the resources to cater to the needs of infrastructure financing. The focused attention of ADB is on social and poverty programmes and its role in regional financial intermediation is very limited. ABF is not meant for financing infrastructure investment. A new institution could complement existing institutions rather than substitute for them in intermediating the region's financial resources;
- (d) Identifying infrastructure projects, structuring them in a manner that makes them financeable, and taking care to meet the complex risk-mitigation requirements of different types of investors are tasks better performed by a specialized institution. Such an institution could also provide liquidity support and securitize the cash flow of infrastructure projects. The existing mechanisms have so far failed to accomplish this.⁶¹

An Asian investment bank could play a substantive role in the integration and development of the countries of the region as the European Investment Bank did in the European Union. The Asian Development Bank, World Bank and other multilateral institutions could be shareholders along with member countries

An Asian investment bank could play a substantive role in the integration and development of the countries in the region as the EIB did for countries of the European Union (see annex VIII.3 on EIB). One way forward might be to establish such a new institution while ensuring that ADB, World Bank and other important development agencies such as JBIC and even possibly EIB are among the main shareholders, along with countries in the region and some developed non-regional countries, if they are inclined to become shareholders. Ideally, shareholders for AIB should *eventually* include every country in the Asian and Pacific region. It would also be ideal if large, private equity companies and banks also participate. This would be necessary if the proposed bank would want to develop public-private partnerships in the area of infrastructure financing.⁶²

⁶⁰ This is based on the average public and private investment in infrastructure during 2000-2003. See chapter II for details.

⁶¹ Ahluwalia, op. cit.

⁶² In the context of PPP, it is worth quoting a recent report by Fitch Ratings (2004). "Public-private partnerships: the next generation of infrastructure finance", *Project Finance Special Report* (August 6) at some length from pp. 2-3: "For a number of countries, a new and more interesting generation of public-private partnerships (PPPs) is now emerging...For this new generation of PPPs to flourish, the host countries must nurture some important prerequisites. These include promoting a relatively stable macroeconomic environment, developing a legal and regulatory framework for infrastructure projects and nurturing the development of a domestic debt market. Unfortunately, these prerequisites do not exist in most of the world, which means that some of the traditional roles of the multilateral and development banks will remain necessary over the long term. In countries where these prerequisites are taking shape, however, there are real opportunities to expand the availability of capital by using pooled financings and credit enhancements to harness a developing domestic debt market".

It would be premature at this stage to offer too much detail on a possible structure of the new institution. However, if a new EIB-type institution is created, it is envisaged that only its developing country members would be eligible to receive financing for projects. The beneficiaries of lending by the proposed Asian investment bank should be projects that are led by government agencies as well as by private consortiums. Such a bank should not be dependent solely on its shareholders to provide it with funds to finance projects. The members should only pay for their share of the subscribed capital. The actual funds that would provide the money for financing projects should be raised from the capital markets by issuing bonds and via other debt instruments. Since the goal of the bank is to offer loans that are typically cheaper than what is available elsewhere, it is imperative that it has high credit ratings so that it can pass on the benefits to its clients.⁶³ This is important as the lower cost of financing does not mean that its loans are concessional or subsidized.⁶⁴

At the same time, an institution such as the proposed Asian investment bank should finance only infrastructure projects that fulfil certain criteria. While EIB has a list of criteria that projects must fulfil (see annex VIII.2), the criteria that the Asian investment bank must have in place should be tailored to the requirements of Asia and the Pacific. Ideally, to ensure its effectiveness and sustainability, the Asian investment bank should:

- Engage in medium and long-term lending. EIB lends for periods of between 4 and 20 years and it does not lend more than 50 per cent of the total cost of a project;
- Lend mainly in local currencies to minimize currency risks for the borrowing country;⁶⁵
- Require adequate security to cover the significant risk in its lending. This security should be provided by banks or other financial institutions or large companies with a good credit rating, or even other multilaterals such as ADB or the World Bank;
- Monitor all projects, especially the larger ones, which it co-finances or (partially) guarantees;
- Minimize moral hazard and adverse selection problems in financing both by constant project monitoring and by working with other multilateral institutions, such as ADB, and national Governments in the areas of regulatory and legal reform, improving transparency and disclosure requirements and contract enforcement and making the investment and operating environment more predictable.⁶⁶

An Asian investment bank should have lending criteria for projects tailored to the needs of Asia and the Pacific while establishing safeguards to ensure efficiency and sustainability

⁶³ As with EIB, care must be taken to ensure that administrative costs are relatively low, so even if the interest charged on loans covers the administrative costs, the rates remain very attractive to borrowers.

⁶⁴ It is premature at this stage to go into detail on such issues as how an Asian investment bank should handle loan financing and credit guarantees.

⁶⁵ See Tobias C. Hoschka, "Local currency financing – the next frontier for MDBs", *ERD Working Paper No. 68*, Asian Development Bank, April 2005, for an elaboration of the role of multilateral banks in local currency lending to developing countries.

⁶⁶ The crafting of regulations for infrastructure projects is detailed in Ionnis N. Kessides, *Reforming Infrastructure: Privatization, Regulation and Competition* (Washington, D.C., World Bank 2003 (chapter II); it is beyond the scope of the present publication.

An Asian investment bank should be based on the concept of a public-private partnership to mobilize resources mainly from the capital market, to co-finance and guarantee projects and to provide financial and technical assistance at relatively low cost

These are key requirements if the private sector is to participate more actively and in a much bigger way in Asia's infrastructure development. To summarize, the proposed Asian investment bank could include the following elements:

- (a) It could be based on the concept of public-private partnership rather than being a purely public institution;
- (b) It would mobilize resources mainly on the capital market for financing the region's infrastructure needs through the issuance of bonds and other financial instruments;
- (c) It would have the capacity to identify and evaluate infrastructure projects, make environmental impact assessments and monitor programme finance;
- (d) It would co-finance and guarantee private sector investment in infrastructure;
- (e) It would stand on its own yet still provide financial and technical assistance at relatively low cost.

E. CONCLUSION

A recent ESCAP publication highlighted the necessity of paying adequate attention to the financing of infrastructure as a key to reinforcing the foundations of sustained development in the Asian and Pacific region.⁶⁷ This should be viewed within the broader context of finance for development and must be the central focus of the region's development agenda.

As discussed in the previous chapters, the infrastructure needs of the Asian and Pacific region are monumental, thus confronting the region with a significant annual financing gap. To deal with this gap, national Governments and multilateral organizations must systematically access savings through domestic and international capital markets while developing public-private partnerships.

