IV.1

International Production Systems and Connectivity of Hinterlands

The Story

In contrast to previous phases of globalization in world history, this time transport infrastructure development has been a major driver of far-reaching *qualitative* changes in the internationalization of production. In fact, the impressive growth of shipping in Asia is in large part due to the formation of regional production networks (RPN) in Asia[117] , whereby countries have specialized 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' (see Section II.4). The following "story" captures the essential ingredients of this process:

In Asia, the process of internationalization of production gathered momentum in the mid-1980s, when a number of countries of the region started to lower their barriers to trade and investment. This was particularly the case in the newly industrializing economies (NIE) and ASEAN 4, which introduced outward-looking structural reform policies that moved away from import-substitution production towards export-oriented production. These policies included liberalization of trade and foreign direct investment (FDI) as well as deregulation of domestic economic activities, the aim being to stimulate economic growth.

The impact of these policies is often referred to as the "East Asian Miracle". FDI inflows increased twelve-fold and East Asian exports increased five-fold between 1985 and the "East Asian Crisis" in 1997. Annual economic growth during this period in these economies exceeded that of most other economies in the world. One of the features of the FDI was that the multinational corporations active in the region established factories that specialized in the production of specific components of finished goods. As a result, regional production networks (RPNs) were formed which, in turn, increased intra-industry trade within the region.

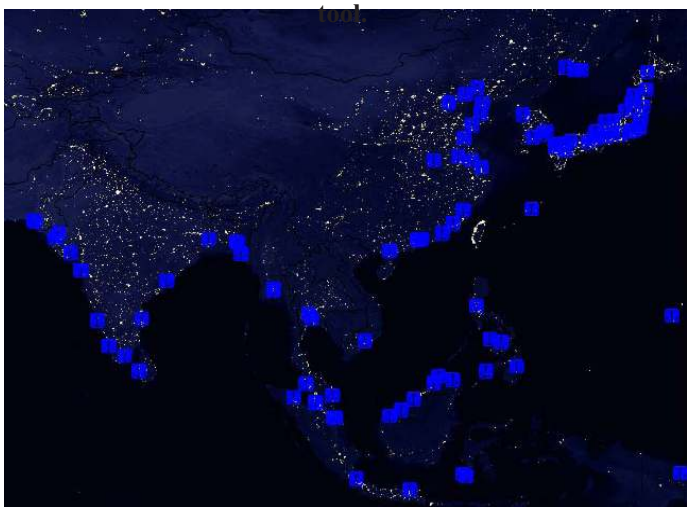
In assessing the contribution of transport to the emergence of RPNs, it has been the developments in the maritime sector that have been the primary motivating

117. similar to those in other world regions, e.g., in Europe.

force. Probably the most important factor contributing to the massive productivity and cost savings in transport was the advent of the marine container and the container ship. Since the 1970s, container ship size has increased more than five-fold to over 5,000 TEUs in Post-Panamax Plus ships, in order to exploit economies of scale. In order to keep these ships moving, operators have introduced various network structures, 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, improved service reliability and increased service frequency (with many operators providing "day-of-the-week" calls at named ports).

Further, to achieve the significant productivity gains from the container and changes in shipping technology, complementary, large-scale investments were required in seaports. Access provided by these seaport locations to international and domestic markets has attracted the FDI of corporations engaged in RPNs, a process which has received policy support through the development of industrial estates and special economic zones. As a result, it is mainly the coastal areas of East and South-East Asia that have benefited economically from this process (Figure 15). These coastal areas are not only richer than inland sites but have seen much faster growth too, exacerbating spatial inequalities in each of these national economies.

Figure 15: Night light density map of Asia and location of major ports. Night light density is a good proxy for GDP (linear relationship). Created with ESCAP's GIS tool.



Data source: NOAA[118]

In addition, spatial concentration of economic activities, particularly in megacities, has been a key feature of rapid development in Asia. In essence, megacities have taken up the role that special economic zones played in the past three decades. For example,

118. National Oceanic & Atmospheric Administration (NOAA), U.S. Department of Commerce, http://www.noaa.gov/.

Bangalore accounts for 25% of India's software exports, with some 100,000 workers (or 0.01 percent of population) in the city producing 3% of India's exports. Another key feature is sectoral concentration. There is surprisingly little overlap in the top product lines of quite similar countries[119].

Vision

As it has been mainly coastal regions of Asia and the Pacific that have benefited from the current phase of globalization by becoming important nodes in the regional production networks, how could these international production networks be extended to all ESCAP member countries, their national hinterlands and even landlocked countries that currently face marginalization?

Systems view

One comprehensive way to describe the vision of a desirable future transport network in Asia and the Pacific is to take a systems view that aims to take into account all important interrelationships between all relevant subsystems.

A strategy to support such an extension in terms of its transport aspects could be based on strong linkages to trade, investment and ICT, and could be predicated upon a model that promotes physical access to hinterlands and neighbouring countries. Such a model envisions a phased approach which commences with capacity building in developing unimodal transport links and nodes of international importance. It then moves towards integrating the modes into an intermodal network. In parallel, the model envisions development of nodes that support increased efficiency of the system, adding value and creating employment in areas that are in danger of being marginalized in the globalization process. Such nodes may include a spectrum of functions ranging from inland container depots simply providing transfer facilities, the addition of value added logistics services to the nodes through to special economic zones. In implementing the model, attention will be paid to both the development of infrastructure and operationalization of the network.

