II.1

Globalization and Infrastructure Networks

Domestic and international infrastructure connectivity in Asia and the Pacific has increased to unprecedented levels over the past two decades, a period of time that corresponds to the latest wave of globalization. This is no coincidence, as advances in network infrastructures, such as transport and communications, have always fueled waves of globalization in the past. Equally, globalization has been a dominant force that has shaped development trends in Asia. This introductory chapter makes a number of observations on the relationship between globalization and infrastructure that set the background for the following chapters.

The East Asian Miracle

In Asia, the process of globalization 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[29] (NIEs) and ASEAN 4[30], which introduced outward-looking structural reform policies that moved away from import substitution and 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 in these economies during this period exceeded that of most other economies in the world.

Contribution of Networks to Globalization

Physical networks: Transport, IT and communications

Major infrastructures, such as roads, railways, ports, airports, canals, telephone lines, the Internet, mobile networks, pipelines, and electricity grids, form part of

29. Hong Kong, China; Republic of Korea; Singapore; and Taiwan, Province of China.
30. Indonesia, Malaysia, Philippines and Thailand.

a physical network. These networks have played a significant role in the globalization process.

As in the past, the principal driving forces behind the current phase of globalization are lower barriers to trade and investment, lower transport costs, and lower information technology costs[31]. 'The noticeable reduction in the transportation and communication costs has facilitated the division of the productive process, allowing participation by a larger number of geographical locations according to the advantages that each one contributes to the value added chain. This fact has broadened the opportunities, so the individual economies can participate more actively in the international production networks administered by large multinational companies'[32].

It should be noted that there have always been strong complementary linkages between transport and communications[33] . Since both are two-way networks, they exhibit similar characteristics, including significant externalities, thus reinforcing themselves as also each other in the process.

This is somewhat different from the typical one-way energy and water networks, and maybe this is one of the reasons why these networks have not been as prominent in the discussion of globalization as transport and communications.

Non-physical networks

The physical networks outlined above are not only interlinked in varying degrees, but they are also closely related to many non-physical networks, such as formal and informal communication channels within and between organizations. These non-physical networks are often of a commercial or social nature. Combinations of these physical and non-physical networks form more complex networks, such as the international production networks.

This simple insight can go a long way in clarifying and offering solutions to major infrastructure issues[34] . In short, there is a clear need for various non-

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31. Hardware, software and org(anizational)ware.
32. SELA Permanent Secretariat *Risks and Opportunities of Globalization*, in Capitulos del SELA (Latin American Economic System), *Globalization, trade and integration*, 1996, p.60.
33. For example, Gruebler (Global Change, Cambridge University Press, 1993) shows that transport and communications volumes in France have been growing at the same, almost constant long-run rate for the past 200 years.
34. Note that one may to look at networks in time and/or space. This paper discusses paths both in time (e.g., scenarios for strategy building), and in space (e.g., geographical paths from A to B through a network).

physical networks to strengthen and interlink the physical networks that could be argued to be the 'backbone infrastructure' of globalization.

Mixed networks and regionalization

Mixed networks are systems that consist of strongly interlinked physical and non-physical networks. Examples of mixed networks, such as logistics and regional production networks have created a largely market-driven form of regional economic cooperation that is commonly referred to as 'regionalization'. Mixed networks are a major characteristic of the latest wave of globalization.

(a) Logistics

In parallel with the discussion on 'globalization', considerable attention has been paid to concepts, such as 'logistics management', and 'supply threads'. These concepts are about the efficient flow of goods, services and information from the point of origin of raw materials to the point of consumption of the final product and in some cases return for repairs or maintenance, disposal and recycling, including all the intermediate planning and related decisions.

Prior to the relatively recent changes in transport and information technology, today's networks and chains consisted of unconnected subnetworks and subchains. The recent developments in transport and information technology have facilitated the linking together of these subnetworks and subchains. As a result, information can be passed from point-of-sale through the network or chain to factories. Policies and inputs themselves are bound together in networks, whether they be social, operational, facilitatory or physical networks which, in turn, interact or are linked together to form the overall chain or network. These developments in logistics are at the heart of the 'division of the productive process' and 'regional production networks', which are the topic of the next subsection (see also Section IV.1).

(b) FDI and regional production networks (RPN)

One of the major features of FDI was that the multinational corporations active in the region established factories (in different countries) specializing in the production of specific components of finished goods. As a result, regional production networks (RPNs) were formed which have been a major reason for increased intra-industry trade in the region.

An example of one of these networks is the automobile industry network of South East Asia. In the Toyota supply chain, Thailand focuses on the production of diesel engines, Malaysia on steering gear, Indonesia on engine blocks and the

Philippines on transmission[35]. It should be noted that this so-called 'intra-product' trade even now constitutes less than a third of the world trade in manufactures, which implies a large scope for further expansion[36]. This process of increased specialization, interdependence and integration, which is at the heart of globalization, has reinforced a largely market-driven form of regional economic cooperation, or 'regionalization'.

Regionalism: Government networks to reduce the risk of marginalization

In practice, it has become increasingly apparent that 'regionalization' needs to be complemented with a similar collaboration among governments, that is often referred to as 'regionalism', in order to address the many social, economic and political inter-country challenges.

In particular, there is a need for policy intervention in the land transport sector. In this sector, deep concerns have been voiced that certain regions of countries, landlocked countries, and hinterlands located far away from the centres actively participating in regional production networks, will be marginalized.

Consequently, it is also recognized that 'the important question for each nation is how to make the best of the advantages and mitigate the negative impacts of the process'.[37] In this respect, there is broad agreement that 'in a period of growing global economic interdependence, regional cooperation offers Asia-Pacific countries an effective vehicle for promoting sustainable development.'[38]

Whether one adopts a general approach that improved infrastructure and related services facilitate economic growth, an approach that links infrastructure and globalization to growth, or draws upon the experience related to policies adopted by the more dynamic Asian economies, it is generally agreed that regional economic

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35. It should be noted that, of course, almost all commercially-driven forms of regionalization are complemented by some form of regional government cooperation. For example, some might argue that the "Toyota supply chain" was realized through an ASEAN industrial complementation scheme and AFTA tariff liberalization which were both commercially and government-driven. A similar case could be argued for the Singapore – Johor (Malaysia) – Riau (Indonesia) Growth Triangle (SIJORI) where the three regions have pooled their human and natural resources in order to attract new investors.
36. Yeats, A. (1997). Just how big is global production sharing?, Policy Research Working Paper No. 1871, World Bank.
37. Statement of Head of Delegation from Malaysia to the Sixtieth Session of the Economic and Social Commission for Asia and the Pacific, Shanghai, 26 April 2004.
38. Statement of Head of Delegation from Viet Nam to the Sixtieth Session of the Economic and Social Commission for Asia and the Pacific, Shanghai, 26 April 2004.

cooperation in infrastructure offers a way forward for countries of the region to address such issues as market access, economic growth, marginalization and poverty reduction.

Marginalization has been one of the factors contributing to a large number of bilateral and multilateral agreements, organizations and programmes, particularly at the subregional level. Such a 'proliferation' of heterogeneous agreements calls for increased importance being placed upon regional coordination and harmonization. 'Facilitating' such 'concerted action'[39] of the governments of Asia and the Pacific and the "strengthening of economic relations of these areas [Asia and the Pacific] both among themselves and with other countries of the world'[39] has been a major part of the mandate of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) since 1947.

Conclusion

The following four major conclusions gleaned from the role of infrastructure in the globalization process will guide the discussions in the succeeding chapters.

(i) The network concept is helpful in understanding the role of infrastructures in the current phase of globalization. Physical networks in transport and communications are closely interlinked with each other and also with the non-physical networks, combinations of which form more complex networks, such as the international production networks.

(ii) The physical networks should be analyzed together with non-physical networks. The commercially-driven form of regionalization (and RPNs) needs to be complemented with regional governmental collaboration, in order to address the many inter-country challenges.

(iii) The landlocked countries, certain regions of countries, hinterlands located far away from the centres actively participating in the regional production process, face the risk of marginalization.

(iv) There has been a proliferation of overlapping bilateral and multilateral infrastructure-related agreements, which highlights the increased importance of coordination and harmonization at the regional level.

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39. Terms of Reference of the Economic and Social Commission for Asia and the Pacific.

II.2

Network Infrastructure, Development and Poverty

Productivity and Long-run Growth

It is an indisputable fact that infrastructure development and economic development have always been closely intertwined. While a certain rate of infrastructure development is clearly needed to 'support' a particular rate of economic development, it has remained controversial as to whether an infrastructure supply-oriented approach can actually accelerate development. The confusion has largely arisen from the fact that infrastructure *per se* is almost without exception a necessary but not sufficient condition for development.

Most of the East Asian economies, that have been growing rapidly in recent decades, have followed a supply-driven approach with massive investments in infrastructure well ahead of demand[40]. However, these correlations do not necessarily imply a causality. Whether infrastructure supply-oriented policies actually foster long-run growth appears to depend on many factors, including the development stage of a country, the status of industries that rely most heavily on infrastructure and the extent to which non-physical supporting networks exist.

Van Duijin and others[41] have documented how political and academic attention on the one hand and actual investments in infrastructure on the other hand have changed like waves over the decades. In the case of Europe and the U.S., the most recent wave of massive infrastructure investments particularly in highways and the maritime sector took place in the 1950s, 1960s and early 1970s, until huge overcapacities became obvious. Not surprisingly, those years have seen interesting literature on the role of infrastructure in economic development (see, in particular, Nurkse's 'Vicious Circles of Poverty'[42], Hirschmann's 'Social Overhead Capital'[43] and the concepts of 'balanced and unbalanced growth').

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40. See also ADB's earlier paper comparing investment in infrastructure in Japan and the Republic of Korea over the past century.
41. Van Duijin, J. J. (1982).The Long Wave in Economic Life. London: Allen & Unwin.
42. R. Nurkse (1953) Problems of Capital-Formation in Underdeveloped Countries. New York: Oxford University Press.
43. Hirschmann, A. O. (1958), The Strategy of Economic Development, Yale University. Press, New Haven.