Commitment at the political level is the key to moving forward in developing public-private partnerships and mobilizing resources for infrastructure financing

Commitment at the political level will be key to moving forward in that direction. An action plan that could be facilitated by ESCAP is needed to further the process of enhancing cross-border financial intermediation in the Asian and Pacific region. The status quo is not an option. ESCAP members and associate members need to formulate a mechanism to make use of the region's savings for the development of its infrastructure. Forming an inter-governmental committee/task force to further evaluate the options and make recommendations on the way forward could be the next step.

⁶⁷ ESCAP, *Implementing the Monterrey Consensus in the Asian and Pacific Region: Achieving Coherence and Consistency* (United Nations publication, Sales No. E.05.II.F.8).

Annex VIII.1

ESTIMATING FUTURE INFRASTRUCTURE INVESTMENT NEEDS: METHODOLOGY AND RESULTS

The methodology for estimating future infrastructure investment needs was first introduced by Fay and Yepes in 2003.⁶⁸ Subsequent studies in this area have used a similar but revised methodology.⁶⁹ This box summarizes the main features of the methodology and the results of using it are summarized below.

The model

- The infrastructure sectors considered are electricity, roads, water and sanitation, railroad, telecommunications (fixed-line and mobile);
- Demand for infrastructure services (by the categories described above) as consumption goods as well as inputs for production are determined by specifying:
 - Consumption demand as a function of per capita income
 - Input demand as a function of aggregate output, share of agriculture and industry in GDP and a proxy for technology;
- As the flow of infrastructure services is proportional to the infrastructure stock, demand for infrastructure stock is estimated by using relationships of the categories above with per capita income, aggregate output and the share of agriculture and industry in GDP.

The data

The following variables are used to represent infrastructure stock:

- Main telephone lines per 100 persons
- Mobile telephones per 1,000 persons
- Kilowatts (Kw) of electricity-generating capacity per capita
- Kilometres (Km) of railroad per 1,000 persons
- Km of paved roads per Km² of land
- Percentage of households with access to water and sanitation
- Ordinary least squares (OLS) regression using data for 113 countries during the period 1960-2000 is the method used to estimate the relationships of the above variables with the economic variables (e.g., aggregate output) discussed previously for each of the countries.

⁶⁸ Marianne Fay and Tito Yepes, "Investing in infrastructure: what is needed from 2000 to 2010?", World Bank Policy Research Working Paper 3102 (Washington, D.C., World Bank, July 2003).

⁶⁹ The Asian Development Bank, Japan Bank for International Cooperation, World Bank study which states that the same methodology has been used is *Connecting East Asia: A New Framework for Infrastructure* (Manila, Asian Development Bank, Japan Bank for International Cooperation and World Bank, 2005).

- The relationships are used to estimate future demand for infrastructure for the countries using economic variables projected by the World Bank.

Resource requirement for investment

- Future demand for infrastructure assets is multiplied by unit costs (in United States dollars) of infrastructure investment and of infrastructure maintenance to estimate the financial resources required for future infrastructure investment.

The results

Using the study by ADB, JBIC and World Bank and the annual investment requirements for developing East Asia (including Pacific island countries) during the period from 2006 to 2010 are as follows:

	Investment	Maintenance	Total (millions of United States dollars)
Energy	63 446	25 744	89 190
Telecommunications	13 800	10 371	24 171
Transportation	24 345	12 524	36 869
Water and sanitation	5 458	9 359	14 817
Total	107 049	57 998	165 047

Adding investment requirements for South Asia as given in an earlier World Bank study, total annual infrastructure investment needs for the developing Asian and Pacific region during the period 2006-2010 are:

	Investment	Maintenance	Total (millions of United States dollars)
Energy	74 570	32 730	107 300
Telecommunications	20 425	15 590	36 015
Transportation	31 046	29 649	60 695
Water and sanitation	9 077	15 062	24 139
Total	135 118	93 031	228 149

Annex VIII.2

NORTHEAST ASIAN DEVELOPMENT BANK

The idea of establishing a northeast Asian development bank was first presented at the Northeast Asia Economic Forum meeting in Tianjin, China, in September 1991. Political leaders put forward the proposal in order to address specific conditions that the region faced and because they believed that integration would enhance the region's economic prospects. The proposed bank appeared on the agenda of successive annual meetings of the Forum. In 2000 the Forum created the Ad Hoc Committee for the Establishment of the Northeast Asian development bank and once again emphasized the strong need for such a bank to play a role in fostering greater economic cooperation and financing infrastructure investment and economic development in the region.

The need for a northeast Asian development bank⁷⁰

A successful bank would involve not the public sector alone in promoting economic development; in market-based economies it would also engage the private sector as the primary driver of economic progress. However, private investment in resource development, manufacturing, financial markets and service industries would take place only when potential investors are confident that a country's basic infrastructure, such as transportation, telecommunications, energy and environmental facilities, are adequate to support and service their investments.

The state of the infrastructure in North-East Asia falls short of widely accepted standards. Expanding the transportation infrastructure is essential to economic integration in North-East Asia but would require huge investments in construction, raw materials, plants and equipment.

The role of a northeast Asian development bank

The proposed northeast Asian development bank would supplement financing of the existing multilateral financial institutions such as ADB and the World Bank.⁷¹ The bank's main role would be to fill the perceived financing gap and it would therefore direct its financing primarily to projects that improved and expanded the region's infrastructure. In addition to providing financial support, the bank would also provide technical assistance in identifying, designing, evaluating and implementing projects.

The capital structure

The proposed bank's capital structure would be the same as that of ADB's, where subscribed capital constitutes the largest portion of financial resources, with only a small percentage of it paid up and most available as callable capital.

⁷⁰ Katz, op. cit.

⁷¹ D.W., Nam, "Why is a northeast Asian development bank needed? Summary of Discussions in the Northeast Asia Economic Forum at Tianjin, China, 2-7 September 1991.

Opportunities and benefits

A northeast Asian development bank would bring both economic and social benefits.⁷² A regional development bank would enable resource development and provide a market for services and equipment. More of the finance for infrastructure could be raised from capital markets, thereby reducing the burden on the few countries such as China, Japan and the Republic of Korea, with its ability to finance such investments in the region.

The proposed bank would also play a role in ensuring that long-term infrastructure projects would be funded by long-term borrowing, thus helping to reduce the mismatch involved in using short-term financing to fund long-term projects exposed in the 1997 financial crisis. The bank would maintain greater financial discipline, ensure investment decisions are based on the region's infrastructure priorities and prevent waste.