In particular, ESCAP has been focusing on the development of international transport corridors that have been designated as priority by ESCAP member countries. This is the approach taken by ESCAP's Trans-Asian Railway Network (TAR), the Asian Highway (AH), the Euro-Asian Linkages Project and other initiatives.

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119. Burgess and Venables (2004). Toward a Microeconomics of Growth, World Bank Policy Research Working Paper 3257, April 2004.

These corridors provide pieces of an intercontinental Euro-Asian 'puzzle' that is geared to promoting an extension of production networks. In essence, the vision of such an extension follows the historical process of transportation network development that leads to corridors. For example, it happened in North America and elsewhere in the world. Following is an excellent description by Jean-Paul Rodriguez[120]:

"Phase A (Scattered ports): A set of small trade ports are established along a coastline. They are connected to a wider network of trade and provide access to locally supplied resources.

Phase B (Penetration lines and port concentration): Trade lines accessing the hinterland are constructed permitting the development of new resources and/or markets. The ports to which they are connected grow in proportion to the new traffic generated.

Phase C (Development of feeders): The hinterland of penetrating lines is further expanded by the development of feeders.

Phase D (Beginning of interconnections): The transport networks that have so far been developing independently gradually become interconnected. Intermediate centers also start to emerge.

Phase E (Complete interconnection): As the level of connectivity increases, traffic tends to concentrate in the most connected ports (often corresponding to the largest cities), implying that several less well-connected ports decline or disappear.

Phase F (Emergence of high priority links): Economies of scale favour the concentration of traffic along the most efficient links, supporting the emergence of transport corridors. Links having lower volumes can even be closed down. The regional transport system has thus reached a phase of maturity and the structure of the network is unlikely to change unless there are significant economic or technological developments."

Countries of Asia and the Pacific are at various stages of this development process. ESCAP's Asian Highway Network is aiming to support Phases B, D, and F of this extension network, as it will provide the backbone land transport network. In fact, in Section IV.2, we will argue that upgrading the Asian Highway (everywhere to at least grade three) implies only a doubling of currently committed investments

120. Jean-Paul Rodriguez, http://people.hofstra.edu/geotrans/eng/ch7en/conc7en/corridordev.html, accessed Sept. 2005. *Note*: The original model is due to Taaffe, Morrill and Gould (1963).

into the Asian Highway of the order of US$20 billion. This amount is small compared to total financing needs of roads in Asia and the Pacific, hence the benefit of prioritization.

As population densities in East, South-East and South Asia are considerably higher than in North America, and are more in line with those in Japan and Europe, it is likely that railways will play an increasing role in Asia in the future, to complement and substitute for road transport in the backbone network functions. In other words, a desirable vision of the land transport system of Asia would see a *re-emergence of railways (Phase G)*. Early signs of this can be seen, for example, in China today. Such a phase G would also have substantial environmental and safety benefits.

It appears that strategic transport infrastructure investment at a regional level could lead to a similar rapid growth pattern of those Asian countries that are currently facing marginalization. The timeline for this process will vary from country to country, but an ambitious scenario would see all ESCAP member countries participating in and benefiting from the world's most important regional production networks at least by 2030. Finally, it should also be noted that this extension process to inland sites would not come at the expense of coastal areas and port development. On the contrary, ESCAP container forecasts foresee a huge expansion of container shipping and berth development (see Box 3).

International routes

Another way to describe the vision of a desirable future transport network in Asia and the Pacific is to focus on what it would mean for international routes. This perspective is essentially the one that shippers and many national transport policy makers take. In contrast to the systems view, it is easier to apply and provides hands-on indication on what might need to be done to make the vision happen.

In the international context, the availability of *choice* among alternative competing international transport routes is of key importance. Increased choice is a common consequence of network integration. Taking a perspective focused on international routes, the ESCAP Secretariat suggests to consider the usefulness of the following "transport vision statement" of an integrated transport network in Asia and the Pacific:[121, 122]

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121. The authors are grateful to Vladimir N. Timofeev for providing the transport vision statement.
122. A similar statement was published first in: Timofeev, V. (2005*). Integrated Euro-Asian Transport System: Role of UN and OSJD in its development*, OSJD Bulletin, No. 3-5, 2005. [in Russian only]

Box 3: ESCAP Forecasts of container shipping for 2015 with the Maritime Policy Planning Model

Forecast of container shipping service requirements: According to a recent joint study of UNESCAP, APEC and KMI, utilizing the Maritime Policy Planning Model developed by UNESCAP, the annual average growth rate of the world's full container trade was estimated at 6.5 percent during the period from 2002 to 2015 compared to 8.5 percent during 1980 to 2002. The increasing prominence of China in the world container transport market is noted now as it accounts for 20 percent of the world container handling and nearly a half of the Asian total.