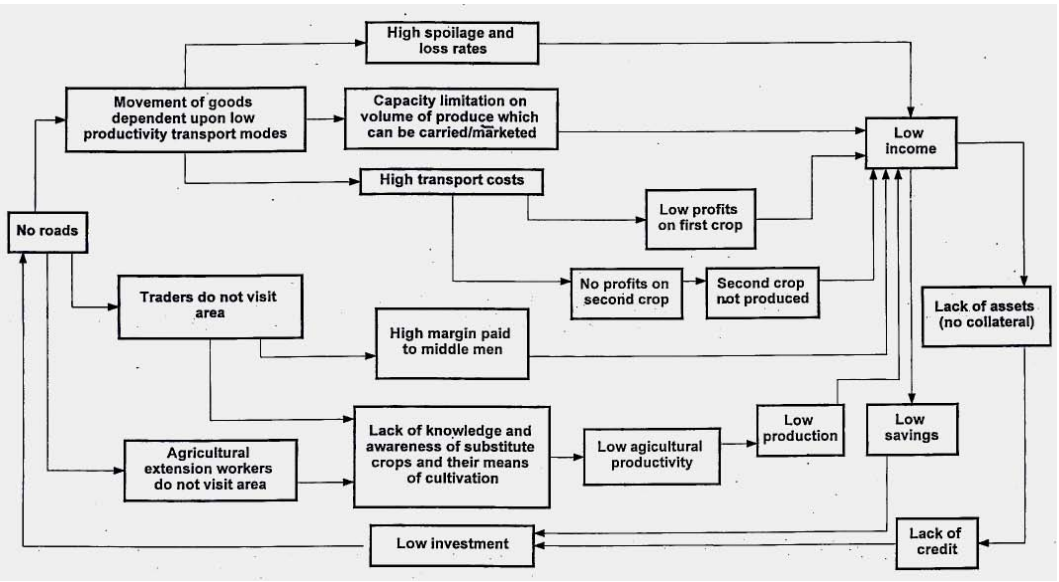
Poverty Reduction

Vicious circles of infrastructure access

Since the mid-1990s, development banks and donors have increasingly focussed their attention on direct interventions for poverty reduction, as the 'trickle-down' effect of infrastructure development alone was considered insufficient in terms of results.

Despite some popular scepticism, there are obvious direct poverty reduction impacts of infrastructure development. For example, Figure 4 illustrates a typical vicious circle of lack of access to transport facilities and services, which can be turned into a virtuous cycle through infrastructure development. In turn, this vicious circle implies that even direct poverty reduction intervention will be unsustainable in the long-run, if it is not supported by sufficient infrastructure development.

Figure 4: Vicious circle of lack of access to transport facilities and services



Sometimes the vicious circle of lack of access depicted in Figure 4 is taken further to include information flows, networks and other related factors. Since this amounts to taking the concept of international logistics to the local level, this is sometimes referred to as domestic logistics. To date, surprisingly, few activities of governments and international organizations have promoted integrated transport and logistics at the domestic level.

Millenium Development Goals

The principal international mandate governing activities at the national, subregional, regional and global levels is the Millenium Declaration[44] and the associated Millenium Development Goals (MDGs). Under the goals, United Nations' member states have pledged, by 2015, to: eradicate extreme poverty and hunger; achieve universal primary education; promote gender equality and empower women; reduce child mortality; improve maternal health; combat HIV/AIDS; ensure environmental sustainability; and to develop a global partnership. Surprisingly, there is little, if any, mention of how development of infrastructure facilities and services can contribute to achieving these goals. Consequently, there is a danger that the role of infrastructure interventions in poverty reduction may be neglected by omission.

In August 2002, however, the United Kingdom's Department for International Development (DFID) published a paper entitled 'Transport's Role in Achieving the Millenium Development Goals'.[45] This paper went through each of the goals and highlighted the contribution that transport could make to its achievement. In conclusion, it effectively inverted the question 'what is the contribution of transport to achievement of the MDGs?' and asked 'can the MDGs be achieved without transport interventions?' The clear answer to this question is 'No'. A similar argument could be advanced in respect of information flows, including aspects of freedom of information as well as the underlying tools or networks for information exchange.

Sectoral Issues

(a) Transport

There is ample evidence that efficient transport infrastructure facilities and services are a key pre-requisite for sustainable economic growth and poverty reduction. The efficiency of the transport system depends on many factors, including technology and institutional change, regulation, business environment, human resources, and even geographical factors. Major efficiency improvements in international transport can be traced back to scale economies in containerization and seaports, as well as to applications of modern information and communication technologies (ICT).

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44. Ref. Millenium Declaration.
45. DFID Transport Resource Centre, "Transport's Role in Achieving the Millenium Development Goals", August 2002.

Inter-country land transport has received less attention than maritime transport in Asia and the Pacific. For various historical reasons, land transport networks in countries with maritime coastlines are oriented towards their major seaports. This lack of connectivity between land transport networks of neighboring countries in Asia contrasts markedly with the situation in Europe and other parts of the world. It is also a serious disadvantage for landlocked countries. Better connectivity leading to lower transport costs would enhance export competitiveness and reduce the costs of imports.

(b) Information and Communication Technologies (ICT)

There is evidence that the application of modern ICT leads to significant productivity gains. However, these gains take some time to emerge. As with other infrastructure in the past, productivity gains usually emerge only after a critical level of market penetration for the infrastructure has been reached. This is a serious predicament for the least developed countries (LDCs) as they cannot yet afford the high levels of ICT usage that are needed to significantly gain from ICTs as well as to participate in the modern international production networks.

Secondary regional Asian Internet hubs have emerged in Japan; the Republic of Korea; Hong Kong, China; Singapore; and Australia to complement the larger, global hubs in Europe and North America. Developing countries, least developed countries and most transition economies can only benefit in such a hub-and-spoke system through bilateral and regional cooperation. Trends to such cooperation have become increasingly visible in the region. For example, Thailand has expanded data and communication services into Cambodia and Lao People's Democratic Republic, through sharing agreements. Furthermore, there are regional efforts to create a regional high-capacity Internet backbone (both fixed and satellite-based) for Asia.

Issues of international transit and interconnection in communications are very similar to those in transport and pose a serious challenge to landlocked countries. It should also be noted that despite the prominent role of the private sector in ICT infrastructure, cross-border connections and issues (e.g., international interconnection pricing and standards) are a game of governments rather than that of the private sector in Asia, which is similar to the situation obtaining in cross-border transport.

(c) Energy

The noticeable reduction in transport and communications cost has opened up the possibility for a larger number of geographical locations to fully participate

in the international production process. Yet, the availability of cheap and reliable energy at specific locations has been a crucial factor in attracting FDI to specific locations, i.e., energy availability has a 'pull effect'. In addition, energy is a fundamental input to the transport and communications sectors. Consequently, its availability and cost will influence the contribution that these sectors make to the globalization process and economic development in general.

Conclusion

There are following five major conclusions from the role of infrastructure in development process, long-run growth and poverty alleviation that need to be taken into account in designing strategies and programmes:

(i) The East Asian model of long-run infrastructure supply-oriented development has proven highly successful under certain circumstances, particularly where non-physical supporting networks were strong.

(ii) Direct poverty reduction interventions will be unsustainable in the long-run, if they are not supported by sufficient infrastructure development. This simple fact appears to have received insufficient attention of governments in recent years.

(iii) A lack of connectivity between land transport networks of neighboring countries is a serious disadvantage for landlocked countries in Asia.

(iv) The least developed countries are trapped in a vicious circle, as they can neither afford ICT infrastructure to the extent needed for significant economic gains nor can they participate in the modern international production networks.

(v) Due to the Internet's hub-and-spoke network system, most developing countries and transition economies can only benefit from it through bilateral and regional cooperation.

II.3

General Network Characteristics

One of the principal themes highlighted in this paper is the concept of networks. This Chapter considers further the concept of networks and discusses some of the general characteristics of infrastructure networks that influence or condition their integration as well as negotiations of regional and subregional agreements. In doing so, it provides the background for formulating strategies, programmes and activities for network infrastructures.

Physical Networks

Links and nodes

The infrastructure sectors being considered within the context of this paper, including transport, ICT and energy, are *all networks, consisting of links and nodes*[46] . A network is a system, the performance of which depends, to varying degrees, on the performance of individual links and nodes. One of the salient features of a network is that any inefficiencies, or missing links or nodes can affect the overall efficiency of the network.

Depending on the characteristics of the network, 'failure' of 'critical' links or nodes can shut down the whole network ('Bracers effect'[47]). The resulting 'system' failure is discussed under reliability theory. An example of what happens is that of the nuclear meltdown at the Three Mile Island nuclear reactor, which occurred due to the failure of a single component[48] .

'Closure' of one link or node does not necessarily lead to failure, but it reduces choice. In the context of negotiation of issues related to cross-border land transportation, for example, closure of a link can substantially reduce bargaining power.

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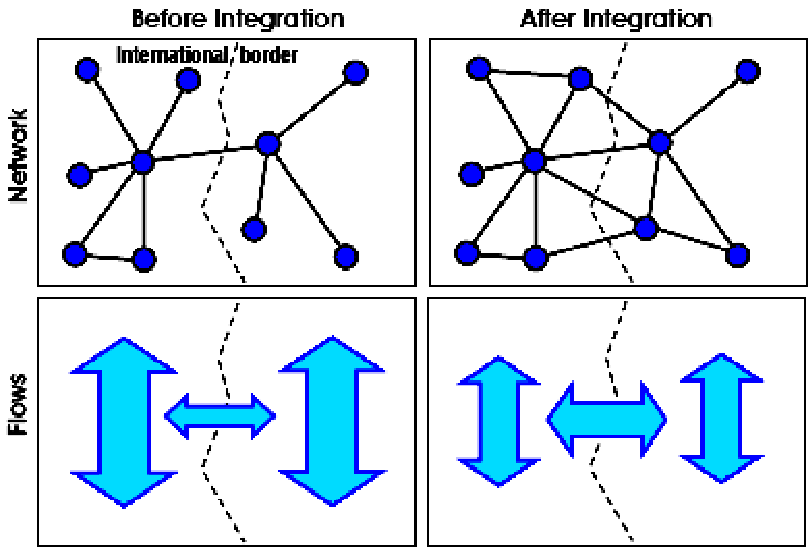
46. Similarly, networks of water pipelines are increasingly emerging as a major issue for the coming decades. However, they are not included in this paper's discussions.
47. Cut the bracers and the trousers fall down…
48. The "(in)famous" nuclear accident at the Three Mile Island light-water reactor occurred in Middletown, Pennsylvania, on 28 March 1979. "A simple interpretation of the cause of the accident is that it was initiated by an equipment failure, a valve that failed to close, compounded by several operator errors" (see http://www.magma.ca/~jalrober/Chapter8e.htm.)