⁷² Katz, op. cit.

Annex VIII.3

EUROPEAN INVESTMENT BANK: ORGANIZATIONAL BACKGROUND AND KEY FUNCTIONS

Founded in 1958 under the Treaty of Rome signed in March 1957, the European Investment Bank provides long-term loans and guarantees mostly for fairly large-scale public and private projects, mainly within the European Union, but also in the developing world.⁷³ The latter are provided under the European Union's development aid and cooperation policies.⁷⁴ Although EIB is a European Union institution, it is a legally separate and financially autonomous entity with headquarters in Luxembourg. Its members are the European Union's 25 member States which have all subscribed to the Bank's capital. Each member's capital share is calculated on the basis of its economic weight within the European Union as measured by the size of its GDP relative to the total GDP of all member States.⁷⁵ Four countries, Germany, France, Italy and the United Kingdom, make up about two thirds of the Bank's shareholding. Shareholders are fully eligible for bank financing operations without any geographical or sectoral quota restrictions.

The stated mission of the Bank is "to further the policy objectives of the European Union by making long-term finance available for sound investment".⁷⁶ Projects in which the Bank can invest must be broadly aimed at fulfilling one of the following objectives: (a) development of the European Union's less-favoured or less developed regions; (b) modernization of businesses and creation of new activities which cannot be entirely covered by national funding resources; and (c) provision of aid for investment in the infrastructure of community interest which, as a result of its scope or nature, cannot be funded by one member State alone.

a) Lending by the European Investment Bank

In 2004, the Bank started to concentrate on public – private partnerships engaged in building infrastructure and delivering public services. In explaining the rationale of PPPs the Bank's 2004 annual report noted that they:

Represent a relatively new approach to building infrastructure and delivering public services. Their main attraction lies in the increased efficiency and effectiveness achieved by sharing a project's risks, which are shouldered by those best able to manage them: the construction and operational risks are borne by private enterprise, while public authorities take on the responsibility for establishing and maintaining a balanced legal and

⁷³ A more detailed description of EIB is provided by Griffith-Jones, Steinherr and de Lima, *op. cit.*

⁷⁴ The duration of the loans generally is between 4 and 20 years. Extraregionally, EIB lends to countries in Africa, the Caribbean and the Pacific (ACP); in South Africa, the Western Balkans and the Russian Federation, Asia and Latin America; (ALA); countries in the Mediterranean as well as to Romania and Bulgaria which are European Union accession countries. In 2004, ACP countries received 440 million euros while the ALA countries received about 230 million euros in loans (less than a third of this went to Asia).

⁷⁵ The current subscribed capital of EIB is slightly over 160 billion euros. Germany, France, Italy and the United Kingdom are the largest shareholders, each having a stake of about 16 percent.

⁷⁶ See <www.foei.org/publications/pdfs/eib1.pdf>.

economic framework throughout the life of the project. In addition, PPP's enable public authorities to create public service infrastructure while staggering the burden of their investment over time and, in certain cases, allowing off-balance sheet commitments (p. 25).

The Bank's PPP lending has particularly concentrated on transportation projects, which have accounted for 85 per cent of total approvals; health and education projects accounted for the remainder of the funds approved. The Bank has also recently focused on the development of efficient transport, energy and information networks within Europe.

As a rule, the Bank lends up to 50 per cent of the project cost and it requires adequate security for its loans. This security could take the form of guarantees from a bank, a financial institution, or a large, well-diversified parent company with a good credit rating. In certain circumstances, EIB might, also include a risk margin in the financing arrangements.⁷⁷ In addition, EIB seeks assurances that no other creditor is in a more favourable position than itself. EIB monitors the project's progress and may carry out on-site inspections. While the Bank usually lends money to large projects, it also supports smaller investments through a facility called "global loans", under which EIB provides capital to smaller banks, which in turn lend the money out. Such loans have to conform to all EIB specifications.

b) Financing of the European Investment Bank

EIB relies primarily on two sources of funding. Apart from its capital and reserves, EIB raises a significant amount of money from international capital markets via the issuance of bonds and other debt instruments. The rating agency, Moody's, has given EIB a triple-A rating. In 2004, the Bank raised almost 50 billion euros, an 18 per cent increase over that of the previous year. EIB is so well recognized in capital markets that it has received awards such as the "Borrower of the year 2004", "Most impressive borrower" and "Most innovative borrower". All of this translates into cheaper borrowing for EIB and it means cheaper credit can be provided to its clients for development work. In other words, the Bank lends at low, but market-based rates; they are not concessional.

THE EUROPEAN INVESTMENT FUND

In 1994 EIB co-founded the European Investment Fund (EIF) as a joint venture with the then European Commission. EIB took a 60 per cent shareholding, the European Union took 30 per cent and 34 financial institutions took a combined stake of 8 per cent. The Fund's authorized capital is 2 billion euros. As part of the EIB Group, the Fund is also committed to contributing to the pursuit of European Union objectives. However, unlike EIB, the Fund does not provide loans; EIF was founded specifically to pursue one of the priorities of EIB, which is "support for small and medium-sized enterprises (SMEs) as well as mid-cap companies of intermediate size". The Fund focuses on providing venture capital and guarantees. It

⁷⁷ The availability of such guarantees has ensured that the European Investment Bank has the highest quality assets; however, there are two criticisms. First, lending to borrowers that have good credit standing or are able to obtain credible guarantors and thus may be able to raise finances themselves may merely crowd out private lending. Second, what about those countries that are less developed and caught in poverty traps and are not able to obtain third-party guarantees as easily?

makes equity investments in venture capital funds and business incubators that support SMEs, particularly technology-oriented enterprises that are in an embryonic development stage. In essence, EIF acts as a fund-of-funds. It also provides guarantees to financial institutions that provide credit to SMEs. In its role as the risk-capital arm of the EIB Group, the Fund uses the financial means at its disposal to support the development of the European venture capital market.

NEXUS BETWEEN THE EUROPEAN INVESTMENT BANK AND THE EUROPEAN BANK FOR RECONSTRUCTION AND DEVELOPMENT

An issue of interest to Asia and the Pacific is the nexus between EIB and EBRD. Why does Europe have two public development and investment banks?