Forecast of container port throughputs: It was estimated that the world port throughput of international container cargo will increase from 242.5 million TEU in 2002 to 576.4 million TEU in 2015, representing 6.9 percent of annual average growth rate. During the same period, international container port throughput in Asia and the Pacific will increase from 133 million TEU to 352 million TEU, equivalent to an annual average increase of 7.7 percent, increasing the region's share from 55 percent to 61 percent. World container transhipment volume will increase from 30 million TEU in 2002 to 76 million TEU in 2015 at an annual increase rate of 7.7 percent. According to the preliminary study forecast, 927 new container berths in the world, of which 569 berths in the ESCAP region will be required to meet the increased throughput in 2015.

Extension of the Maritime Policy Planning Model (MPPM): The ESCAP Secretariat is currently working on an extension of its MPPM model to land transport in order to be able to give better quantitative policy guidance on the process described above.

Transport vision statement: "Integrated, intermodal international transport and transport logistics system that provides a choice of international alternative competing routes, thus reducing costs and improving quality of services. Such a system will have the capacity to change both the destination and the delivery path for goods already en-route."[121,122]

The key word in this description is *choice*. This may also include choice in various dimensions, such as choice in terms of economic and financial performance, flexibility, speed, quality of service, reliability, safety and security, and, above all, choice in terms of the availability of physical routes which may increase system resilience and help mitigate risks related to natural disasters and political instabilities.

Main building blocks of such a system are international unimodal and intermodal transport routes formalized through intergovernmental agreements, such as in para (b) below.

From a route-specific point of view, the achievement of the transport vision in Asia and the Pacific will require various elements to be put in place, such as:

(a) Identification of Integrated Eurasian Transport Corridors

In terms of land transport routes in Asia, long-distance linkages between Europe and Asia are of key importance. In view of huge Eurasian landmass and in order to support national prioritization for land transport infrastructure development, various steps have been taken in recent years to *formulate* (i.e., identify) broad corridors and eventually *formalize* (i.e., through international agreements) international routes.

For example, since 1998, a series of Euro-Asian Conferences on Transport have been held in St. Petersburg at the initiative of the Russian Federation and with the support of ESCAP and ECE. The 2nd such conference in Sept. 2000 identified four main Euro-Asian transport corridors as the backbone network:

Trans-Siberian: Europe (PETCs 2, 3 and 9) – Russian Federation – Japan, with three branches from the Russian Federation to: (a) Kazakhstan – China; (b) Korean Peninsula; and (c) Mongolia – China;

TRACECA: Eastern Europe (PETCs 4, 7 8, and 9) – across Black Sea – Caucasus – across Caspian Sea – Central Asia. TRACECA was initiated as a programme more than 10 years ago by the European Union (EU) as an additional route to the existing transport corridors and promotes optimal integration with the Trans-European Networks (TENs);

Southern Corridor: South-eastern Europe (PETC 4) – Turkey – Islamic Republic of Iran with two branches to: (a) Central Asia – China, and (b) South Asia – South East Asia/Southern China; and

North-South Corridor: Northern Europe (PETC 9) – Russian Federation, with three branches: (a) Caucasus – Persian Gulf, (b) Central Asia – Persian Gulf, and (c) Across the Caspian Sea – Islamic Republic of Iran – Persian Gulf.

The third St. Petersburg Conference held in September 2003 recommended a S*trategy for the Development of an Integrated Euro-Asian Transport System*[123], as well as several support measures and a number of specific initiatives. The strategy focuses, inter alia, on:

- formulation of integrated intermodal international Euro-Asian transport routes/corridors and networks;
- formalisation of international transport routes/networks through related international agreements or amendments to existing ones, as a basis for their coordinated development;

123. Proposed by ESCAP.Details were published later in ECE document number TRANS/2004/12.

- facilitation of transport at border-crossings and ports based on relevant international conventions;
- analysis of routes/corridors;
- operationalization of international transport routes and their periodical performance evaluation;
- development of Public-Private Partnership with freight forwarders and multimodal transport operators.

(b) Compatible international transport agreements in both Europe and Asia

The *Strategy for the Development of an Integrated Euro-Asian Transport System* recommends that formulation of corridors need to be complemented by formulation and formalization of international routes. A number of international agreements in Europe and Asia have emerged as building blocks in this process:

Asia[124] *:*

- Intergovernmental Agreement on the Asian Highway Network, 2005;
- Intergovernmental Agreement on the Trans-Asian Railway Network, signed in November 2006;

Europe[125]*:*

- European Agreement on Main International Traffic Arteries (AGR), 1975;
- European Agreement on Main International Railway Lines (AGC), 1985;
- European Agreement on Important International Combined Transport Lines and Related Installations (AGTC), 1991;
- European Agreement on Main Inland Waterways of International Importance (AGN), 1996;

Europe-Asia:

- Organization for Cooperation of Railways (OSJD) Agreement on organizational and operational aspects of combined Euro-Asian transport, 1997.[126]

The vision of a desirable future transport system in Asia and the Pacific would foresee these agreements to serve as initial building blocks for the eventual

124. http://www.unescap.org/ttdw
125. http://www.unece.org/trans/conventn/legalinst.html
126. This agreement identified a number of Euro-Asian railway corridors and routes.

development of a formalized *intermodal network in Eurasia* which will also comprise of IWT, sea and air routes.