It should be further noted that, while the term 'network' in economics was originally used in 'network externalities' to refer to benefits that accrue from connections of physical networks, such as telephones or railway lines, the term was extended to include value created by networks of users sharing compatible products and standards[49] . In fact, as long as there are significant complementarities between types of goods in a non-network industry, network externalities will play an important role. For example, the sales of icecream will influence the price and sales of waffles.

Linking subnetworks together

The linking together of two formerly unconnected or weakly connected national or international subnetworks is the principal objective of regional cooperation in infrastructure (Figure 5). This subsection briefly discusses the interconnectivity and interoperability issues associated with the establishment of such linkages.

Figure 5: Linking two subnetworks[50]



(a) Interconnectivity

The term *interconnectivity* simply refers to whether subnetworks are actually connected. For example, different rail gauges require special technical solutions to allow physical interconnection.

49. Frels, Shervani, Srivastava, (2003). The Integrated Networks Model: Explaining resource allocations in network markets. University of Texas.
50. Source: Rodrigue, J-P et al. (2004) Transport Geography on the Web, Hofstra University, Department of Economics & Geography, http://people.hofstra.edu/geotrans.

In this context, the difference between *connectivity* and *accessibility* should be noted. While connectivity is an attribute of a network and measures the minimum number of links needed to reach all nodes from all other nodes, accessibility is an attribute of a node and measures the minimum number of links needed to reach all or certain nodes from a specific node.

Interconnection is critical for efficient operation of many network industries, as a relatively small investment in interconnecting two networks can quickly create a much more valuable network (see Metcalf's Law[51]). From the users' perspective, interconnection increases the variety of services from which they can choose. From the government's perspective, it is important to assess the economic and social incentives for rival networks to interconnect so as to expand the range of services[52].

The transportation industry has elaborate arrangements to convey shipments across non-overlapping networks. Even in North America, in the early days, it involved loading and unloading of freight when lines used different track gauges (a situation similar to that in the Asia-Pacific region today). After standardization of track and equipment, interlining agreements allowed rolling stock to travel over contiguous rail networks without transferring shipments.

Similar to the regional situation of fragmented regional electricity networks in Asia today, in the early days of the US electricity power industry, two standards of power transmission coexisted on disjoint networks[52]. While the direct current standard was adopted in urban distribution systems of the US[53], the remainder used the alternating current method that enjoyed a cost advantage in serving the rural and outlying areas. Interconnection between the two systems awaited the development of the rotary converter which gave power plants expanded access to users and also added to the ranks of generators that could deliver power to the system[54].

(b) Interoperability

The example of the rotary converter in the previous paragraph highlights the fact that interoperability may have to be ensured before some networks can be interconnected. On the other hand, even in cases where networks have been

51. The so-called "Metcalfe's Law" states that the value of many networks is directly proportional to the square of the number of users
52. Economides, N., and Woroch, G., (1992). Benefits and pitfalls of network interconnection.
53. accounting for about two-thirds of installed generating capacity
54. Economides, N., and White L., (1994). One-way networks, two-way networks, compatibility, and public policy. http://www.stern.nyu.edu/networks/site.html.

interconnected, they may still lack interoperability. For example, railway networks that are interconnected and use the same gauge, may still not be interoperable, for example, due to differences in electricity supply or the signaling systems. This is the case even today in Europe for some neighbouring countries, where railway locomotives have to be exchanged at the border.

In the US, the trucking and rail industries have had to make themselves interoperable, in order to offer shippers end-to-end services. Under the 'piggyback system', tractor trailers are loaded aboard flatbed rail cars for the rail portion of their journey[52], thus ensuring interoperability between road and rail.

Containers are another good example where standards (ISO standards) have supported interoperability of networks of different transport modes and, consequently, have led to large productivity gains.

Technical considerations of interconnectivity and interoperability as illustrated here provide a useful perspective to identify issues in regional cooperation and integration in maintaining and developing inter-country infrastructure.

Linking more than two systems (e.g., transit issues)

When more than two systems are linked, more complex issues arise. In the case of transport and communications, probably the most important of these are transit issues. Examples are: transit through a third country (road, rail, water, air, communication lines, etc.) and simple right-of-way issues within a country (different communications network providers, fiber optic cables along railway lines, more than one railway company, etc.).

International transit issues have been perceived as highly complex matters, inter alia, due to the complicated distribution of costs and benefits derived from transit. In particular, international negotiations of transit fees, quotas and rights for land transport, air transport, oil/gas pipelines, have often proved long and difficult.

In an economic sense, the issue of transit fees depends on the marginal cost (to the 'producer'[55]) as well as the willingness to pay (demand) which depends on alternative choices available in the network and their particular characteristics. By definition, sufficient choice for landlocked countries through agreements with all their neighbours is costly. However, most government policies have been geared to maximize choice, in order to minimize the economic and political risks.

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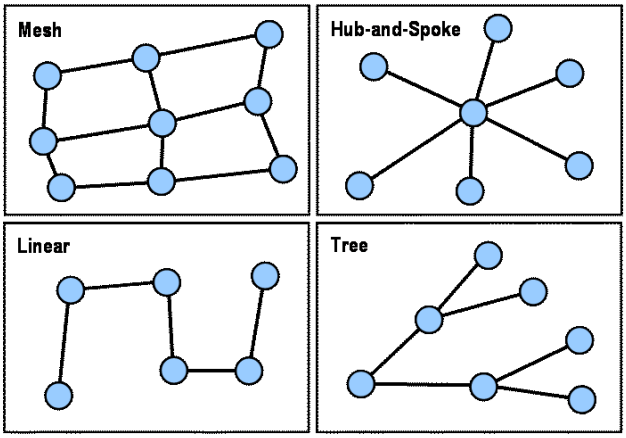
55. This means that the transit country is also a factor.

Key links and nodes that can limit or reduce possibilities of choice depend on the type of network. Figure 6 illustrates four types of network structures that typically arise in transport and communications. At any point in time, the optimal type of network depends on the specific economics of the links and nodes and government regulations. For example, international commercial air transport and maritime transport (ports) are organized along the hub-and-spoke system. However, the competing budget airlines typically follow the mesh structure. In other words, the hub-and-spoke system is not necessarily the optimal outcome for air transport in general. In fact, the structure which is optimal may change over time. A well documented example is that of the US Internet which changed from a linear set-up in the early 1970s, to a mesh network from the mid-1970s to the early 1990s, and to a hub-and-spoke system ever since due to the Internet's commercialization. In the hub-and-spoke system, interconnection pricing is an important issue due to the powerful position of the 'owner' of the hub. A typical example of the tree network is the land transport network of a country with a large hinterland but a small coastline where the major cities and most of the countries' economic activities are concentrated.

Figure 6: Types of network topology[56]



Quality and capacity

In practice, it is necessary but not sufficient to ensure interconnectivity and interoperability. As illustrated by Figure 5, if we make changes in our network (e.g., by interconnecting to networks or more users), resulting 'traffic' flows will change. And some links will have to be of higher quality and sufficient capacity in order to sustain such changes. While it seems very clear in the case of transport, it similarly applies to all other physical networks. For example, in the case of the Internet, providing access to more users without upgrading the Internet backbone (i.e., the salient, high capacity links) would only lead to degrading quality and decreasing utility to all users.

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56. Source: Rodrigue, J-P et al. (2004) Transport Geography on the Web, Hofstra University, Department of Economics & Geography, http://people.hofstra.edu/geotrans.

In order to characterize networks in terms of their interconnectivity, interoperability and quality, economists refer to the concept of the 'strength of the network'. This includes network characteristics of interconnectivity, interoperability and quality[57], together with current network size and expectations of future size. These characteristics determine the utility a user derives from the network.

One-way vs. two-way networks

There is a clear distinction between two-way networks (e.g., telephones, railroads, the Internet) and one-way networks (e.g., ATMs, television, distribution and service networks). In the former case, additional customers usually yield direct externalities to other customers; in the latter case, the externalities are indirect, through increases in the number of varieties (and lower prices) of components. Most industries involve vertically related components and thus are conceptually similar to one-way networks.

From paths to corridors

A *path* is something like a route on a map. In the network terminology introduced above, it is a set of consecutive links involving different nodes.

Particularly in the case of transportation, corridors rather than paths are the focus of attention for development. Corridors may include only one path/route (e.g., when network density is very low) or many alternative paths/routes, sometimes even including small distribution networks.

Non-physical Networks

All the classifications and issues of physical networks that we have just discussed also apply to non-physical networks. In fact, many of these non-physical networks are so closely interrelated to physical networks that it is more instructive to analyze them together.

There are many different types of non-physical networks, including social, economic, political/regulatory, information, knowledge, and environmental networks. For example, regional production networks would not have emerged without similar development of a variety of non-physical networks.

Linkages

In addition to classifying network linkages relating to physical or non-physical networks, one should look at linkages between networks in the 'same' traditional

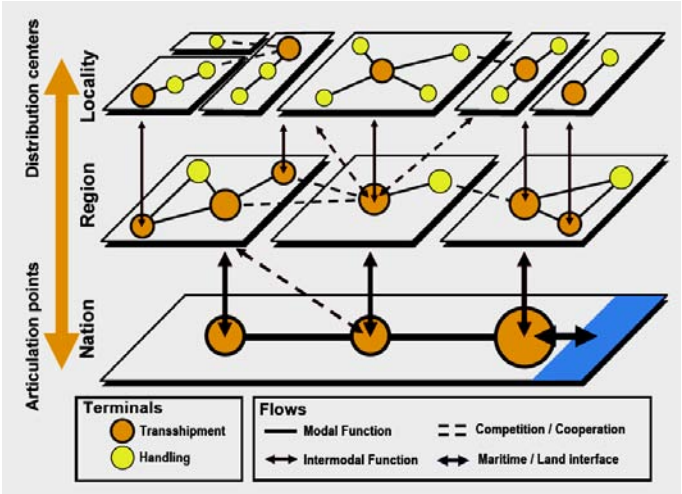
57. To be precise, the three network characteristics are actually compatibility, accessibility and quality. This is a more general terminology that also applies to complementary industries, etc.

sector (e.g., transport), or linkages between networks in 'different' sectors (e.g., between road transport and the Internet).