The role of EIB has been noted. EBRD was established in 1991 to nurture the private sector in the newly democratic States of Central and Eastern Europe after the break-up of the former Union of Soviet Socialist Republics (USSR). The EBRD is owned by 60 countries (including the United States) and two inter-governmental organizations (EIB and European Union), with total subscribed capital of 20 billion euros (compared with 160 billion euros in the case of EIB). EBRD is currently involved in 27 countries stretching from Central Europe to Central Asia. It provides project financing for banks, industries and businesses, both new ventures and investments in existing companies. It works with publicly owned companies to support privatization, restructuring State-owned firms and improving municipal services, and with Governments to institute policies that will help to bolster the business environment. EBRD also tries to function as a catalyst of change. It promotes co-financing and FDI, mobilizes domestic capital and provides technical assistance.⁷⁸

Both EBRD and EIB raise money from capital markets by issuing bonds and other instruments to finance their loan operations. Both institutions have co-financed some projects and they both have triple-A ratings, thus enabling them to raise money cheaply and to pass on the benefits to their borrowers. Both institutions are involved in infrastructure development as well as financing environmentally sound projects and both lend on a long-term basis. However, apart from some organizational differences, the main distinction between EIB and EBRD is that the former tends to lend relatively more to large infrastructure projects while EBRD, with its smaller capital base, finances mostly smaller private sector projects. For example, EIB lent over 40 billion euros in 2004 while EBRD lent only about 4 billion euros. The broader objective of EIB is to further the development policy objectives of the European Union; in the case of EBRD it is to help to develop free markets and the growth of democracy in the former USSR and elsewhere. Annex table VIII.4 summarizes the key characteristics of, and differences between, EIB, EIF and EBRD.

⁷⁸ See <www.ebrd.com/about/>.

Annex VIII.4

TABLES AND FIGURES

Annex table VIII.1 Cumulative investment in infrastructure projects with private participation, by developing region, subregion and sector, 1990-2001

(Billions of United States dollars)

Region/subregion	Tele- coms	Elec- tricity	Natural gas transmission and distribution	Air- ports	Sea- ports	Rail- ways	Toll roads	Water and sani- tation	Total
Latin America and the Caribbean	163.2	89.5	19.6	7.1	5.7	17.9	36.9	20.7	360.6
East Asia and the Pacific	65.0	68.6	6.0	2.6	8.8	10.1	34.1	15.3	571.1
Europe and Central Asia	64.9	19.1	4.7	1.5	0.7	0.3	2.6	3.3	307.7
South Asia	14.6	22.1	0.2	0.1	1.8	0.0	0.5	0.2	136.7
Middle East and North Africa	8.1	9.0	3.9	0.7	0.9	0.2	0.0	0.1	62.4
Sub-Saharan Africa	15.7	4.8	0.1	0.3	0.2	0.3	1.9	0.2	46.2
Total	331.4	213.2	34.5	12.5	18.0	28.8	76.0	39.8	754.1

Source: World Bank, *Private Participation in Infrastructure Database*, <<http://ppi.worldbank.org/>>.

Annex table VIII.2 Infrastructure projects with private participation, by country, subregion and sector, 1990-2001

(Percentage of GDP)

Region	1995				2000				2001				2002				2003			
	Energy	Telecom- muni- cation	Trans- porta- tion	Water supply and sanitation	Energy	Telecom- muni- cation	Trans- porta- tion	Water supply and sanitation	Energy	Telecom- muni- cation	Trans- porta- tion	Water supply and sanitation	Energy	Telecom- muni- cation	Trans- porta- tion	Water supply and sanitation	Energy	Telecom- muni- cation	Trans- porta- tion	Water supply and sanitation
South and South-West Asia	0.60	0.11	0.04	-	0.73	0.61	0.02	0.02	0.11	0.43	0.01	-	0.05	0.54	0.06	-	0.02	0.26	0.03	-
Bangladesh	-	0.07	-	-	0.04	0.15	-	-	0.99	0.10	-	-	-	0.12	-	-	-	0.81	-	-
Bhutan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
India	0.27	0.19	-	-	0.62	0.14	0.02	0.05	0.06	0.68	0.02	-	0.02	0.91	0.11	-	0.04	0.31	0.05	-
Iran (Islamic Republic of)	-	0.00	-	-	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-
Maldives	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nepal	-	-	-	-	0.73	0.28	-	-	-	0.53	-	-	-	0.02	-	-	-	-	-	-
Pakistan	2.64	0.03	0.45	-	-	0.04	-	-	-	0.10	-	-	-	0.25	-	-	-	0.21	0.04	-
Sri Lanka	6.03	-	-	-	-	47.01	-	-	39.46	2.69	-	-	-	44.56	-	-	-	106.94	-	-
Turkey	1.04	0.07	-	-	1.79	2.27	0.06	-	-	0.14	-	-	0.20	0.11	-	-	-	0.06	-	-
South-East Asia	1.39	0.97	0.81	0.03	0.56	0.32	0.23	0.01	0.68	0.78	0.43	0.09	0.37	0.60	0.14	0.00	0.70	0.38	0.31	-
Cambodia	-	0.06	3.63	-	0.77	0.06	-	-	0.23	0.70	1.90	-	-	0.76	0.19	-	-	-	-	-
Indonesia	1.22	1.20	0.24	-	-	0.43	-	-	-	0.62	-	0.03	0.11	0.83	0.34	-	-	0.41	-	-
Lao People's Democratic Republic	-	-	-	-	-	0.35	-	-	-	0.68	-	-	-	0.60	5.47	-	-	-	-	-
Malaysia	1.35	1.14	2.13	0.01	-	0.32	1.21	0.03	1.98	0.42	0.66	-	0.01	0.49	-	-	1.99	0.28	1.63	-
Myanmar	1.73	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Philippines	3.14	0.93	0.40	-	2.39	0.51	0.01	-	0.74	1.61	1.26	-	-	0.91	0.04	0.03	0.47	0.64	0.15	-
Singapore	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thailand	0.82	0.68	1.01	0.09	0.70	0.17	-	0.02	0.77	1.03	0.39	0.21	-	0.40	-	-	0.91	0.24	0.03	-
Viet Nam	-	0.62	-	-	-	0.05	-	0.06	-	0.05	-	0.47	5.03	0.05	0.08	-	1.08	0.64	-	-
East and North-East Asia	0.07	0.00	0.02	0.00	0.07	0.33	0.11	0.00	0.03	0.02	0.11	0.01	0.03	0.07	0.06	0.06	0.07	-	0.06	0.02
China	0.14	-	0.04	0.01	0.11	0.52	0.18	0.00	0.05	0.03	0.16	0.02	0.05	0.11	0.09	0.10	0.10	-	0.09	0.03
Hong Kong, China	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Macao	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mongolia	-	1.05	-	-	-	0.95	-	-	-	0.49	-	-	-	-	-	-	-	-	-	-
Republic of Korea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
North and Central Asia	-	1.78	-	-	1.06	4.83	0.37	0.14	0.67	3.54	-	-	0.42	4.42	-	-	0.00	5.56	-	0.05
Azerbaijan	-	-	-	-	-	1.16	-	-	4.03	0.30	-	-	2.33	0.11	-	-	-	0.55	-	-
Georgia	-	0.35	-	-	0.36	1.25	-	-	-	0.47	-	-	-	0.44	-	-	0.05	0.41	-	-
Kazakhstan	-	-	-	-	1.64	0.41	-	0.22	-	0.29	-	-	-	0.47	-	-	-	0.50	-	-
Kyrgyzstan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Russian Federation	-	30.04	-	-	-	93.45	8.46	-	-	67.73	-	-	0.84	89.76	-	-	-	110.04	-	1.02
Tajikistan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uzbekistan	-	-	-	-	-	0.26	-	-	-	1.50	-	-	-	0.29	-	-	-	0.18	-	-
Pacific island economies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fiji	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Papua New Guinea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanuatu	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	0.50	0.25	0.19	0.01	0.34	0.45	0.11	0.01	0.16	0.28	0.13	0.02	0.09	0.33	0.07	0.04	0.15	0.19	0.09	0.01

