3.1 Background and the need for a regional land transport system in Asia

The efforts towards establishing a global land transport system date back to the early days of the history of development. For many centuries, East, South, Central and West Asia were connected to the Mediterranean region through an extensive network of caravan track trade routes, collectively known as the Silk Road. The historic Silk Road was a successful effort in establishing a global land transport system, which for many centuries had contributed to the expansion of trade, and transfer of knowledge, technology, culture, languages and sharing of ideas.2

The historic Silk Road however did not survive the test of time. Eventually, a number of factors led to its gradual disintegration over time and its final collapse. The main factors included were growing insecurity along the routes especially after the fall of the Mongol Empire that made safe passage along the routes difficult, and the discovery of a new sea route from Europe to India in 1497. Since then, some major developments in maritime transportation had taken place, which led to prominence of maritime shipping and diminished the importance of land transport connectivity. The opening of the Suez Canal in 1869 and the steam revolution of the nineteenth century led to a remarkable growth in maritime shipping. With these new developments, maritime shipping became the predominant mode of global transportation and remained unchallenged until a few decades back.

The end of World War II and the collapse of the old colonial empires marked the beginning of a new course of development in Asia. The new leaders of the Asian countries shared an urge to get their countries more closely connected. They shared the goal of better connectivity in the region and revived the interest in establishing an Asian land transport system.3 It was clear that land routes within Asia could be faster and more economical for many products and destinations. Following this, the idea of developing regional road and rail networks in Asia was initiated in the 1950s by the United Nations (UN) Economic Commission for Asia and the Far East (ECFAFE), the forerunner of the present UN Economic and Social Commission for Asia and the Pacific (ESCAP).4
For various historical, political and topographical reasons, the land transport networks of many Asian countries are orientated towards coastal areas. As a result, inter-country land transport linkages were not well developed. In other cases, the emergence of new countries, for example in the Indian subcontinent and Central Asia, created physical and non-physical barriers to traffic flows at borders that formerly did not exist. The initiative of ECAFE also provided an opportunity to re-establish some of these former transport links and connect those links to the networks in other countries. It was also realized that the development of regional land transport networks could offer a better alternative to maritime shipping in many cases especially for trading with neighbouring countries.

The growth of external trade and its changing pattern in the region is expected to be a major driving force in shaping future transport development in Asia. The share of intraregional exports increased during the past decade from 46% of total Asia-Pacific exports in 2002 to 54% in 2014, while the share of intraregional imports remained quite stable at above 50% during that period (UN ESCAP, 2015a). Countries in the region are now trading more within the region. With the changing pattern of intraregional trade, it is expected that the demand for regional land transport would also increase in the future. It is also important to note that empirical studies and actual experience suggest that the supply of more efficient land transport linkages has the potential to significantly increase cross-border trade and transport demand (Edmonds and Fujimura, 2006).

Further, much of the economic development in countries of the Asia-Pacific region has been in coastal areas due partially to underdeveloped land transport infrastructure in deeper inland areas. The development of transnational networks through inland areas offers huge potential to generate economic development in such areas which have not benefited much from the current spate of development.

This article traces the history of development of the inter-country road and rail networks initiated by ECAFE, which are now known as the Asian Highway (AH) and Trans-Asian Railway (TAR) networks. The AH and TAR networks are important regional transport cooperation initiatives aimed at enhancing the development and efficiency of road and rail infrastructure in Asia. The AH and TAR networks also support the development of Euro-Asia transport linkages as well as improving connectivity for land-locked countries in Asia. The article provides an account of the process of development and criteria for inclusion of road and rail links in the AH and TAR networks, progress of development in different phases, formalization of the networks through intergovernmental agreements, current state of development, challenges and potential for further development, potential benefits of regional transport infrastructure development and finally presents some conclusions.

3.2 The initial phase of development of the AH and TAR networks (until early 1970s)

3.2.1 Asian Highway

The development of the AH was initiated by ECAFE at its fifteenth session, held in 1959 in Australia. The Commission endorsed the recommendation of the Highway Subcommittee to develop international highways within the ECAFE region. There was a general awareness on the part of the governments of the need to develop such links in order to foster the economic, social and cultural development of the region. In the case of landlocked countries, highway communications were considered an important means of linking those areas with the neighbouring countries and thus providing outlets for trade and commerce.