Linkages between networks in the 'same' sector

Figure 7 is an illustration of the various network linkages in the transport sector, including linkages between networks of different transport modes (e.g., shipping, roads, railways) and between various geographical levels (nation, region, locality). This is what is usually referred to as the *intermodal transport system*. This concept implies that it is useful to look at the networks of all transport modes in terms of a complex intermodal transport network system. An analogous situation exists in data communications where various standards, electronic, optical and all-optical transmission links are integrated into a complex communication system.

Figure 7: Intermodal transport system[58]



Linkages between networks in "different" sectors

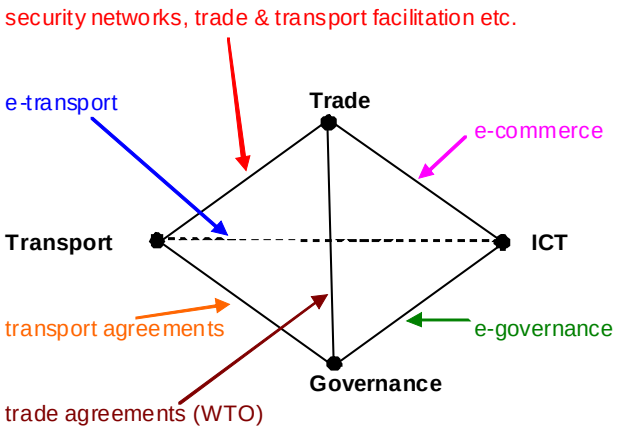
It appears that an even broader perspective that includes linkages between different "traditional" sectors proves useful. In essence, this approach looks at a complex network, consisting of many networks of various types.

The tetrahedron of Figure 8 symbolically illustrates these linkages between physical and non-physical networks in transport, ICT, trade and governance. More dimensions can be added in a similar fashion (for example, FDI, banking, finance, production and sales), but those included in Figure 8 are of direct relevance to regional production networks. Another example of linkages between networks in "different sectors" are documentary credit operations (letter of credit) which involve networks in trade, banking, chambers of commerce (certifying letter of credits), shipping and communications. Yet other examples are freight forwarding, international commercial contracts, competition policy and international regulation.

58. Source: Rodrigue, J-P et al. (2004) Transport Geography on the Web, Hofstra University, Department of Economics & Geography, http://people.hofstra.edu/geotrans.

The rapid emergence of new sectors (Figure 8) on the intersection of traditional sectors is evidence of increasingly strong linkages between the networks of formerly disjoint sectors. For example, the application of ICT in government has not only made government more efficient, but it has actually led to a new concept of governance in its own right, namely e-governance. Similarly, e-transport (ITS, logistics, etc.) has emerged as a separate field.

Figure 8: Symbolic illustration of linkages between physical and non-physical networks in transport, ICT, trade and governance



These developments do not replace the logic of traditional sectors, but they point to an increased need to fully consider the linkages to other relevant sectors and trends.

Finally, it should be noted that in various disciplines there are some attempts to widen the network perspective even further. For example, in Potts' evolutionary model of growth[59] economic systems are seen as "hyperstructures", i.e., multidimensional networks. In this model, economic change and growth of knowledge are in essence a process of changes in connections, such as the creation of a more complex organization, new connections or the grouping of those connections.

Externalities and Network Effects

The fundamental idea of network externalities is that "the act of joining a network confers a benefit on all other participants in the network"[60] . Network externalities may cause markets to fail in allocating resources efficiently. And markets in which incompatible standards compete may tip in the direction of an inferior standard that gains an early advantage.

While the concept of network externalities was developed within economics to analyse market outcomes, there is no reason why these types of considerations

59. Potts, J., (2000). The New Evolutionary Microeconomics: Complexity, Competence, and Adaptive Behaviour. Cheltenham, Edward Elgar.
60. Page, W. H.; Lopatka, J.E. (2000). Network Externalities, Chapter 0760 in Encyclopedia of Law and Economics, http://allserv.rug.ac.be/~gdegeest/tablebib.htm.

cannot be applied to nations and their international/regional integration, where a global or regional "regulator" does not exist.

Some economists distinguish direct from indirect externalities, depending on the different types of sources of benefit to participants in the network. *Direct externalities* are those typically seen by two-way networks in transport and communications. For example, the more phone users there are, the more useful it is for another person to become a phone user. Direct benefits do not exist for users of one-way networks (e.g., gas pipelines). *Indirect externalities* are externalities in the network of users of compatible systems[61] , even if they are not physically connected, such as in the case of computer soft- and hardware.

There is no clear consensus among economists as to the definition of the term "network effects", as compared to "network externalities". Some economists[62] define network effects in a broader sense than network externalities: network effects are said to exist when "the net value of an action… is affected by the number of agents taking equivalent actions". Other economists[63] use the term network externalities to comprise all network effects.

Conclusion

Physical transport and communication infrastructure and related non-physical software issues are, or form part of, various types of networks. Taking such a comprehensive network view allows one to readily use the tools and terminology from the discipline of economics of networks.

Thus, strategies and programmes stand to benefit, if they are designed to take explicit account of general network characteristics (such as key links and nodes, interconnectivity, interoperability, quality, capacity, network types, paths, corridors, network externalities and effects), since these characteristics already (knowingly or unknowingly) condition negotiations of regional and subregional agreements in infrastructure.

Similarly, strategies and programmes should include explicitly the linkages between physical and non-physical networks, including linkages in one sector and between sectors.

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61. These users are said to form a virtual network.
62. e.g., Liebowitz and Margolis.
63. e.g., Economides and Klausner.

II.4

Regionalization and related Issues in Developing Inter-Country Infrastructure Networks

This Chapter applies the concept of networks introduced in the previous chapter, in order to identify major issues related to inter-country infrastructure networks, including barriers to regional cooperation and integration in maintaining and developing infrastructure. These issues are closely related to the process of regionalization.

Regionalization

Chapter II.1 introduced the term "regionalization" to refer to a form of regional economic cooperation that is largely driven by multinationals establishing factories in different countries for specialized production of specific components of finished goods. This process has led to regional production networks in Asia and has been characterized by increased international specialization, interdependence and integration.

Naturally, the possibility for countries to 'participate' in these production networks has been limited by the quality of their inter-country infrastructure networks. Landlocked countries, certain regions of countries, and hinterlands located far away from the centres actively participating in the regional production process, face the risk of marginalization.

In fact, regional production networks in Asia have largely been limited to coastal areas due to inefficient inland infrastructure, in terms of network strength including issues of interconnectivity, interoperability, quality and current and future expected inland network size. The major question that this Chapter addresses is under which conditions could this process of regionalization be extended to inland sites. In particular, *can improved physical and non-physical networks contribute to "replication" at inland sites of the observed "coastal development"?*

Issues in Developing Inter-country Infrastructures

In order to answer this question, we use general network characteristics to analyze a possible extension of the regional production networks, that are currently concentrated in the coastal areas, to their hinterlands and even to landlocked countries.

Physical networks

(a) Links

To enable inland production centres to emerge, a hub-and-spoke system[64] of transport and communication infrastructure with hubs at inland sites needs to emerge. This requires efficient and high capacity national and international land-based backbone and access networks (road, rail, IWT, communications etc.). In addition to developing new links, rehabilitation and maintenance of existing links remains an important issue for most countries, including countries with economies in transition.

Defining paths (routes) and corridors (e.g., transport corridors and communication backbones) has proved a useful approach to achieving low-cost connections deep into the hinterlands. The corridor approach can be a catalyst for transforming linear networks into tree networks, meshes and finally into hub-and-spoke network systems. It should be noted, that this sequence is what is typically observed. However, this or any other such sequence does not necessarily exist, nor is the hub-and-spoke network necessarily the most desirable outcome.

Yet, if hubs emerge, accrued network benefits often concentrate around those hubs. Therefore, policies of hinterland and landlocked countries will need to be geared to promote the emergence of their own hubs. In a more general sense, this is in fact what was done explicitly or implicitly when so-called "growth poles" or "growth areas" were developed that linked "growth centres" with a strong backbone, trunk, path, corridor, or transmission system. Such concepts are an integral part of current thinking in some countries (e.g., the United Kingdom), where network-based or related cluster-based policies are used for regional development.

When more than two networks (of different countries or with different ownership) are linked, typical transit issues arise. These are of great concern, particularly to landlocked countries. Often the best approach to solving such issues is to take the perspective of the combined larger network, rather than that of national networks as competing agents. An obvious solution to controversial transit issues is some sort of integration[65] which will be mutually beneficial.

(b) Nodes

For the strength and value of a network (in terms of network interconnectivity, interoperability, quality, as well as current and future expected network size), the

64. For economic reasons, other network types such as the simple tree structure would imply that no veritable inland centre could evolve due to the additional cost factor.

65. Assuming the absence of significant negative externalities, of course (e.g., pollution and congestion).

nodes are as important as the links. In the case of transport, important nodes include intramodal connections (change of gauge, transhipment), intermodal connections, ports and border crossings. Governments and the private sector have promoted and even created key inland nodes through the development of inland container depots (ICDs), logistics centres, freight villages, and economic zones. Similar trends can be seen in communications. For example, IT service industries cluster in close location to high capacity international Internet backbones and hubs.

Linkages between physical and non-physical networks

Regardless of which level of quality and efficiency of land-based networks is achieved, hinterlands and particularly landlocked countries will always face an additional cost disadvantage due to their location and the lower relative costs of maritime transport and communications[66]. However, specialized inland production hubs may emerge, if these inland areas (or landlocked countries) can offer linkages to superior non-physical networks, such as institutional networks, markets, human resources and learning networks. As a matter of fact, the examples of the landlocked countries of Austria and Switzerland illustrate this point in the case of Europe[67] where economic integration has been far-reaching.