Sources: World Bank, *Private Participation in Infrastructure Database*, <<http://ppi.worldbank.org/>> and United Nations, *Statistics Division Common Database*, <<http://unstats.un.org/unsd/cd>>.

**Annex table VIII.3 International investment in infrastructure of developing countries
as a share of gross domestic capital formation, 1992-2003**

(Percentage)

Region/subregion	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003 ^a
Total	1.5	2.5	2.1	3.8	3.8	6.2	5.1	5.6	5.4	3.7	2.9	3.4
East Asia and the Pacific	2.8	5.1	3.5	4.7	4.6	4.7	5.1	3.1	4.4	1.7	3.1	4.2
Europe and Central Asia	0.6	0.8	1.3	4.3	3.2	5.9	7	8.3	8.1	4.3	4.9	5.5
Latin America and the Caribbean	1.3	1.4	1.2	2.7	4.2	8.1	5.9	5.9	7.5	7.8	2.8	1.7
Other regions	0.8	1.5	1.6	3.2	2.2	5.8	2.4	7	3	2.6	1.1	2.1

Source: World Bank, Global Development Finance 2004: Harnessing Cyclical Gains for Development (Washington, D.C., World Bank, 2004), p.155.

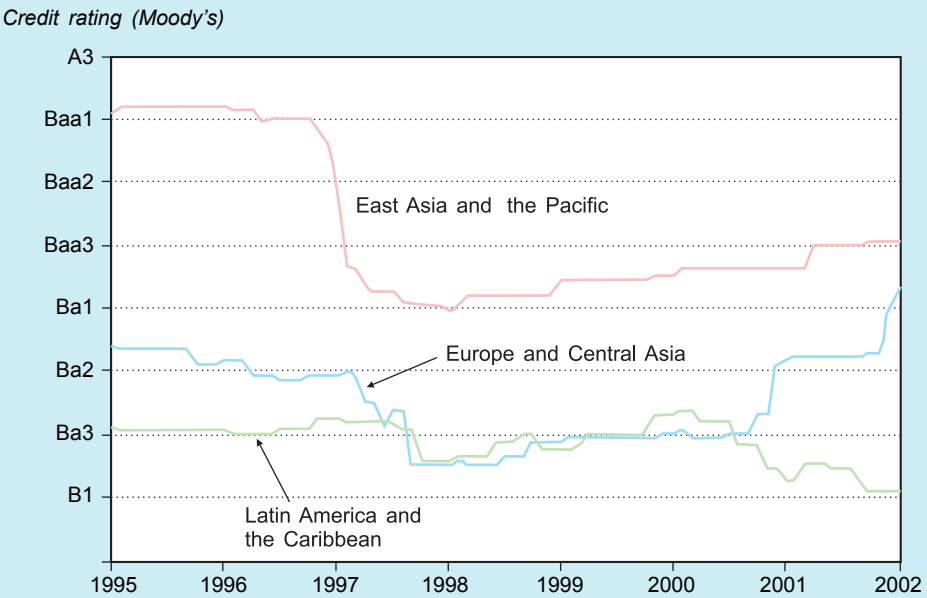
^a Data are from January-November.

Annex table VIII.4 Characteristics of the European Investment Bank, the European Investment Fund and the European Bank for Reconstruction and Development

Institution	Year of inception	Subscribed capital	Key objectives	Type of financing	Regions served	Financing provided in 2004
European Investment Bank	1958	164 billion euros	• Develop European Union's less-favoured or less developed regions. • Modernize businesses and create new activities which cannot be entirely covered by national funding resources. • Provide for investment in infrastructure of community interest which, as a result of their scope or nature, cannot be funded by one member State alone.	• Mostly in the form of loans given for infrastructure projects, such as industries, schools and hospitals.	• Primarily European Union member countries • Southeastern Europe • Asia and the Pacific • Latin America • Caribbean • Africa	48 billion euros
European Investment Fund	1994	2 billion euros	• Stimulate technological and industrial innovation throughout a project's early-stage, development and expansion. • Foster economic growth and job creation. • Transfer new technologies to and their adoption by more traditional small and medium-sized enterprises; the objective is to contribute to the diffusion of innovation. • Make investments with a regional development focus the goal being to reinforce balanced development. • Contribute to the establishment of efficient risk capital markets.	• Does not directly invest or lend money. • Venture capital in small and medium-sized enterprises through intermediaries. Act as a fund-of-funds. • Providing guarantees to institutions that provide loans to small and medium-sized enterprises	• Primarily European Union member countries.	• Venture capital committed: 358 million euros. • Guarantee provided: 1.44 billion euros.
European Bank for Reconstruction and Development	1991	20 billion euros	• Help to move a country closer to a full market economy by providing assistance during the transition period. • Take risks that support private investors without crowding them out. • Apply sound banking principles.	• Provides loans to former communist countries. • Provides project financing for banks, industries and businesses, both new ventures and investments in existing companies	• 27 countries in Central Europe and Central Area	4.1 billion euros