Following the Commission’s endorsement, three working groups on international highways were convened. The main purpose of convening working groups was to propose routes to be
included in the network, which would provide direct links between the capitals, important ports, production and consumption centres, and tourism sites, as well as necessary connections with landlocked countries and the European highway system. The international highway network in the region was referred to as the AH for the first time at the Commission session in 1960. Subsequently, two resolutions on AHs were adopted by the Commission in 1961 and 1962. These resolutions, among other matters, requested the relevant entities and the cooperating countries to extend assistance for carrying out pre-investment surveys, and for the planning and execution of projects that would help to complete the AH network.

As a result, pre-investment studies were undertaken in AH member countries with funding support provided by the UN’s Special Fund and some donor countries. To make further progress in network planning and setting of technical standards, a Ministerial-level Asian Highway Coordination Committee and a technical bureau were also set up in 1965 and 1968, respectively. Subsequently, activities were undertaken at various levels to develop consensus between neighbouring countries on an agreed highway network structure, which gradually started to give a shape to the network.

Route maps were prepared in the 1960s and six maps were published in 1972 showing road links between the member countries of that time. The initially conceived network length increased from a mere 11,000 km in 1959 to about 64,000 km in 1971.

### 3.2.2 Trans-Asian Railway

Initially an idea for the development of an Asian Railway association was proposed in 1950. The ECAFE Secretariat prepared a working paper on the need for an Asian and Far Eastern Railway Association and the possibility of cooperation between such an organization and other international railway organizations. Recognizing its importance, this working paper was mentioned in the annual report of ECAFE of that year.

The 1960 annual report of ECAFE mentioned that the railways of the region should study the problems of linking the railway networks of neighbouring countries in order to provide international connections not only between the countries of the region but also with the Middle Eastern and European systems. Following this, activities were initiated with the objective of providing a railway link between Singapore and Istanbul.

The trans-national railway network in the region was referred to as the TAR for the first time in the 1967 annual report of ECAFE. The Inland Transport and Communications Committee recommended that a large railway network be created with the cooperation of all railway administrations in the region. The objective was to eventually link countries of the region with those served by the European and African systems by a TAR.

On the basis of the above recommendation, ECAFE subsequently made efforts to give reality to the project for providing a continuous rail link from Singapore to Turkey via an alignment through Malaysia, Thailand, Myanmar, Bangladesh, India, Pakistan and the Islamic Republic of Iran over a distance of 14,000 km. Later on, Indonesia was added to the proposal considering the shipping connections between the islands of Java and Sumatra to the Malayan Railway at Singapore and Penang.

### 3.2.3 Loss of momentum of the progress of development

The momentum of the progress of development of both the AH and TAR networks was greatly lost after their initial phases of development. The implementation of the networks did not progress much in the 1970s and 1980s as political conditions were not favourable to the
development of land transport linkages in the region at that time. Further work was affected due to prevailing domestic, regional and global political tensions and some major regional wars and conflicts which caused mistrust especially between neighbouring countries. The absence of political environment for regional cooperation due to such adverse conditions and closed door policies in some major countries impacted the whole region in one way or another.

However, the overall political situation for the development of cross-border land transport linkages became favourable again from the late 1980s, especially after the dissolution of the Soviet Union in 1991, which marked an end to the Cold War. The dissolution of the Soviet Union also led to the emergence of land-locked independent countries in Central Asia; new borders severed the transport networks and affected their operations in Central Asia. Nevertheless, the severance of transport networks also led to an even stronger urge to establish cross-border land transport linkages throughout the region.

3.3 The Asian Land Transport Infrastructure Development (ALTID) project: a watershed in the history of development of the AH and TAR networks

With the gradual improvement of the political situation in the 1980s and afterwards and more favourable economic conditions, ESCAP took the initiative to reactivate the work on AH and TAR. A renewed initiative under the Asian Land Transport Infrastructure Development (ALTID) project was launched. The ALTID project provided a region-wide framework for the development of an integrated transport network. The project focused not only on the physical integration of national transport networks through the development of the AH and the TAR, but also on the importance of accession to various international facilitation conventions to assure efficient movements of goods and people across national boundaries in the region.

The launch of the ALTID project was a watershed in the history of development for both the AH and TAR networks. The project gathered a real impetus in the intergovernmental processes for the development of the networks. The basic strategy of the ALTID project was to establish specific criteria for inclusion of certain road and rail links in the networks. An identical set of criteria was adopted for consideration of road and rail links in the AH and TAR networks (see Box 3.1). These criteria were selected with emphasis to minimize the number of such routes, and to maximize the use of existing transport infrastructure.