While landlocked countries will tend to focus their economic policies on services, their geographical location is not prohibitive for possible full participation in the international production networks focusing on manufacturing. It should be noted that transportation accounts on average around 4% of the costs of each unit of output in manufacturing[68]. In OECD countries, transport usually accounts for a quarter of total logistics costs (storage for a fifth, and inventories for a sixth)[69]. In contrast, in the case of landlocked developing countries, transport appears to account for much less than a quarter of total logistics costs[70], due to inefficiencies in the system and transit issues, including "under the table payments". This implies

66. Maritime transport is generally cheaper than land transport due to economies of scale of ships and ports. Most major inter-country communications lines are under-sea cables, since land-based cables are more costly due to right-of-way and other issues.
67. For example it should be noted that the industrial mix of Austria and Switzerland differs significantly from that of the Netherlands.
68. http://people.hofstra.edu/geotrans/eng/ch7en/conc7en/ch7c1en.html
69. http://www.worldbank.org/transport/ports_ss.htm
70. No reliable data seems to be published for Asian countries regarding the proportion of transport costs in total logistics costs to and from inland locations. However, common-sense tells us that this ratio must be lower than the one in OECD countries. Related measures collected by UNCTAD, such as the ratio between transportation and insurance payments to the value of exports, indicate a similar direction (e.g.,UNCTAD/TD/B/LDC/AC.1/17 and UNCTAD/LDC/112, June 2001), but these measures have not been corrected for the countries' different mix of export/import goods.

that the major constraints to improved competitiveness of landlocked countries in manufacturing are cross-border issues (including choice of product issues) and inefficient logistics systems rather than infrastructure issues or their geographical location *per se*.

Yet, transport remains an important issue for landlocked developing countries, since in these countries freight costs alone (transport and insurance) can make up to 40% of export values[69]. In contrast, in OECD countries, total logistics costs[71] are estimated to reach up to only 20% of total production costs. These shares are much larger than those quoted in the previous paragraph, due to: (a) a large share of exports of developing landlocked countries are bulk commodities of low unit value and high unit transport costs; and (b) shares quoted earlier are for OECD countries and manufactured products which are high-value goods.

Network externalities and effects

Network externalities in particular, and network effects in general, are at the same time a serious challenge and a great opportunity for smaller economies and landlocked countries. This is because regional cooperation and integration in both physical and non-physical networks increases the effective size of a network in terms of its associated user base and market size. In other words, if sufficiently integrated with larger or better geographically located neighbouring countries, smaller and landlocked countries will be able to offer foreign investors both the benefits of a large network/market as well as those of an easier manageable, flexible economy. For example, the relatively small Irish economy has benefited considerably from European Union membership, as it has proved to be an attractive location for investment by multinationals that were motivated by the perspective of EU market access.

Similarly, even in the absence of far-reaching economic integration, Singapore and Hong Kong, China, are examples illustrating how relatively small and flexible economies can benefit from their special geographic location, by promoting themselves as major nodes in the global transport and communication network.

In general, the benefits of regional integration are mutual for all participating countries, as the value of the networks of even the larger countries and coastal areas will increase as networks/markets in hinterlands and neighbouring smaller economies get connected. An increased network size will make the combined network more useful and competitive, even when a newly connected economy does not significantly participate in the regional RPNs. For example, Thailand and

71. packaging, storage, transport, inventories, administration and management

the Lao People's Democratic Republic both benefit from sharing Thai satellite capacities – Thailand through a larger user base, and the Lao People's Democratic Republic through access to otherwise inaccessible services.

Barriers to effective cooperation and integration in the infrastructure subsectors

There remain many physical and non-physical barriers to effective cooperation and integration in the infrastructure subsectors. These barriers define the issues to be addressed, the nature of which is remarkably similar throughout the different subsectors. They are summarized in Table 1 for the cases of transport and ICT and

Table 1: Selected major issues for effective regional cooperation in the transport and communications sectors

Transport	Communications/IT
Infrastructure (hardware) related issues	
Network formulation[72], design standards, and vehicle weight and dimensions	Network formulation[72]: Emergence of secondary regional hubs in Asia ('hub-and-spoke system')
Network formalization[72]	Network formalization[72]
Infrastructure facilities and services at border crossings	International interconnection (e.g., pricing and standards)
Road signage and traffic rules	
Software related issues	
Understanding of Documentation by Officials	Human resource issues; Software life cycle much shorter than organizational 'clockspeeds'
Collaboration on Procedures and Practices between Officials	Taxation, "bit-tax"; DNS and intellectual property
Transit issues	
Transit Traffic (fees, standards, procedures)	Transit traffic (land-based fixed lines)
Infrastructure related transit issues (see also network formulation)	Fixed lines vs. satellite footprints
Movement of people, goods, digital signals, etc. across borders	
Drivers and Crews	International outsourcing of IT services and IT-enabled services; software; open-source sharing and IP; etc.
Vehicles	Censorship of information flows by some governments at their 'borders'.
Containers	Protocols and integration of international testbeds (e.g., with IPv6); DNS
Other considerations	
Safety (including carrier liability regimes)	Safety
Security (including terrorism issues)	Information security; system vulnerabilities (including issues in using ICT for international terrorism)
Environmental considerations	Indirect environmental effects

72. Whereas network "formulation" refers to identifying a network, network "formalization" refers to a formal, legal (possibly international) agreement on what constitutes the network. For example, in the Asian Highway project since 1957 an international highway network had been jointly identified by government officials in the region, but only since the coming into force of the *Intergovernmental Agreement on the Asian Highway Network* in 2005 has this network been formalized.

can be organized into four categories: (a) infrastructure (hardware) related issues; (b) software related issues; (c) transit issues; (d) issues of movement of people, goods, digital signals, etc. across borders; (e) safety, security and environmental considerations.

It should be noted that, while there are similarities, there is not a one-to-one mapping in Table 1 between the issues in the two sectors. The major differences between the transport and ICT issues arise from a very short time-scale for the 'software layer' and more significant increasing returns to scale in the case of ICT. These differences have implications for market regulation, the role of government, and time management (for example, requiring different organizational set-ups).

Transportation and energy networks also have somewhat similar characteristics. In fact, energy grids are closely related to transportation grids. In some instances, they even compete with each other, as is the case with LNG transport by ship versus natural gas transport through pipelines. Similar to different transport modes, different energy fuels require fundamentally different infrastructure, and the choice of fuel causes a strong lock-in. However, a major difference when compared to transportation is the fact that energy grids are usually one-way 'pipes', rather than two-way pipes.

Conclusion

In conclusion, though it appears possible it is challenging to extend the Asian production networks from the coastal areas to hinterlands and even landlocked countries. The key to such an extension is regional cooperation and integration in the physical and non-physical transport and communications networks and interlinked networks from other sectors.

While links, nodes, and linkages between different physical and non-physical networks need to be strengthened in a strategic fashion, there remain many physical and non-physical barriers to effective cooperation and integration in the infrastructure subsectors which are listed in Table 1. These barriers define the issues that need to be addressed in strategies and programmes.

II.5

Regionalism: Government-Level Regional Cooperation in Infrastructure

All the previous chapters have highlighted the overarching importance of regional cooperation in infrastructure, particularly due to its network nature. This chapter analyses in more detail *the role of regional and international agreements, organizations and programmes in the process of extending international production networks from coastal areas to inland sites in Asia*.

In order to examine this role more closely, the chapter, firstly, puts regionalism in perspective; secondly, it provides examples of international and regional agreements, organizations and programmes; thirdly, it reviews general organizational trends within the region; and, finally, it addresses the question of which path (bottom-up, top-down, or a combination of both) might be the "right" path to enter into multilateral agreements in the region.

What is Regionalism?

Whereas regionalization was defined as the largely market and private-sector driven form of regional economic cooperation, for the purpose of this paper, *regionalism* is the state-driven form of regional economic cooperation among governments.

A strong message throughout this paper is that regionalization and its expression in terms of regional production networks needs to be complemented with regional cooperation between governments in infrastructure development (i.e., regionalism) in order to address the many inter-country challenges and to reduce the potential risks of marginalization of hinterlands, landlocked countries, and small economies.

Examples of regional intergovernmental organizations, agreements and programmes

This Section provides some examples of major intergovernmental organizations, agreements and programmes in the region. Organizations' full names, membership information and date of establishment is summarized in Annex II.

Classification

Regional and subregional[73] cooperation in infrastructure takes many different forms. It ranges from activities and projects that include several countries, through official inter-country projects with government involvement, projects of international organizations and development banks, to policy cooperation through the United Nations regional commissions or formal intergovernmental agreements (IGAs).

For the purpose of this paper, we identify six different types[74] of cooperation. They include:

(i) Global UN conventions

(ii) Intergovernmental agreements/organizations addressing regional cooperation

(iii) Intergovernmental agreements/organizations addressing subregional cooperation

(iv) Programmes addressing regional or subregional cooperation

(v) Frameworks for agreements

(vi) Guidelines for legislation

It should be noted that this categorization does not give a static picture. For example, programmes are often designed to have a catalytic role in leading to various formal, intergovernmental agreements. Also, some programmes, such as TRACECA, start out as a programme, but are later transformed into a specific intergovernmental agreement (IGC-TRACECA).

Global United Nations conventions

There are global United Nations conventions of a general nature, as well as those in specific sectors. These conventions have often set international standards which are applied in practice, even in some countries that have not actually acceded to the convention. These conventions are usually deposited with the Secretary General of the United Nations and are open to world-wide accession.

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73. The definition of what is considered to be "regional" varies substantially among organizations. For the purpose of this paper, the term "regional cooperation" refers to cooperation that engages amany Asian countries from more than one geographically defined region (e.g. countries from South-East, South and North Asia). Sub-regional cooperation refers to cooperation between fewer countries, for example, cooperation in South-East Asia (e.g., ASEAN), or South Asia (e.g., SAARC).
74. and eight subcategories

(a) Global UN conventions of a general nature

Some of the global UN conventions of a general nature, that are most relevant in the context of this paper, include general international conventions on landlocked countries, such as the Convention on Transit Trade of Land-Locked States (New York, 1965)[75] , the Convention and Statute on Freedom of Transit (Barcelona, 1921), and the United Nations Convention on the Law of the Sea (1982).

(b) Global UN conventions in a specific sector

Global UN conventions in transport: There is an established set of more than 50 international conventions specifically dealing with transport issues (e.g., the seven conventions included in ESCAP resolution 48/11[76]), a large number of which are open to accession by any State. Because of the importance and rapid development of land transport in Europe over the last 50 years, the United Nations Economic Commission for Europe (ECE) has been designated by the Secretary General as the lead organization in matters related to land transport conventions.