(c) High performance land transport links between major trade partners

Once formalized, these networks need to be optimized in terms of their performance. In particular, the performance of the future integrated intermodal Eurasian transport system will be measured in terms of its provision of high performance land transport links between major trading partners. Regular integrated assessment of specific alternative routes (e.g., Astana, Kazakhstan to Berlin, Germany) according to objective criteria may help improve route performance. Common criteria used for this purpose are of a technical (e.g., container dimensions), commercial (e.g., time, money, and level of service, including reliability and en-route information), or operational (e.g., reasonable, reliable, sustainable) nature. They may also refer to logistics capacities (e.g., dry ports, logistic centres, communications bandwidth), relate to necessary equipment (e.g., cranes for 40ft containers), or to broader policy objectives, including environmental, safety and poverty aspects.

(d) Multilateral solutions for transit issues

Finally, it should be borne in mind that it may not be possible to realize this vision in a unilateral fashion. Multilateral solutions will need to be found to solve the many transit and cross-border transport issues. Development of such solutions may best be organized as some kind of public-private partnership with the possibility of participation by all relevant stakeholders.

Synthesis

This Section briefly outlined two complementary perspectives of the *same* vision of desirable future transport system in Asia and the Pacific. Depending on the purpose, either one of these perspectives may be more useful to decision-makers. However, it should also be noted that a perspective focused on international routes, while being easier to apply and understand, is necessarily an *incomplete* description of the vision and, therefore, needs to be cross-checked with more comprehensive views, such as the systems view presented above.

Remaining Gaps

In order to make the desirable vision of a future transport system a reality, a significant number of gaps and deficiencies which remain would need to be removed, and are, therefore, of particular interest to transport policy makers.

As a result of the emerging regional production networks organized along major ports in the region, the benefits of globalization have been confined to coastal areas. Another factor contributing to the concentration of development in coastal areas of countries of the region has been inadequate land transport infrastructure and services connecting seaports to their deeper hinterland. A typical landlocked developing country has transport costs that are 50 percent higher and volumes of trade that are 60 percent lower than countries with coastal access.

Due to various historical reasons, land transport networks of UNESCAP member countries with maritime coastlines are oriented towards their major seaports; inter-country land transport linkages are not well developed; and goods in the hinterland of one country have to follow a circuitous route to reach the hinterland of another country (if they move at all).

The 'logical extension' of the ocean fleet to double-stack train services with direct transfer from ships to trains, as is the case in the United States, is one example of how integrated, intermodal, international transport services can change the concept of transport from that of a stop-start process to a smooth flow of goods and people. In parallel with the discussion on "globalization", considerable attention has currently been focussed on concepts, such as "logistics management", "supply threads", "supply chains", "value threads", "value chains" and "production networks". These chains and networks are being developed within an environment that encompasses physical trade and investment policies, and inputs including: human resources; infrastructure; services; and capital equipment. Each of these policies and availability of inputs will influence location decisions for each of the activities in the chain or network as well as the way in which goods, services and information flow through the chain or network.

Huge disparities in terms of land transport development persist in the ESCAP region. Essentially, in most areas such development has only started. This also applies to port hinterland areas on the subnational level, including even the West of China.

In order to economically move inland sites closer to the coastal production networks, inland container depots (ICDs) have been promoted and connected efficiently to ports. The idea is to realize similar scale economies around ICDs as exist around ports. In fact, 80 percent of general cargo in terms of value and 50 percent in terms of weight, today move by containers. A recent ESCAP study[127]

127. Kim, O., (2005*). Inland Container Depots of Asia*, Draft report, ESCAP.

reviewed the status of ICD development in Asia, clearly indicating that this process has just started and will require large-scale investments in the medium-term future.

Furthermore, there appear to remain major gaps in many ESCAP member countries in terms of addressing imminent urban transport issues. This is despite the fact that megacities have become major nodes in international production systems. In fact, megacities have taken the place that export processing zones, special economic zones etc. had taken in the past. This raises a wide spectrum of policy issues that need to be addressed in a coherent fashion from the local to the national government level. ESCAP has been addressing these types of issues through a number of its programmes, including the creation of CITYNET, an institutional network of cities that promotes city-to-city cooperation.

IV.2

Infrastructure Investment Needs and Financing

This chapter provides order-of-magnitude examples of investment needs and possible financing mechanisms that might be considered in extending fragmented, international production systems to inland sites in Asia, thus developing an Asian Integrated Transport Network.

Investment Needs

By any measure, investment needs for transport infrastructure in Asia and the Pacific in the coming years are the largest of all world regions, due to burgeoning economic growth and further integration of Asian economies into the world economy. It should be noted that investment needs presented in this Chapter are sums of actually identified priority projects of governments. Of course, such a wish-list approach produces different estimates than those based on the usual econometric estimates which essentially assume a continuation of historical dynamics. In other words, numbers presented here are the lower limits of what needs to be invested in order to achieve the desirable future targets. Yet, they are higher than estimates based on historical dynamics, implying a need to significantly increase infrastructure investments in the region.