Over a period of the next ten years between 1992 and 2002, the ESCAP secretariat completed a series of studies under different phases for the development and formalization of the AH network covering all sub-regions. It is important to mention here that the initial AH network did not cover all the 32 Asian countries. Subsequent studies undertaken under the ALTID project facilitated the inclusion of all countries.

Box 3.1 Criteria for including specific links into AH and TAR networks

- Capital-to-capital links.
- Connections to main industrial and agricultural centres.
- Connections to major sea and river ports.
- Connections to major container terminals and depots.
In the case of the TAR network, four studies were undertaken between 1996 and 2001 for the formalization of the network. These network development studies followed similar methodologies and criteria in identifying the potential links and finally their inclusion in the proposed TAR network. These criteria included: 1) identification of potential links that satisfy the ALTID criterion as mentioned in Box 3.1; 2) conformity of the identified links with a set of technical requirements such as loading gauge, axle load and speed; and 3) compatibility of railway operation practices on both sides of national borders. Two other important factors were also taken into account in identifying the linkages: the existence of break-of-gauge points with an assessment of possible solutions to overcome this barrier, and the existence of any “missing links” which would make movements impossible along the link.

The network development studies together with a series of meetings of the member countries at the subregional level helped to build consensus on agreed AH and TAR routes. The network development process helped to put the networks in place literally, link by link based on consensus especially between neighbouring countries. It required diplomacy, technical knowhow and the goodwill that ESCAP had generated with member governments over a long period of time.

The most important significance of the ALTID project was its endorsement by the ESCAP member countries. This endorsement signified their acceptance in principle of the shared goal of greater transport connectivity in the region. It is therefore not surprising that later on subregional groups such the Association of Southeast Asian Nations (ASEAN), Economic Cooperation Organization (ECO), and South Asian Association for Regional Cooperation (SAARC) had taken initiatives to consider greater land transport connectivity at the subregional level by taking advantage of the possibilities opened up by the AH and TAR networks. Consequently, more dense subregional road and rail networks have emerged through consolidation and building upon the AH and TAR routes in ASEAN and ECO subregions.

3.4 Formalization of the AH and TAR networks

3.4.1 Asian Highway network

The formalization of the AH network was initiated in 2002 following a mandate by the Ministerial Conference on Infrastructure in 2001. The ESCAP secretariat undertook a project on development of a regional intergovernmental agreement on the AH network. The main purpose of the project was to develop an agreed text for the agreement. In order to negotiate a consensual text for the agreement, a series of expert group meetings were organized at the subregional level, which ultimately led to the development of an agreed text.

Finally, the Intergovernmental Agreement on the Asian Highway Network was adopted by an intergovernmental meeting in November 2003, and was opened for signature during the ESCAP Commission session, held in Shanghai, China, on 26 April 2004. On that occasion, 26 member States signed the Agreement, which came into force on 4 July 2005. As of December 2015, 30 member States are signatories to the Agreement, of which 29 are parties to the Agreement (Table 3.1). The ESCAP Secretariat provides the updated AH network.

The current AH network extends from Tokyo in the east to Kapikule, Turkey in the west and from Torpynovka, Russian Federation, in the north, to Denpasar, Indonesia in the south. The network has a route numbering system. The one-digit routes are the highway routes that cross several countries in more than one subregion; two-digit route numbers are assigned to indicate the routes within subregions, including those connecting to a neighbouring subregion. A provision of three-digit numbering is also there for routes that would link the main one- or two-digit
numbered AH routes. Each subregion has been assigned a set of two- and three-digit numbers for the routes within the subregion. The detail alignment of the AH routes are specified in the Asian Highway Agreement.