It should also be noted that there are international UN initiated agreements that are deposited at the UN in New York[77] and are open to accession by any State, but are of a purely regional nature (e.g., the European Agreement on Main International Traffic Arteries (AGR, 1975)[78]). In the transport sector, they provide a function similar to the one performed by the rule-based multilateral trade agreements embodied in the WTO Agreement and subsequent negotiations, in that they provide a firm basis[79] (and end game) for the harmonization[80] of regional, subregional, and bilateral transport agreements.

Global Internet communications agreements and cooperation: By its very nature, the Internet is global. As a result, international standards for the Internet

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75. see the Website of the UN High representative for landlocked developing countries for detailed information, http://www.un.org/special-rep/ohrlls/ohrlls/default.htm
76. These seven conventions are covering issues such as road traffic rules, road signs and signals, transit of sealed containers, temporary importation of vehicles, harmonization of border crossing procedures and the commercial carriage of goods by road. http://www.unescap.org/tctd/lt/reso48_11.htm
77. http://untreaty.un.org/ENGLISH/bible/englishinternetbible/chapterXI.asp
78. http://untreaty.un.org/ENGLISH/bible/englishinternetbible/partI/chapterXI/subchapB/treaty161.asp
79. However, it should be noted that, in the contrast to the case of the WTO, the UN transport agreements discussed here do not provide for a similar quasi-judicial dispute settlement system and sanctions for non-compliance.
80. It should be noted that liberalization is a more prominent objective of WTO than harmonization.

and the WWW have been set at the global level by new organizations, such as the W3C and ISOC, with ITU playing a relatively minor role compared to the past.

However, in a manner similar to transportation networks, the Internet is a physical network that is bound and shaped by geography (Figure 9). In fact, the network characteristics of fixed-line IP networks are similar to those of land and water transport networks, and those of satellite communications are similar to those of air transport. The laying of communications cables needs to overcome the same physical and economic constraints of space, such as right-of-way issues, as in the case of roads. For this reason, long-distance Internet backbones often follow least-cost transport routes. Figure 9 shows that the Trans-Europe-Asia Information Network (TEIN) follows the usual sea routes of container trade between Europe and Asia.

Figure 9: Trans Europe Asia Information Network (TEIN): Actual route in November 2003

While there are striking resemblances between many of the issues that need to be addressed in the communications sector and the transport sector, only few international agreements exist in the ICT sector. These issues are either of a general nature (e.g., the Council of Europe's Cybercrime Treaty) or focus on technical standard setting in telecommunications (e.g., ITU standards). In contrast to the transport conventions, W3C and ISOC standards have been developed by non-governmental organizations and are non-binding. However, they have become "de-facto industry standards". There appears to be a growing need to move to consistent, binding international conventions for cross-border Internet use, similar to those relating to cross-border transport infrastructure, facilities and services.

Intergovernmental agreements/organizations addressing regional cooperation

Other types of formal intergovernmental agreements have been created for the purpose of promoting regional economic cooperation in general or at least in several pre-specified sectors. These agreements have usually set up a secretariat, an organization or some working mechanism that draws upon administrative and substantive resources. The examples of such agreements/organizations are summarized in Table 4 (Annex II).

(a) IGAs addressing regional cooperation in general

The earliest post-World War II example in Asia and the Pacific was the establishment of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP)[81] in 1947. This regional commission has been mainly serving the function of a regional intergovernmental forum. It has catalyzed the creation of many governmental and non-governmental regional organizations and networks, including, for example, the Asian Development Bank (ADB) and the Asia-Pacific Telecommunity (APT), which, in turn, have promoted regional cooperation.

(b) IGAs addressing regional cooperation in a specific sector

There exist an increasing number of intergovernmental agreements/ organizations on regional cooperation in the transport sector and to a lesser extent in the communications sector (see Table 5 in Annex II).

A recent example in the area of cross-border road transport is the 'Intergovernmental Agreement on the Asian Highway Network' that was signed at Shanghai in 2004. The agreement covers issues related to routes, including their numbering, classification, design standards, and signage of the highway.

In terms of inter-governmental cooperation in IT, the Asia-Pacific Telecommunity (APT) has facilitated regional ICT standards and regional exchange of technical expertise. The ASEM process has also played a dominant role in Asia and in the Europe-Asia interconnections.

However, Asian regional cooperation in the key area of cross-border Internet backbones, has been very limited, compared to cooperation in other regions of the world and other sectors. IT cooperation has been rather global in nature, and has been driven by multinationals from North America, Europe, and (to some extent) Japan. These have emerged as global Internet hubs, with Asian countries at the end of the spokes.

Intergovernmental agreements/organizations addressing subregional cooperation

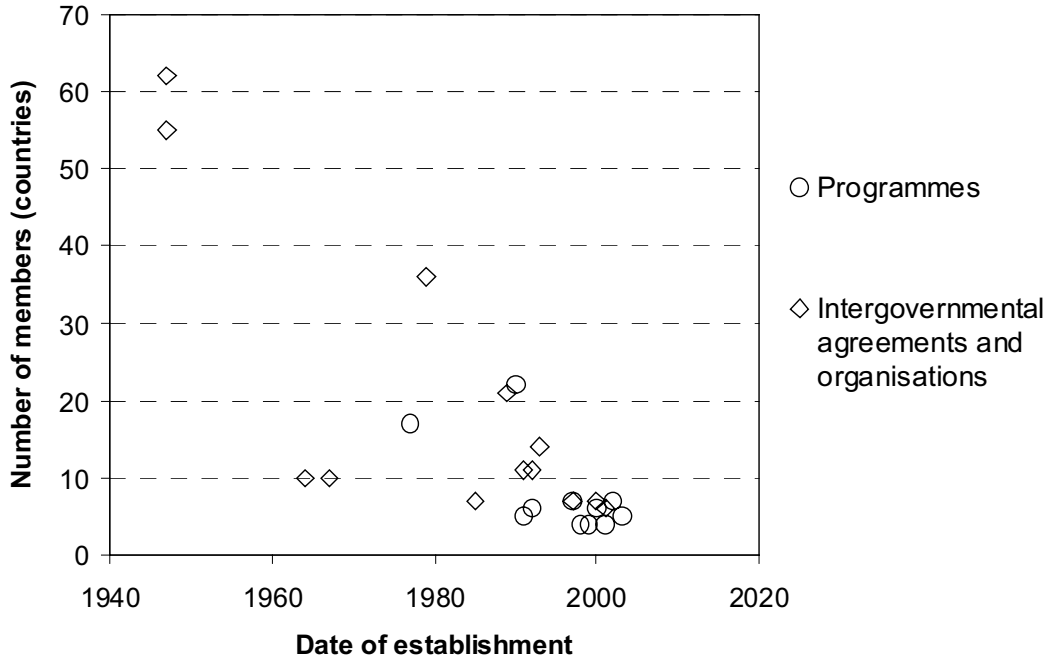
(a) From regional to subregional organizations and programmes

While a sizable number of regional and subregional intergovernmental organizations and programmes have been created in Asia and the Pacific since 1945 and particularly in the past 20 years, there has been a clear trend to establish ever more and often overlapping organizations and programmes. These have tended

81. The original name was ECAFE (Economic Commission for Asia and the Far-East)

to have fewer and fewer members (Figure 10)[82] . All these organizations and programmes have promoted inter-governmental agreements and economic cooperation on many issues, including cross-border transport and communications.

Figure 10: Number of members of intergovernmental agreements, organisations and programmes addressing subregional or regional cooperation in Asia and the Pacific[83] versus their date of establishment



(b) IGAs addressing subregional cooperation in general

A number of subregional, intergovernmental agreements have emerged, such as SAARC, ECO, SCO, BIMSTEC, and significantly ASEAN. These organizations are increasingly providing the forum for the creation of formal regional agreements.

(c) IGAs addressing subregional cooperation in a specific sector

Under the umbrellas of these organizations, formal regional agreements have been created on a large number of specific issues or in specific sectors, particularly

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

83. Data source: All organizations listed in Tables 4 to 7 were included (see Annex). It should be noted that the total number of member countries is plotted, including member countries that are not located in Asia and the Pacific. The criteria for inclusion of organizations was that they promote regional cooperation in Asia and the Pacific.

the transport sector. An example of this in the region is ASEAN. The resulting formal agreements on specific issues in practice serve the role of instruments for regional cooperation and integration.

Recently, there have been efforts by Japan and the Republic of Korea to foster regional cooperation on Internet backbones in Asia in order to develop them into regional Asian hubs. Initially, this cooperation was mainly on a bilateral basis. However, more recently, a multilateral approach has been gaining greater significance. Interestingly, the multilateral approach is driven by non-state actors. Such cooperation and the development of new hubs is likely to gain further importance in the coming years, as the Internet population of Asia and the Pacific (ESCAP region) has surpassed that of North America earlier this year. However, to date, official, inter-governmental cooperation in Asia on international Internet backbones has been much less 'developed' in comparison to transport.

Selected programmes

(a) Selected programmes addressing subregional or regional cooperation in general

ADB has been a pioneer in the promotion of general regional cooperation programmes such as GMS, CSATTF, CAREC and SASEC (Table 6, Annex II). These subregional programmes are organized through ministerial-level subregional conferences where high-level policy agreement is reached for subsequent programme activities. However, in contrast to the example of ESCAP and probably due to the fact that ADB is a bank, much of the programme activities themselves are on the national level (see also Table 2). Other organizations including the UNDP and the World Bank have created subregional, general cooperation programmes of their own (e.g., Tumen River Area Development Programme and the CIS-7).