International transport backbone network

The international backbone of the transport system consists of nodes, such as airports, ports and ICDs, as well as inland links, such as major railway lines and roads. In the case of Asia, the latter two have been formalized as Asian Highway and Trans-Asian Railway lines. In terms of international accessibility, these are the highest priority assets for investment purposes.

According to the annual forecast of ESCAP's Maritime Policy Planning Model (MPPM), about 930 new container berths will be required in the world to meet the increased throughput in 2015. About 570 of these berths will be required in the ESCAP region and ESCAP estimates total investment needed at around US$36 billion for the ESCAP region, which is 65 percent of the total world investment needs. As inland sites in Asia are increasingly developed through ICDs and efficient intermodal connections, a similar level of investment will be required for the construction of ICDs in the future as for container ports today.

Under the recent ESCAP project on "Identifying investment needs and priorities for the development of the Asian Highway Network and related intermodal connections", three subregional EGMs were organized in 2004 and 2005[128] that reviewed the status of the Asian Highway network, identified investment requirements for the development of the network, including intermodal connections and prioritized projects of subregional importance. A consolidated picture from the meetings indicates that about US$21 billion is currently being invested or committed for the development of various sections of the Asian Highway routes in member countries. The subregional meetings also identified a shortfall of about US$18 billion required to further upgrade and improve about 26,000 km of Asian Highway in 26 member countries.

The ESCAP Secretariat estimates immediate investment needs to be of the same order of magnitude as those of the Asian Highway. In addition to more than 80,000 km of Trans-Asian Railway (TAR) network, thirteen major missing links have been identified. They make up a total of 7060 km requiring roughly US$13.5 billion for construction of single track lines. Furthermore, several thousands of TAR lines are still only single-track. To upgrade them to double-track lines would cost several billions of US dollars.

A significant share of global airport and air navigation services investment requirements of more than US$ 300 billion between 2000 and 2010 is being committed to airport infrastructure in the Asian and Pacific region, in order to cater for the growth in both passenger and cargo traffic and to accommodate new large aircraft and emerging budget airlines. Over the past decade, major new airports in the Asian and Pacific region at Chubu Centrair International Airport (Nagasaki), Baiyun International Airport (Guangzhou), Kuala Lumpur International (Kuala Lumpur), Chek Lap Kok (Hong Kong, China), Imam Komeini International Airport (Tehran), Osaka (Kansai), Incheon International Airport (Seoul) and Pudong International Airport (Shanghai) required a combined investment of more than US$ 50 billion. Bangkok's new Suvarnabhumi Airport is due to open in 2006 and new airports are being constructed at Bangalore and Hyderabad in India. Current plans are to continue the development of these new facilities, to upgrade existing hub airports and to construct completely new airports requiring at least another US$20 billion funding by 2010. In the past two years in Asia and the Pacific, eight new terminal and building extensions have been completed, while work is underway for the construction of three terminals and seven new terminals have been planned.

128. For SAARC (with participation of Afghanistan and the Islamic Republic of Iran) on 21-23 Sept. 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.

Access networks and secondary and feeder routes

Typically, more than half of a developing country's public investment in the transport sector is in roads. This is also mirrored by the fact that roughly 70 percent of the World Bank transport loan portfolio remains to be for the road sector. This is despite the Bank's policy change since the early 1990s to focus on direct poverty alleviation rather than an approach targeting merely economic growth. However, this shift and the full adoption of the results-based budgeting approach has led to an increased investment in rural access roads, in order to make it possible to define a clear target group of people whose poverty has been reduced as a result of the infrastructure intervention.

Financing of rural roads has become a big issue. The grand total for connecting all the currently unconnected villages (roughly 50 percent of the total) with all-weather black-topped roads has been estimated at US$ 26 billion (Rs. 1,11,000 crore), excluding the cost of major bridges[129] . This compares with currently[130] committed investments in the Indian sections of the Asian Highway, i.e., the road backbone network, of roughly US$ 3.6 billion. Similarly, the Chinese government plans to construct 400,000 kilometres of new rural roads to connect 80 percent of all villages in China by 2020, compared to currently committed investments of US$ 6.6 billion in the Chinese sections of the Asian Highway. This indicates that financing needs for rural roads in the region might be one order of magnitude larger than for the road backbone network.

As governments and donors have focussed on international connectivity on the one hand and access networks on the other hand, the part in-between, i.e. the secondary and feeder roads have been increasingly neglected. In some cases, this has become a serious issue, as the efficiency of the road *system* depends on the state of *all* its links and nodes.

No reliable overall estimates exist of the financing needs for urban transport, including mass transit systems, in Asia and the Pacific. However, rough estimates of investment needs for urban transport are approximately as large as those for airports and seaports combined.

Contributions of individual, private investments

While investments in road and railway infrastructures have been almost entirely public investments by governments, the fact is often overlooked that such public investments lead to much larger private investments.