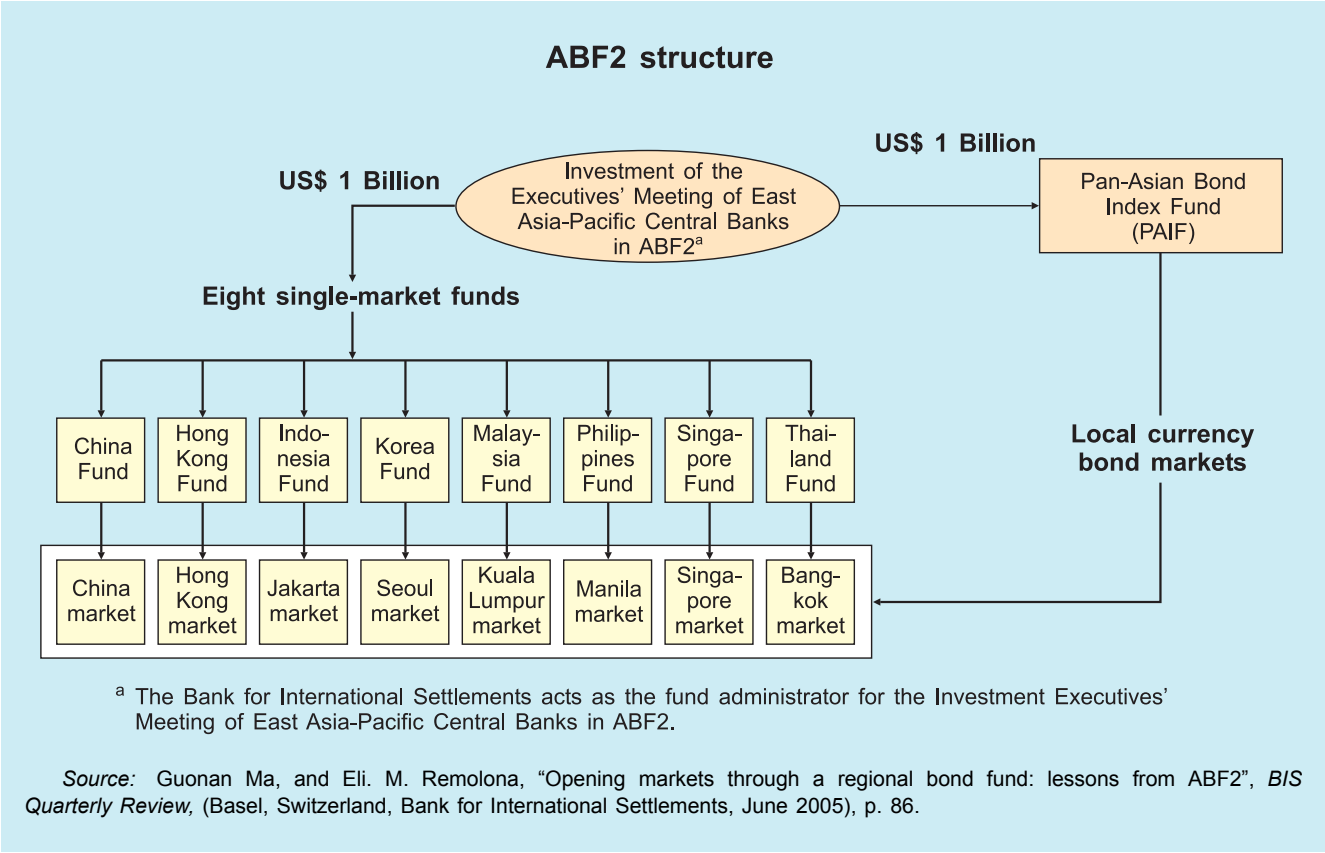
Source: Compiled by Sunil Rongala and Ramkishan Rajan

Annex figure VIII.1. Average regional credit quality, 1995-2002



Source: World Bank, *Global Development Finance 2004: Harnessing Cyclical Gains for Development* (Washington, D.C., World Bank, 2004), p.158.

Annex figure VIII.2. Structure of the Asian Bond Fund (ABF2)



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IX. CONCLUSION

This study joins a growing body of literature on infrastructure development but has several features which will distinguish it from the rest. Firstly the study sounds an alarm. The Asian and Pacific region needs to invest in infrastructure to maintain its economic growth and competitive edge and to maintain its momentum towards achieving its MDGs, but the financial resources needed are simply enormous. It is worth noting that the World Bank, the Asian Development Bank and Japan Bank for International Cooperation have all pointed out the enormity of the region's infrastructure funding needs.

Secondly, the study makes clear that the status quo or business as usual, implying dependence on the existing sources and modalities of infrastructure financing, will not enable countries to mobilize the required resources and will leave a huge financing gap. Asian and Pacific countries need either to make substantial changes to existing institutions or to set up new institutions capable of delivering the needed investment. This study evaluates a number of options, including the use of the region's surplus savings, for developing infrastructure in Asia and the Pacific under the rubric of regional cooperation.

Thirdly, the study recognizes the multifaceted nature of infrastructure development and that regional cooperation limited to financing infrastructure is not sufficient to build the infrastructure assets and deliver the services required. Regional cooperation is also required in identifying and implementing cross-border infrastructure projects (such as the Asian Highway), harmonizing cross-border rules and regulations, sharing infrastructure facilities (such as dry docks in landlocked countries), sharing "good practice" lessons (such as formulating economic and institutional policies that attract private investment) and providing a forum for senior policymakers to discuss issues related to infrastructure development. Fourthly, the study draws the attention of policymakers to the region's vulnerability to natural disasters and suggests how infrastructure development can be used to lessen their impact.

Discussed below are selected examples of key messages from different parts of the study to provide a brief overview on how it has addressed the issues outlined above and what could be the role of ESCAP in strengthening regional cooperation in infrastructure development.

Transport development

A two-pronged approach is needed to strengthen cooperation in transport. The first approach is to promote subregional cooperation in integrating national intermodal transport systems. For example, an integrated

The Asian and Pacific region requires very large financial resources for infrastructure investment but regional cooperation is needed to mobilize them

Regional cooperation in identifying cross-border infrastructure projects, harmonizing cross-border rules and regulations and learning good practice lessons are equally important for infrastructure development

international transport and logistics network proposed in North Asia with a mix of roads, railways and water transport, including connections between major seaports and inland container depots, freight terminals, distribution centres and border crossings represent a potentially important element in regional cooperation. ESCAP has drawn up a plan for implementing the proposal. The second approach is to ensure compatibility and consistency in terms of both standards and methodology. ESCAP's regional cooperation initiatives in Asian land transport, the Asian Highway and Trans-Asian Railway, continue to serve as reference points for both subregional and international initiatives. The Intergovernmental Agreement on the Asian Highway Network entered into force in July 2005 and the Intergovernmental Agreement on Trans-Asian Railway Network is expected to be signed in November 2006.