(b) Selected programmes addressing subregional or regional cooperation in a specific sector

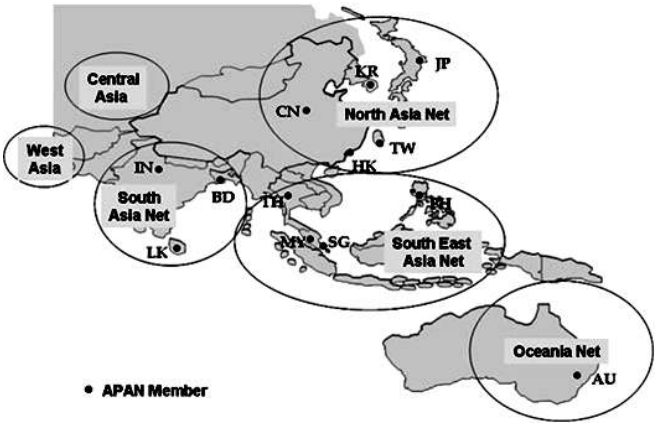
Programmes on regional cooperation specifically in the transport sector include the ESCAP's Asian Land Transport Infrastructure Development (ALTID) project and the UNDP's Silk Road Area Development Programme. Examples from Europe are the Trans-European Railway (TER) and the Trans-European Motorway (TEM) projects.

In the communications sector, the cluster "Trans-Eurasia Information Network (TEIN)"[84] of the inter-governmental ASEM process has played a dominant role in

84. TEIN was originally suggested by the Republic of Korea and co-sponsored by France.

Asia. Activities are organized under the so-called Information Technology Thematic Cluster[85] . On the technical and Internet network implementation level, a number of so-called AP* organizations[86] have emerged under APNG leadership since the early 1990s. For example, there is an APAN network, which follows roughly the existing divisional lines of general, subregional, economic cooperation initiatives (Figure 11).

Figure 11: APAN Networking environment



Frameworks for Agreements

Examples of frameworks for agreements include the ASEAN framework agreement on multimodal transport, the GMS framework agreement for facilitation of cross-border movement and the ECMT recommendation for bilateral agreements in road transport[87] . Such frameworks perform a number of functions, perhaps the most important of which is that they provide a consistent basis for negotiating bilateral, plurilateral and subregional agreements. In the case of the GMS transit transport agreement, it was initially used to govern bilateral and trilateral relationships between GMS member countries on specific routes. One of the principal advantages of the agreement is that it can be easily extended to additional routes and countries as it has been developed in a participatory manner by all the member countries.

Another advantage of the ECMT type of agreement is that it provides a 'level playing field' for partners in weaker negotiating positions or with weaker negotiating skills and capacities. Besides, there are also the reduced resource costs and less time required to negotiate agreements based upon agreed frameworks. A 'disadvantage', however, is that the initial negotiators 'set the terms', leaving others with only a 'take it or leave it' option.

85. http://europa.eu.int/comm/external_relations/asem/cluster/it.htm
86. The activities of the Asia Pacific Networking Group (APNG) have led to the creation of Asia-Pacific Internet-related organizations that are loosely connected with each other and are often referred to as "AP* organizations". Examples include APNIC, APIA, APTLD, and APCERT.
87. http://www1.oecd.org/cem/resol/road/road97e.pdf

Legislative Guidelines and Model Clauses

There are a number of examples of such guidelines, including the UNCITRAL legislative guide on privately financed infrastructure projects (including model legislative provisions)[88], and the ESCAP Guidelines for Maritime Legislation[89] . Such guidelines perform a number of functions. Firstly, they provide 'checklists' for countries in developing domestic legislation, thereby reducing resource costs and time-span as well as assisting in the capacity building process. Secondly, if they are related to the subject matter of bilateral, regional or international agreements, they can provide consistent advice in the formulation of domestic legislation. Thirdly, whilst they may be primarily related to domestic legislation, they introduce a consistency and familiarity that facilitates the attraction of foreign direct investment.

Substantive content of regional cooperation in infrastructure, facilities and services

Table 2 summarizes in a stylized form the major items of the substantive content of regional cooperation agreements in transport infrastructure. The results

Table 2: Substantive content of current regional cooperation in infrastructure, facilities and services

Type of activity	National	Bilateral/subregional/regional
Policy	Policy planning and coordination; Public sector reform; Broader policies, including economic, safety, security, environmental and poverty aspects; Integrated assessment; Participation and transparency in infrastructure development.	Cooperation and dialogue; Transit policy; Bilateral and subregional agreements; International transport conventions.
Infrastructure	New construction; Rehabilitation/upgrading; Modernization (e.g., use of ICT); Equipment (vehicles, rolling stock); Facilities (intra- and intermodal); Maintenance.	Facilities (border-crossing); Infrastructure development coordination; Resource mobilization;
Operations	Services; Related businesses; Capacity building (e.g., for asset management).	Cross-border service coordination, including equipment exchange; Transit tariffs.
Facilitation	Improvement of business environment for transport operators working in international transport (e.g., one stop windows for processing export/import documents).	Border crossing facilitation.

88. http://www.uncitral.org/english/texts/procurem/pfip-index-e.htm
89. United Nations ESCAP, 1991 (ST/ESCAP/1076); http://www.unescap.org/tctd/pubs/pubs_topic_water.htm.

are mainly based on ESCAP's analysis of the work of the organizations and programmes listed in Table 4 through to Table 7 in Annex II.

The national-level work that is done under the umbrella of regional cooperation is in large part the work of development banks (ADB, EBRD and the World Bank), UNDP and bilateral agencies. It may be noted that Table 2 above appears to be heavily focused on transport. This is largely due to the fact that there are very few regional cooperation activities on cross-border communication issues in the region.

In terms of content, there is currently little cooperation on actual operationalisation of infrastructure.

While many regional cooperation initiatives generally seem to target socio-economic subregional development (e.g., along infrastructure corridors), the explicit link between the various network layers and regional development using a strategic and long-term network perspective, is surprisingly non-existent.

Which path toward multilateral agreements?

There has been a significant increase in the number, magnitude and extent of regional and subregional cooperation initiatives and organizations. In the second half of the 20th century and particularly in the past 20 years, a complex web of cooperation mechanisms and relationships has emerged in the infrastructure sectors of Asia and the Pacific.

Table 3 shows a matrix which lists a selection of the main agreements/ organizations/ programmes against their membership in Asia. As the regional arm of the United Nations, ESCAP is the organization with the most comprehensive membership coverage in Asia and the Pacific. Within the table, groupings of countries can be clearly identified which would appear to follow topographical, historical, religious and cultural lines. Furthermore, some countries are members of a large number of organizations, whereas others are members of only a few regional organisations[90] .

While it would be noted that the list of regional and subregional organizations and programmes is *not* comprehensive, a number of otherwise intuitive general trends are reflected in the table (with notable exceptions, of course). Landlocked countries, such as Tajikistan, Kyrgyzstan, Azerbaijan, Kazakhstan, Uzbekistan, as well as geopolitically important countries, such as Russian Federation, China, India,

90. The rank size distribution of membership size shows a typical power law distribution.

Thailand, and Turkey are the countries that are members of the largest number of agreements and organizations. In contrast, island countries and other developed or newly-industrialized countries in the region[91] are only part of a limited number of such mechanisms or programmes in the region.

Table 3 also suggests that a "hub-and-spoke" system of agreements and programmes in the area of transport is evolving – for example, the International North-South Transport Corridor (INSTC) whose founding members were Russia, the Islamic Republic of Iran and India, and BIMSTEC that links a subset of members of SAARC with a subset of members of ASEAN. This network of agreements can be seen as yet another non-physical 'soft'-network complementing the "hard"-infrastructure. The situation in transport is somewhat similar to that in trade, where some experts have been discussing the implications of an increasingly complicated 'spaghetti bowl' of overlapping bilateral, plurilateral, and subregional trade agreements[92] . This has raised concerns regarding possible inconsistencies between these agreements and the multilateral trade agreements of the WTO. There are also concerns that such inconsistencies could lead to lock-in of negotiation positions at the WTO level. The proliferation of bilateral and subregional agreements in the transport sector raises similar concerns regarding their consistency with regional and global conventions. For example, the current proliferation of bilateral and smaller plurilateral agreements makes it increasingly difficult for countries like China to negotiate new commitments, since it has a large number of neighbouring countries that are parties to many different types of agreements.

This raises the question of the extent to which bilateral, subregional and regional transport agreements contribute to global multilateral conventions. Assuming that the 'optimal' solution is a consistent and fair multilateral, global, or at least regional convention, the question remains as to which path is the 'right' one to achieve such a goal. Due to an increasingly complex 'spaghetti bowl' of agreements, there is a pressing need to address this question.

Since issues, such as cross-border land transport[93] and fixed line Internet communications are regional by nature, a large part of relevant harmonization can