129. PMGSY project in India, http://www.pmgsy.nic.in/pmg216.asp
130. as of July 2004

For example, for each dollar of public investment in new roads there are typically ten dollars of private investment (e.g., in cars, etc.) to make the system operational and to be able to provide road transport services.

Future liabilities for maintenance

Besides investment costs, future liabilities for maintenance costs need to be taken into account. This applies especially to rapid national rural road access projects. If a large share of the roads have a similar age, subsequent maintenance needs will also cluster at one point in time. A case in point is the massive rural road projects in South Asia which, not surprisingly, coincide with serious underfunding for road maintenance. Similarly, road and rail maintenance is a major issue in Central Asia.

Transport Investment needs to achieve the MDGs

The question that is often asked is about approximate transport investments needed in order to help achieve the MDGs. The focus of the answers is then mainly on provision of rural access roads, and the replicability of *direct* poverty interventions is discussed. While this seems to be the obvious direction to take, it does *not* appear the most efficient approach. In this context, comparison between poverty effects of infrastructure investments in China and India is often made. China's phased focus first on international connectivity and later on domestic access has been more successful in overall poverty reduction, but has led to higher inequality. While there are clearly problems with such a direct comparison, the superior performance of the Chinese infrastructure model is easily understandable for at least two reasons:

(i) Investment needs for transport backbone networks are only a fraction of the investments needed for providing nation-wide access, yet the economic benefits derived by countries are very large, even though they initially accrue only to few locations. The ESCAP Secretariat estimates the investment needs[131] for transport infrastructure in developing and transition economies of the ESCAP region at an average of US$224 billion per year between 2005 and 2015[132]. This compares to only US$ 14-18 billion per year for the transport backbone networks (including roads, rail, airports, ports and dry ports).

131. Dynamics-as-usual assumption.
132. ESCAP (2006). *Transport infrastructure*, Chapter III (pages 25-55) in: Enhancing regional cooperation in infrastructure development including that related to disaster management, ESCAP, http://www.unescap.org/pdd/publications/themestudy2006/9_ch3.pdf

(ii) It is simple logic that building a road to a rural village will not make much difference if the linkages to the rest of the network are not well-developed. In the end, what really counts is whether the infrastructure intervention improves the linkage to economic opportunities. The significant poverty alleviation effect in a corridor (with a width of walking distance) along inter-city trunk roads in India is a case in point[133].

In conclusion, it appears that the most cost-effective transport infrastructure intervention for achievement of MDGs is a phased one that tries to adjust an optimal combination of international and domestic connectivity at any point in time.

Financing Mechanisms

In view of the large investment needs identified in this study, countries will have to explore all possible financing options that are available to them, including traditional public expenditure, loans provided by development banks, official development assistance, and different types of private sector participation.

Private sector participation

(a) Current trends

A number of different mechanisms exist via which the private sector may participate in the development projects in general, and in transport infrastructure projects in particular.

Reduced private sector capital flows into the transport infrastructure development in the region: A recurrent ESCAP publication, the 'Review of Developments in Transport' details trends in investments in transport infrastructure projects with private sector participation (PPI) in the ESCAP region and the rest of the world, between 1990 and 2003, and includes management and lease contracts, concessions, Greenfield and divestitures. Over this period, the majority of PPI projects in the ESCAP region, both in terms of the number of projects and their value in 2003 US dollars, were concession and Greenfield projects[134]. The number and value of PPI projects in developing countries fluctuated dramatically between 1990 and 2003. In 1997, investment totalled US$22.4 billion, before dropping rapidly in the following years. As a result, despite a modest increase between 1999 and 2001, in 2003 total PPI transport investment amounted to only US$4.5 billion (Box 4).

133. Study by the Asian Institute of Transport Development (AITD), 2004.
134. All references to US$ value of PPI projects in this section from this point forward are in US$(2003).

Box 1: Transport sector project investments in ESCAP countries with private sector participation, 1990 - 2003 (millions of 2003 US dollars)

Airports	*US$ million*	*Sea Ports*	*US$ million*
Vietnam	15	Myanmar	50
Thailand	16	Vietnam	100
Armenia	50	Russian Federation	102
India	125	Thailand	199
Malaysia	130	Sri Lanka	240
Cambodia	185	Turkey	335
Turkey	390	Pakistan	448
Russian Federation	413	Philippines	960
Philippines	520	India	1,256
China	1,677	Malaysia	2,231
		Indonesia	2,586
		China	4,884
ESCAP total	**3,520**	**ESCAP total**	**13,392**
Global total	**12,435**	**Global total**	**21,157**
ESCAP share of global	**28%**	**ESCAP share of global total (percentage)**	**63%**
Railways	*US$ million*	*Toll Roads*	*US$ million*
India	85	Bangladesh	-
China	2,070	Cambodia	7
Thailand	2,772	Vietnam	10
Malaysia	5,687	Lao PDR	100
		Thailand	632
		Indonesia	934
		India	961
		Philippines	1,309
		Malaysia	6,214
		China	14,358
ESCAP total	**10,615**	**ESCAP total**	**24,525**
Global total	**27,627**	**Global total**	**64,330**
ESCAP share of global total (percentage)	**38%**	**ESCAP share of global total (percentage)**	**38%**
Shares by Subsector (percentage)			
Global		**Asia**	
Airports	10	Airports	7
Sea Ports	17	Sea Ports	26
Railways	22	Railways	20
Toll Roads	51	Toll Roads	47

Source: Review of Transport, 2005, ESCAP, www.unescap.org/ttdw/

Data source: World Bank Private Participation in Infrastructure (PPI) database [online resource] http://ppi.worldbank.org accessed July 2005. Global totals are totals for low and middle income countries only. Totals may not add up due to independent rounding.