Regional cooperation in maritime transport in the coastal region of the Asian continent differs significantly from cooperation among small island developing States (SIDS). In Asia, changes in technology, ship route structure and State-owned ports have led to consolidation, concentration, cooperation and strategic alliances in shipping. In the Pacific, the Global Action Plan for SIDS has provided a guiding framework for regional cooperation. This is actively pursued by the ESCAP Pacific Operations Centre.

Regional transport cooperation could incorporate sharing facilities and a better mechanism for harmonizing institutional and economic policies

Other regional transport cooperation initiatives which ESCAP could facilitate include the following:

- Exploring options for sharing bilateral and subregional infrastructure, such as dry ports in landlocked countries
- Promoting improved management and maintenance of infrastructure assets, for example by creating road funds
- Promoting better mechanisms for coordinating the regional transport infrastructure, including such issues as tax breaks and designation of special economic zones to promote foreign direct investment
- Improving cross-border facilitation by creating an Asia-Pacific "Single Window" for cross-border customs, trade and transport facilitation is a priority area.

Development of ICT infrastructure

Revolutionary changes in the production and use of ICT have been a principle component of intensified globalization. The digital divide has been widely discussed as a structural impediment to the socio-economic progress of a number of countries of the region, especially its least developed countries.¹ Against this backdrop, developing countries of the region need to take steps to invest in developing network capacity that will enable key economic sectors to take advantage of newer and more cost-effective telecommunications and computer technologies. They also need to create an enabling policy environment to disseminate the technology and to increase private sector participation in this area. Regional cooperation could be very effective in both these areas.

¹ ESCAP, *Meeting the Challenges in an Era of Globalization by Strengthening Regional Development Cooperation* (United Nations publication, Sales No. E.04.II.F.24).

There have been several regional initiatives in Asia and the Pacific focused on increasing the use of advanced and sophisticated technology, especially broadband. To support broadband development (the Asia Broadband Program), ESCAP could focus on creating regional consensus and an enabling policy and regulatory environment, building the required skills base and promoting such applications as e-government, e-business, e-environment, e-learning and e-health.

ESCAP could focus on strengthening the Asia Broadband Program

Energy infrastructure development

The ever increasing requirement for energy to fuel Asia's high economic growth combined with the recent oil price hike has reinforced the need for regional cooperation in energy aimed at improving energy security. There is good scope for innovative regional cooperation in both production and consumption of energy as demand centres are often not within the national boundary of the resource centres. Cross-border energy trade could therefore bring substantial benefits to the economies of the trading countries. Large potential exists for cooperation in two major energy types, natural gas and electricity. At the same time, Asian and Pacific countries could substantially increase their sustainable energy security by cooperating in the development of renewable energy technology and by adapting and sharing knowledge and best practices. In some countries, the private sector is cooperating with the Government and local communities in developing and operating renewable energy-based power plants and biofuel. This cooperation needs to be strengthened.

A number of initiatives for multilateral dialogue on energy cooperation either have been agreed in recent years or are under negotiation. Examples include the Qingdao Initiative under the Asian Cooperation Dialogue (ACD).² A regional body such as ESCAP could further strengthen regional cooperation by:

There is a need for an integrated trans-Asian energy system to enhance energy security for the region

- Facilitating the establishment of consultative or collaborative mechanisms for planning and coordinating efforts to improve energy security. This could include organizing policy dialogues, negotiations and networks for information exchanges.
- There is a need for a policy thrust towards a greater initiative for an integrated trans-Asian energy system, for example through the Asian Gas Grid and Asian Electric Power System Network. A regional approach can support and build on ongoing and planned initiatives and promote linkages and synergies towards greater energy system integration.

Development of water infrastructure

In continental Asia, most large rivers cross boundaries between two or more countries, and there is a considerable need to strengthen regional (cross-border) initiatives for using this important source of water. Hydraulic infrastructure in the Asian and Pacific region is unevenly developed, especially in least developed countries, where inadequate infrastructure is often connected with poor management. The need for policy and institutional reforms to strengthen the roles of governments, municipalities, companies

² Japan, Ministry of Finance website (www.mofa.go.jp/region/asia-paci/asean/acd), accessed 13 January 2006.

and water use associations in both supply and management of water infrastructure has increased rapidly. This need will grow faster with the rapid pace of urbanization in the region. Regional cooperation can be an important way to address the need.

The creation of an Asian water infrastructure investment forum for hydraulic infrastructure development would be an important step in strengthening regional cooperation

A number of innovative regional cooperation initiatives which can be facilitated by ESCAP are discussed in chapter VI. Among these is the proposed creation of an Asian water infrastructure investment forum for the development of water infrastructure with a view to ensuring the effective participation of stakeholders, particularly the private sector, in the implementation of the Millennium Development Goals related to water and to ensure sustainable economic growth and sustainable development. This initiative can be seen as complementary to the initiative to be launched at the Ministerial Conference of the Fourth World Water Forum, to be held in Mexico City in March 2006, to establish an Asia-Pacific water forum. The Asia-Pacific water forum initiative was jointly sponsored by many countries in the region, as well as ESCAP and other international organizations.

Disaster management and infrastructure

Infrastructure development in the context of natural disaster management has two components: infrastructure designed to prevent or minimize the damage inflicted by natural disasters and ensure the sustainability of socio-economic development; and infrastructure that assists reconstruction and recovery. During the past 15 years, the annual damage caused by natural disasters to developing countries in Asia and the Pacific has increased to \$21.3 billion from \$6.9 billion during the past five decades. This trend appears to have accelerated in recent years, especially with regard to infrastructure damage, which was estimated at 70 per cent of all economic damage. On the basis of the average annual economic damage over the past 15 years, it is estimated that developing countries would need to invest \$15 billion annually for rehabilitation and recovery. Furthermore, the need to improve the coordination of rehabilitation and reconstruction activities in terms of developing a strategy for transition from relief to recovery and reconstruction for major regional disasters was recognized in the recent review of the role of the United Nations system in humanitarian assistance for disaster reduction and response undertaken by the Joint Inspection Unit of the United Nations.