3.4.2 Trans-Asian Railway network

The TAR network consists of four major corridors with each corridor presenting different characteristics in their configuration and operational characteristics. The Northern Corridor links

### Table 3.1 Salient features of the Asian Highway network

<table>
<thead>
<tr>
<th>Item</th>
<th>Data (as of December 2013)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of countries linked by Asian Highway:</td>
<td>32</td>
</tr>
<tr>
<td>Number of countries party to the Asian Highway Agreement:</td>
<td>29</td>
</tr>
<tr>
<td>Total length (km):</td>
<td>142,804</td>
</tr>
<tr>
<td>Number of routes:</td>
<td>47</td>
</tr>
<tr>
<td>Type of roads and length (km):</td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>20,915</td>
</tr>
<tr>
<td>Class I</td>
<td>22,213</td>
</tr>
<tr>
<td>Class II</td>
<td>53,924</td>
</tr>
<tr>
<td>Class III</td>
<td>33,837</td>
</tr>
<tr>
<td>Below Class III and others:</td>
<td>11,915</td>
</tr>
</tbody>
</table>

Notes: The AH classification and design standards included in the Agreement provide the minimum standards and guidelines for the construction, improvement and maintenance of AH routes. In those guidelines, routes are grouped into four classes: primary; class I; class II; and class III, which is specified as the minimum desirable standard. Primary refers to access-controlled asphalt or cement concrete dual carriageway highways with four or more lanes. Class I refers to asphalt or cement concrete dual carriageway highways with four or more lanes; class II refers to asphalt or cement concrete highways with two lanes; Class III refers to double bituminous surface treatment (DBST) highways with two lanes. Access-controlled means access to or exit from the highway is provided via ramps at grade-separated interchanges only. Countries have an obligation to make effort to conform to the minimum standards, both in constructing new routes and in upgrading and modernizing the existing ones.

### Box 3.2 Some major benefits of the Asian Highway Agreement

The work on the AH has produced many positive effects on highway development in Asian countries. The AH has been included in the national plan of many countries. The AH network has been used as a reference for the development of subregional highway development cooperation programmes. Some of the major effects can be summarized as below:

- provided basis for coordinated development of road networks at regional level;
- generated interest in greater connectivity which subsequently led to the development of subregional networks;
- developed common design and technical standards for highway development;
- enhanced connectivity that has been supporting the growth of inter-country trade;
- greater interest of development banks in financing regional road projects.

*Source: www.unescap.org/our-work/transport/asian-highway/about (accessed 27 July 2017).*
the rail networks of China, Kazakhstan, Mongolia, the Korean Peninsula and the Russian
Federation; the Indo-China Corridor links Cambodia, China, Indonesia, Lao People’s Democratic
Republic, Malaysia, Singapore, Thailand and Viet Nam; the Southern Corridor links Bangladesh,
China, India, Iran, Myanmar, Pakistan, Sri Lanka, Thailand and Turkey; and the North–South
Corridor links Northern Europe to the Persian Gulf. With the exception of a missing link in the
Korean peninsula, the Northern Corridor characterizes a high level of operational readiness.

After the definition of the network was completed, ESCAP took steps to test its oper-
ationalization and subsequently formalization. The Northern Corridor was selected as a test case
considering its operational readiness. Eight countries and two international organizations par-
ticipated directly in demonstration-runs of container block trains along the routes in the corridor.
Finally, between November 2003 and June 2004, container block trains were run along four
selected segments. These segments included Tianjin in China to Ulaanbaatar in Mongolia;
Lianyungang in China to Almaty in Kazakhstan; Brest in Belarus to Ulaanbaatar in Mongolia; and
Nakhodka in Russian Federation to Malacewicze in Poland. All runs along the four segments
were implemented successfully.

In 2004, the ESCAP Commission agreed to formalize the TAR network through an inter-
governmental agreement. A draft agreement was prepared, which provided a basis for further
negotiation between the countries involved. The draft agreement was subsequently reviewed and
further refined at subregional level throughout 2005. An Intergovernmental Meeting held in
Bangkok in November 2005 finalized the Agreement, which was adopted by the Commission at
its session in Jakarta on 12 April 2006.14 The Agreement was opened for signing of the countries
at the Ministerial Conference on Transport held in Busan, in November 2006, and it came into
force on 11 June 2009. The ESCAP Secretariat provides the updated TAR network.15

3.4.3 Mechanisms for managing the AH and TAR Agreements

The AH and TAR are not static networks. In line with the provisions of the Agreements, two
separate Working Groups (WGs) were established, one for each network. The WGs comprise of
government officials nominated by the networks’ respective member countries. WGs at their
meetings discuss issues related to implementation of their respective Agreement including the
current status, further development and proposals for inclusion of new routes, change of alignment
of existing routes and amendments to the Agreement, if any. The WGs meet on a biennial basis.