The East Asian economic crisis greatly contributed to this contraction in private investment. Of all the ESCAP subregions, East Asia has historically received the greatest level of investment in transport infrastructure projects with private sector participation; on a global scale, it is second only to Latin America and the Caribbean. Since the crisis, however, investment has never returned to its pre-crisis position, attributable to private sector wariness towards the risks of such investment[135]. In 1996, for example, PPI projects in East Asia totalled US$8.5 billion; after a notable variation in the intermediary period, by 2003 this had plummeted to US$1.7 billion.

Flows concentrate on few countries and few sectors: The aggregate value of PPI transport projects completed world-wide during 1990 and 2003 was over US$120 billion, almost 40 percent of which were in the ESCAP region. Yet this activity took place in only 16 ESCAP countries, and mainly in 5 countries, namely, China, Malaysia, Thailand, The Philippines and Indonesia. Investment was the greatest in the roads sub-sector (US$ 25 billion), which accounted for one-half of all PPI transport projects. And over 50 percent of the 188 road projects took place in China, where US$14 billion was invested. In the same period, investments in projects with private sector participation in ports totalled US$13.4 billion, in railways US$10.6 billion and in airports US$3.5 billion.

(b) Public-private partnerships

The 2005 and 2003 editions of the aforementioned ESCAP publication *Review of Developments in Transport in Asia and the Pacific* include a list of major PPI projects. The publication also discusses examples of institutional development and policy and regulatory frameworks that have been introduced recently, in order to promote private sector involvement in infrastructure development. One major issue is the general lack of seed financing for feasibility studies, in order to take the governments' project ideas to a stage where the private sector would get interested. This is a particularly acute problem in the smaller ESCAP economies.

Public sector

Traditionally, it has been mainly the public sector that has directly borne the bulk of transport infrastructure investments. This is still the case in most ESCAP countries and particularly in the land transport sector, due to the concentration of private sector flows into few sub-sectors and few selected countries. As a result, the roles of private and public sector need to be defined on a country-by-country and subsector-by-subsector basis.

135. Asian Development Bank, Japan Bank for International Cooperation and the World Bank, 2005. *Connecting East Asia: A New Framework for Infrastructure* (ADB, Philippines).

Cross-border financing

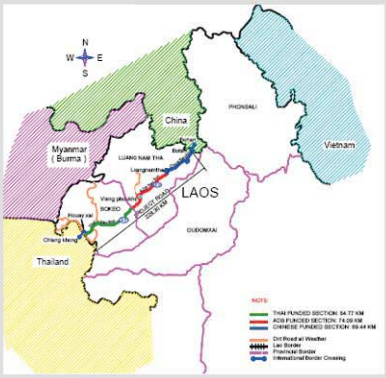
As differences in living standards are very large in the countries in the ESCAP region and benefits of transport infrastructure development spill over national borders, the possibility of cross-border financing (well beyond the ODA type) has recently received increased attention. It is particularly discussed in the context of transit transport and landlocked countries, as well as in terms of seed financing. One example of actual cross-border financing is the construction of a road for transit through Lao PDR connecting China to Thailand (Box 5). Innovative financing mechanisms such as in this case, hold particular promise for the region, particularly

Box 5: Subregional cooperation in road infrastructure development between Thailand, Lao PDR, China (Road between Boten and Houayxay)

One particularly interesting example of subregional cooperation for road infrastructure development is the current upgrading of the existing 228-kilometer road between Houayxay and Boten in the Lao PDR, with the objective to create an international north-south corridor linking Thailand and the People's Republic of China (Figure 16).

This project is carried out under the framework of the Northern Economic Corridor of the Greater Mekong Subregion Programme (GMS) promoted by the Asian Development Bank (ADB). The Project will help accelerate trade and transport in the GMS. It will also link two remote provinces of the Lao PDR to fast growing economies. Louang Namtha province is the most transport deficient province in the Lao PDR whereas Viangphoukha district of Bokeo province is among the poorest in the country. The project includes a social action plan for the ethnic minorities, and capacity building in environmental and social monitoring.

The improved road will follow a combination of class II and class III standards, with seven-meter wide paved road and pavements ranging between 1.5 meters and 2.5 meters in width. The total project cost is estimated at US$96 million. The governments of Thailand and the PRC have provided concessional loans estimated at US$30 million each on a bilateral basis to the Lao PDR. ADB will finance another third of the project cost through a loan of US$30 million, covering construction of 74 kilometers in the middle section, whereas the Government of the Lao PDR will cover the remaining costs amounting to US$7.3 million. The estimated project completion date is 31 December 2006.