Investment in infrastructure for the management of water-related disasters (viz., cyclones and floods) has significantly reduced the loss of human life from an average of 100,000 people per year during the past 50 years to 41,000 per year in the past 15 years. However, the current level of investment in infrastructure for disaster prevention and preparedness is still very much lower in developing countries, 0.05 per cent of GDP in comparison with the recommended level of 1 per cent of GDP. In view of the above and as discussed in chapter VII, some innovative initiatives in which ESCAP could take a leading role are as follows:

A regional task force on disaster recovery and management could be instrumental in helping developing countries in the region to meet rapidly expanding needs in the aftermath of natural disasters and to promote adequate investment in infrastructure for effective disaster preparedness and prevention

- The creation of a regional task force on disaster recovery and management to assist developing countries in the region to meet rapidly expanding needs in the aftermath of natural disasters and to promote adequate investment in infrastructure for effective disaster preparedness and prevention. This regional task force, consisting of key member countries and interested partners, would be expected to draw up a regional strategy on disaster recovery and management and recommend a programme of action to be undertaken by ESCAP and collaborating organizations.

- Promoting the creation of regional multi-hazard early warning and monitoring systems. Regional trust funds for tsunami early warning systems could be promoted and expanded to cover other hazards for specific subregions, such as sandstorms in North-East Asia and drought in South Asia;
- Regional cooperation to integrate the eco-efficient aspects of the development of physical infrastructure into economic decision-making. The green growth concept³ could be promoted both for physical infrastructure linked to disaster management and infrastructure for socio-economic development. ESCAP could assist in the development of guidelines, including procedures and criteria for developing physical infrastructure in harmony with nature.

Financing infrastructure investment

Estimates of how much investment is needed for major infrastructure sectors, namely transport, ICT, energy and water, and infrastructure for natural disaster management depend on their coverage and methodology, but they range from \$228 billion per year (based on infrastructure demand at the macro level) to \$608 billion per year (based on sectoral estimates with additional information and larger coverage).

The message is loud and clear: the investment needed is very large. The funds available from existing public and private sources of financing are estimated at \$48 billion per year. This figure includes \$2.6 billion per year from the Asian Development Bank, \$2.8 billion per year from the World Bank and \$2.0 billion per year from the Japan Bank for International Cooperation from 2000 to 2003. That leaves a financing gap of at least \$180 billion per year. It is thus very clear that funding from existing sources will not suffice to meet the region's financial needs. What additional funds can be tapped?

There are substantial financial resources available within the region. It enjoys a very high savings rate, in some countries amounting to more than 40 per cent of GDP. From 2000 to 2003, the region's surplus savings (savings over investment) amounted to around \$200 billion per year. Most of this is invested outside the region. The region has also accumulated foreign exchange reserves of more than \$2.5 trillion. At least a portion of these funds can be used for infrastructure development in the region. How can this be achieved? The answer lies in regional cooperation to mobilize these resources for infrastructure development. Countries of the region need to initiate, strengthen and facilitate cross-border intermediation of the available savings. The financing options include the following:

1. Expanding the involvement of the Asian Development Bank in infrastructure financing by tapping capital markets.
2. Expanding both the quantum and regional coverage of the Asian Bond Fund.
3. Reviving proposals for subregional banks or funds, such as the Northeast Asian development bank and the South Asian development fund.

The message is loud and clear: the region needs to set up a new financial institution or expand existing ones that can intermediate the region's surplus savings in order to address the infrastructure financing gap

³ ESCAP, *The Fifth Ministerial Conference on Environment and Development in Asia and the Pacific, 2005* (United Nations publication, Sales No. E.05.II.F.31).

4. Setting up an Asian investment bank along the lines of the European Investment Bank to intermediate untapped regional financial resources and to provide loans for infrastructure development.

When assessing these options, it is worth noting that an institution capable of mobilizing the large resources required for infrastructure investment in the region and financing infrastructure projects also needs to be capable of doing the following:

- Identifying financially viable infrastructure projects
- Undertaking complex risk mitigation for and providing guarantees to different types of investors
- Providing liquidity support and securitizing the cash flow of infrastructure projects
- Mobilizing resources, mainly on the capital market through the issue of bonds and other financial instruments.

Policymakers need to take note of these options and requirements and decide on the best future course of action, identifying the institution most capable of fulfilling the region's infrastructure dream.

A comprehensive approach to regional cooperation in infrastructure and the role of ESCAP

ESCAP is well positioned to assist member countries in developing infrastructure sectors through regional cooperation

Infrastructure development is a multidimensional endeavour in which synergy needs to be achieved between the different sectors in order to attain the best results. All of the four main infrastructure sectors, namely transport, ICT, energy and water, need to develop in tandem. Deficiency in one sector could neutralize the benefits of improvements in others. The multi-divisional structure and sectoral experts of ESCAP are well positioned to assist member countries in developing all four infrastructure sectors through regional cooperation. ESCAP activities consist mainly of regional and cross-border issues and projects which no individual country could identify or implement by itself. These activities range from identifying and implementing cross-border projects, harmonizing cross-border rules and regulations, learning from best practice policies and institutions related to infrastructure development and cross-border financial intermediation of surplus savings for infrastructural investment.

This study has underlined the need for multidimensional but comprehensive development of the region's infrastructure and discussed how ESCAP can play a part. The regional cooperation initiatives it suggests form a coherent approach towards balanced infrastructure development in Asia and the Pacific.

A concluding message: the prime importance of mobilizing investment in infrastructure

The opportunity cost of not immediately addressing the infrastructure financing gap could be high

Infrastructure is essential to the production of goods and services and satisfying consumption demand. The region's ability to achieve its hopes of enhanced economic growth and achieving the Millennium Development Goals goes hand in hand with its ability to put in place an appropriate level of infrastructure. Heavy investment in additional infrastructure assets and better maintenance of old assets will be crucial. Regional cooperation could be a

very effective modality for providing countries with access to the necessary financial resources. Studies by various organizations, including the World Bank, the Asian Development Bank, the Japan Bank for International Cooperation and ESCAP, show that the amount of investment needed for the region's infrastructure is immense. The options for regional cooperation to mobilize these sums suggested in this study require serious consideration by ESCAP members. Failure to immediately address the issue of financing infrastructure investment could cost the region dearly in terms of lost socio-economic progress.

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