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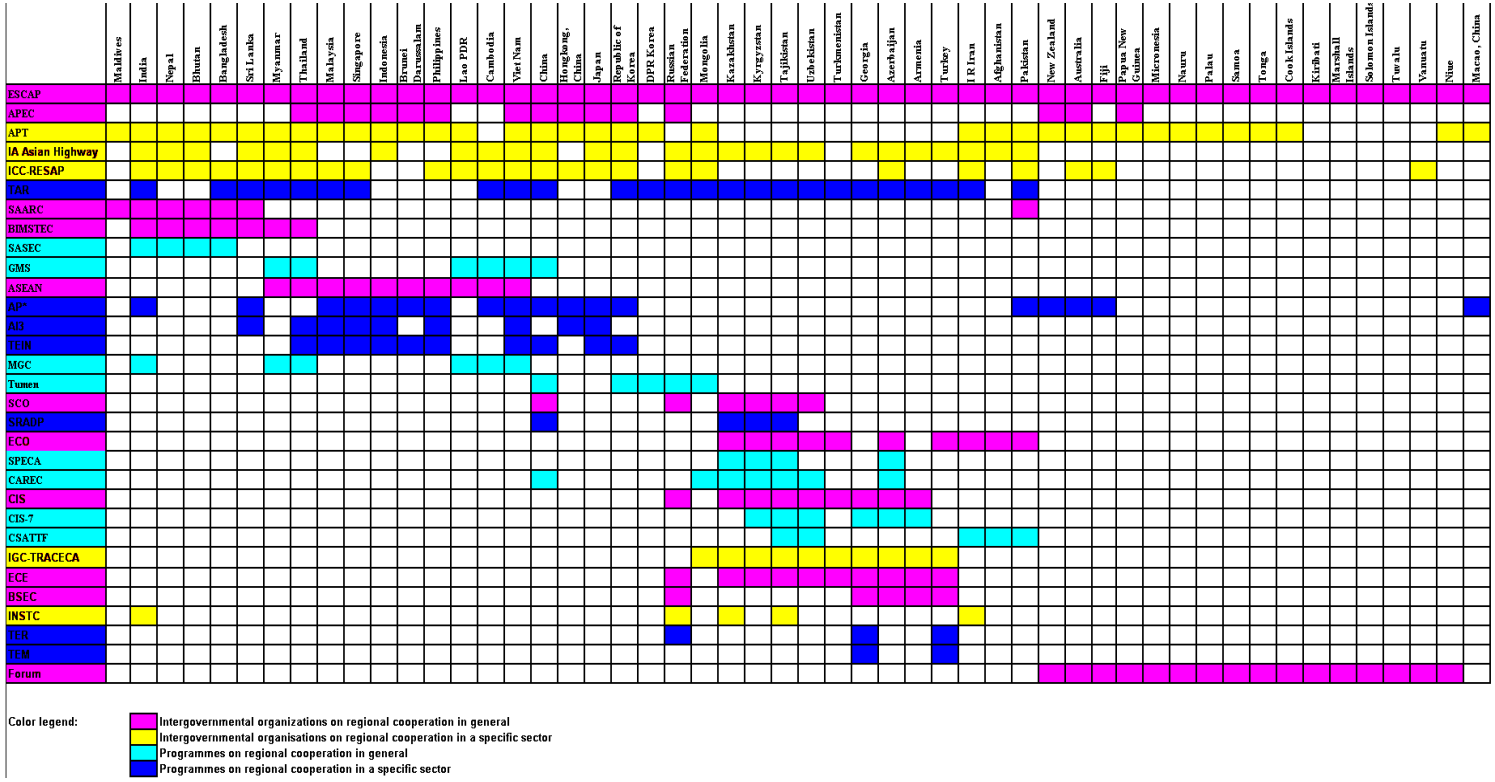
91. Instead, NIEs tend to have more agreements with developed countries, many of which are not located in the region. These agreements are not reflected in the matrix of Table 3.
92. see, e.g., Bonapace, T., (2005), Regional Trade and Investment Architecture in Asia-Pacific: Emerging Trends and Imperatives, RIS discussion paper, RIS-DP # 92/2005, April 2005, http://www.ris.org.in/dp92_pap.pdf
93. For example, it doesn't matter very much whether land transport agreements in South America differ from those in Asia.

Table 3: Matrix of agreements/organizations versus its member countries in Asia[94]



94. It should be noted that the list of countries is not complete for some organizations (e.g., ESCAP, ECE, APEC) as they have member countries located outside Asia and the Pacific region.

be achieved at the regional level. In the context of linkages with other regions (Europe, West Asia, Africa, Latin America and the Carribean), global harmonization is highly desirable, if not necessary. The "spaghetti bowl" example of cross-border trade and transport agreements should also be considered as a lesson for similar future trends in ICT in the region.

Key findings of Review of Regional Cooperation in Land, Maritime and Intermodal Transport Infrastructure development

As part of the preparatory work for the ESCAP Theme Study for the Commission in 2006, a review of regional cooperation in land, maritime and intermodal transport infrastructure development was carried out. The key findings of the review are presented here (for more details, see Annex I):

Asian Highway and Trans-Asian Railway continue to serve as reference for many new subregional cooperation initiatives in land transport development

ESCAP's regional cooperation initiatives in Asian land transport, the Asian Highway (AH) and the Trans-Asian Railway (TAR) continue to serve as reference points for both subregional and inter-regional cooperation initiatives. The Intergovernmental Agreement on the Asian Highway Network entered into force in July 2005 and the Intergovernmental Agreement on the Trans-Asian Railway Network was signed in November 2006. Noteworthy recent cooperation initiatives also include the UN Special Programme for the Economies of Central Asia (SPECA) since 1997 and the Euro-Asian Transport Linkages Project of UN Regional Commissions since 2002.

The major part of subregional cooperation in transport is promoted under the frameworks of subregional, intergovernmental organizations, such as ASEAN, ECO, FORUM and SAARC, which cover a multitude of economic sectors. Most recently, there has also been a proliferation of many other programmes, projects and initiatives with elements of subregional cooperation in land transport, such as BIMP-EAGA, IMT-GT, IMS-GT, AMBDC, GMS, and ACMECS. Most of these organizations and programmes aim to complement each other as well as the Asian Highway and Trans-Asian Railway.

Competition issues in maritime transport development and special needs of Pacific Island States

Regional cooperation in maritime transport takes significantly different forms in the case of the coastal regions of the Asian continent and its major economies, than in the case of small island developing states (SIDS) in the Pacific. Changes in technology, ship-route structures and the role of state-owned ports, have led to

consolidation, concentration, co-opetition and strategic alliances in shipping. Particularly, the emergence of port operating companies with dominant market positions has raised a number of competition issues that still remain unresolved. Regional and subregional cooperation in transport of small island developing states (SIDS) is promoted mainly by the ESCAP Pacific Operations Centre (EPOC) and the Pacific Island FORUM. The Global Action Plan for Small Island Developing States has been a guiding framework for regional cooperation in the Pacific since 1994.

Regional cooperation in the development of an Asian integrated transport system is in its infancy

While the private-sector driven maritime and civil aviation networks have developed into their characteristic hubs-and-spokes systems, governments have tried to promote scale and interconnection through inland container depots (ICDs) at the national level. Since companies in the maritime and air transport sectors are owning or running regional and global networks of their own, regional cooperation initiatives aimed at promoting integrated transport mainly focus on the land linkages to these networks. The ALTID project of ESCAP is an important example. The ESCAP Secretariat is working on a practical methodology for the development of an Asian Integrated Transport System and has promoted cooperation through a series of subregional studies. ESCAP has worked closely with ADB, supporting its comprehensive subregional cooperation programmes in Asia and the Pacific, all of which include components related to integrated transport: GMS, SASEC, CAREC, BIMP-EAGA, SECSCA, and the Pacific Plan for the small island states in the Pacific Ocean.

Conclusion

The large number of agreements and initiatives in Asia and the Pacific in the areas of trade, transport and to a limited extent in ICT are a general expression of the desire of governments to cooperate on the issues and of their recognition of the potential benefits of such cooperation, particularly as a response to the challenges of globalization.

As issues like cross-border land transport and fixed-line Internet communications are regional by nature, useful harmonization can be achieved at the regional level within a global framework.

The complex ‘system’ of overlapping agreements can be viewed as yet another non-physical network layer that emerges with, and complements the physical network infrastructure development.

Despite many similarities, there are also important sectoral differences in regional cooperation on networks' infrastructure, facilities and services.

In terms of the content of regional cooperation, more cooperation in the area of actual operationalisation of infrastructures could prove beneficial. In this context, a strategic and long-term network perspective is needed that fully takes into account the explicit link between the various network layers and development.

II.6

Systemic Risks Arising from Increased Regional Integration

This Chapter uses the concept of networks (introduced in Section II.3) to identify major systemic risks related to increased regional cooperation and integration.

Introduction

Far-reaching processes, such as regional integration or globalization in general often lead to a re-distribution of costs and benefits, including 'material' and social well-being. Consequently, various groups of people and even countries will have different views on what is a desirable or undesirable effect of regional integration. For example, we can look at an expected re-distribution of income opportunities between two groups of people due to regional integration, and assess the probabilities of various possible outcomes. This approach provides measures of risk, a concept that by nature is neither positive nor negative.

Types of Risks

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 such a direct risk. Direct risks can usually be addressed by appropriate policies of national government, and are, therefore, not considered here.

However, there are also so-called *systemic risks* which are risks that are inherent in the "system", as it becomes integrated. These types of risks often can only be addressed by *regional cooperation* of governments, not by policies of a single government.

Systemic risks

Examples of systemic risks arising from increased regional integration include the following:

(i) Strong networks usually lead to concentration on all levels, as specific groups become increasingly able to control key links and nodes within networks and between networks. Under such a scenario, power relations become an important issue. In the most extreme case, lobbying groups

may de-facto achieve increasing control over or "capture" the decision-making process of political representatives.

(ii) Co-opetition trends, where otherwise competing firms collaborate on specific issues (often related to networks), may become a serious challenge for governments, as *national* regulators and competition authorities actually have to deal with *international* networks. Due to the absence of efficient regional or even global regulatory institutions, it may be difficult to find the "right" balance between where to strengthen or refocus networks and where to foster competition.

(iii) Decisions made concerning investment in infrastructure can, due to its high capital cost and long gestation periods, initiate path-dependent processes and lock-in effects. Economic integration, as a whole, appears to be a path-dependent process which may lead to lock-in, resulting in potentially high costs for governments to change course in terms of their regional integration. Examples of the high costs of the reverse process of "disintegration" are the erection of borders that did not formerly exist following the dissolution of the Soviet Union, as well as events in the aftermath of the independence of the Indian Subcontinent (1947).

(iv) Governments need also to be aware that economic cooperation creates inter-dependencies that might eventually spillover into other fields.

(v) Countries that put on the "golden straight-jacket" by engaging fully in various forms of economic integration will prosper, but may also be left with fewer and fewer national policy options. Some argue that this will have adverse effects on social safety nets and human well-being in general.

(vi) Regional integration may lead to increased vulnerability of the 'system'. For example, manufacturing and assembling activities may be deeply affected by political developments in a single yet small country that forms part of its regional production network, if adequate risk mitigation measures are not in place. Similarly, the security of the system of global container shipping lines has been of concern recently, as they form the backbone of the regional and international production system. Such vulnerability may have spill-overs to the world economy, where economic 'hikes' may become more pronounced than in the past[95].

95. One might consider a nightmare scenario for container shipping in which the ports of Singapore or Hong Kong, China, went out of action.

(vii) In regional integration, labour has been[96] the only factor of production that has not been free to move across borders. This may eventually lead to additional imbalances within countries.

A proper risk management view needs to be taken by governments individually and jointly, in order to adequately quantify and address such inherent risks. Systemic improvements could minimize these risks from the outset.

Conclusion

Risks *per se* are neither good nor bad by nature. The risks mentioned above are not arguments against regional cooperation. On the contrary, awareness of these risks ensures that regional cooperation in infrastructure can actually deliver what it promises. Risk management of regional cooperation is analogous to health insurance coverage. Awareness and preparation for the possibility of getting sick does not create sickness; it rather mitigates the risk of getting sick.

96. with few exceptions