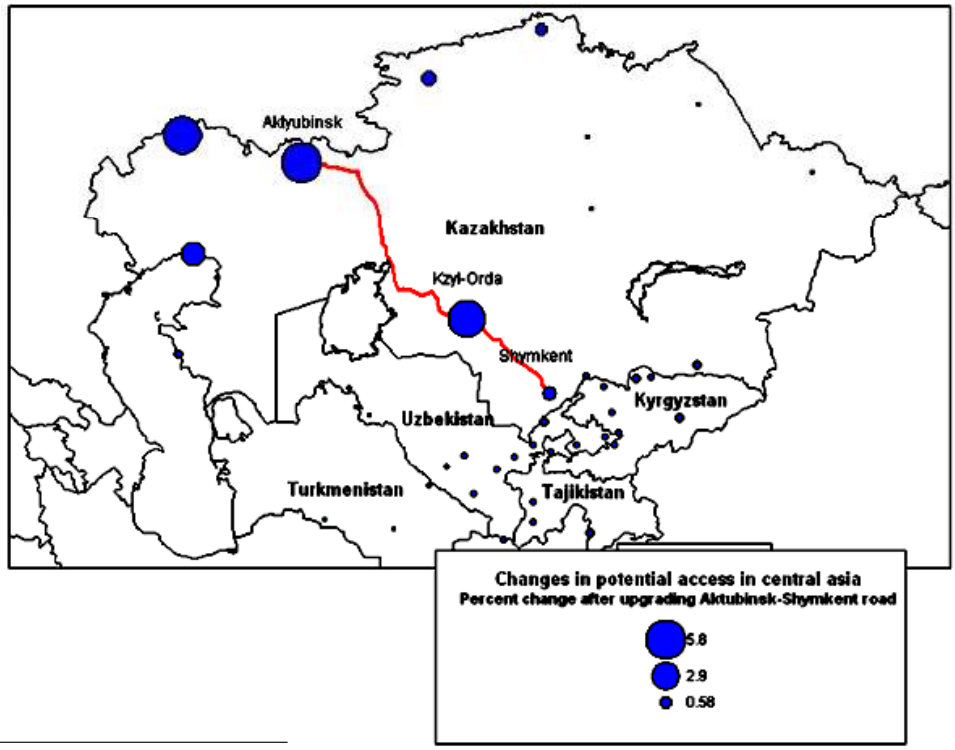


Road maintenance will be financed through transit charges. In order to determine the level of fair and sustainable charges, ESCAP undertook a study of transit charges which also includes comparisons with charging practices in other parts of the world. The findings of the study are currently being assessed under Protocol 2 of the GMS Agreement for the facilitation of cross-border transport of goods and people (http://www.adb.org/GMS/Cross-Border/milestones.asp).

when combined with some sort of private sector participation (e.g., through transit fees).

Indeed, the general case for regional cross-border financing of transport infrastructure is very strong, as illustrated by a recent ESCAP study on Central Asian Accessibility[136]. This study illustrates the accessibility impact of road upgrades, based on a comprehensive view of Central Asian road system. Take, for example, the route between the nationally and internationally accessible Shymkent and the less accessible Aktyubinsk. Assuming an upgradation of this route leads to a 10 percent increase in average speed along all links on the route, there are significant improvements in potential accessibility[137] not only nationally in Kazakhstan, but also internationally, thus showing large positive externalities across international borders (Figure 17). The positive changes in accessibility are quite

Figure 17: Changes in potential accessibility due to an upgrade of the road between Shymkent and Aktyubinsk, leading to an increase in speed by 10 percent



136. Lundin, A. (2005). *Central Asian Accessibility*. Draft report, ESCAP.
137. Geographical accessibility assesses the potential for interaction through average time to reach places, while the potential accessibility is based on a gravity concept, where accessiblity is a trade-off between attractiveness of places and the effort to reach them. More focus is put on the accessibility of the largest/capital cities than on other places, as these cities are more likely to function as growth poles.

striking along the route, and in places whose connectivity is dependent on this route[138].

The few other existing examples of such cross-border financing (mainly in Europe) show the great potential of such an instrument. However, they also show the need for adequate institutional mechanisms that are required for an efficient larger-scale application of such instruments and that are currently absent in the ESCAP region.

Conclusion

Under any plausible scenario, the ESCAP region faces increased investment needs in transport infrastructure in the coming decades. In particular, this chapter identified the need to significantly increase overall infrastructure financing in all ESCAP member countries to the order of US$ 220 billion per year for the ESCAP region as a whole, in order to create an Asian integrated transport network for international production networks to be gradually extended to inland sites of Asia.

A major challenge for countries in the region has been the reduced private sector investment flows and their concentration only in a few countries and sectors. ESCAP members have been exploring new financing mechanisms. A major constraint in attracting private sector participation has been the lack of seed financing that would be needed for initial feasibility studies. Selected examples exist that show the great potential for possible cross-border financing and other innovative financing.

138. This study also showed that the potential accessibility generally follows the same rank size rule as that for city population. Consequently, a focus on improvement of interconnection of major cities has the greatest impact on potential accessibility within the transport system.