3.5 Current status of development of the AH and TAR networks

3.5.1 Asian Highway

The AH network does not have any missing links except a few bridges along some routes. The
classification and design standards included in the Asian Highway Agreement provide the
minimum standards and guidelines for the construction, improvement and maintenance of AH
routes. The quality of the highways along the network is however uneven; it varies significantly
between countries as well as within countries. Nevertheless, over the years countries have taken
considerable measures to conform to the minimum standards, both in constructing new routes
and in upgrading and modernizing the existing ones. Consequently, the quality of the network
has significantly been upgraded over the years.

The Asian Highway Database,16 which contains, among other things, information on com-
pliance with minimum standards is updated using data received from member States. According
to the information currently available in the database, about 11,000 km (8% of the total) of the
roads in the network did not meet the minimum desirable standards in 2014. As of the end of 2014, Primary and Class I standard AH routes covered about 31% and Class II and III standard routes covered about 60% of the AH network. Between 2010 and 2014 about 5,835 km, or 4.5% of the network, were upgraded to a higher class of standards. Such upgrading of routes to a higher class of standards was also undertaken during previous periods.

3.5.2 Trans-Asian Railway

As at the end of 2015, the TAR network comprises 117,500 km of railway routes of international importance serving 28 Asian member countries, 18 of which are party to the intergovernmental agreement on TAR. Unlike the AH network, there are many missing links along the TAR routes. A ‘missing link’ is the absence of continuity between the railway networks of neighbouring countries or an absence of continuity of railway links within the same country. Missing links between neighbouring countries exist either because the links were never constructed, or they ceased to exist due to political conflicts or long disuse. As of 2015, there is an estimated 10,000 km of missing links in the TAR network, most of which are in South-East Asia and Mongolia.

The break of gauge is another issue in the development of the network. A break of gauge exists when railway lines with two different gauges meet at a point. Discontinuities of track gauges exist between some neighbouring countries in the TAR routes such as China and Kazakhstan, and the Islamic Republic of Iran and Pakistan. Such discontinuities also exist within some national railways systems such as in Bangladesh and India. There are different measures to overcome railway network discontinuity due to difference in track gauges. However, whatever solution is considered, a break of gauge causes interruptions in seamless railway operations and involves additional costs in railway operation.

A number of initiatives are underway to develop, upgrade and construct some of the missing links along the TAR network, some of which have already been completed. Since completion of the Kerman–Zahedan section in 2008, there is now continuous rail infrastructure through the Islamic Republic of Iran, Pakistan, India and Bangladesh. In 2009, a short section was completed between Thailand and Lao PDR, which marked the beginning of railway operation in Lao PDR. Currently, work is ongoing to construct the following important links along the TAR routes:

- Qazvin-Rasht-Astara section along the western coast of the Caspian Sea; this route will provide continuous rail infrastructure from Western Europe to Bangladesh.
- Islamic Republic of Iran is constructing a cross-border rail link to Afghanistan.
- Work has started on a 98-km Kars-Akhalkalaki section between Turkey and Georgia which would provide direct rail access to Turkish ports on the Mediterranean Sea.
- A tripartite arrangement has been made between India, Myanmar and Thailand to reconnect Myanmar by rail with India and Thailand.
- In China various projects are at different stages of planning or construction, to connect with Lao PDR, Myanmar and improving the existing lines to Viet Nam.

Notable success has also been achieved in the railways’ operational side. For example, long-distance cross-border railway traffic between many countries such as China and the Central Asian countries and Mongolia have increased. Chinese Railways introduced a five-days-a-week direct rail freight service in 2011 between the Port of Antwerp and Chongqing, the industrial hub in China’s southwest. Since 2011, Schenker Rail Automative has managed container trains from Leipzig and Wackersdorf in Germany to Shenyang in China.
Some progress has also been made in other subregions. In 2009, a container block-train was run along the 6,500 km long route between Islamabad and Istanbul via Tehran. Since April 2016, a monthly container train service has been introduced between China and the Islamic Republic of Iran along a 10,400 km route via Kazakhstan and Turkmenistan.

### 3.6 Linking the AH and TAR networks: the development of an integrated intermodal transport system in Asia

The AH and TAR networks deserve consideration for further development on their own merits. However, their functional integration through intermodal interfaces such as dry ports and inland container depots leading to the development of an integrated intermodal transport system in Asia provides further opportunity to bring greater efficiency in the overall transport process as well as making transport development more sustainable.

The use of intermodal linkages through dry ports and interfaces can increase the modal share of more resource-efficient transport modes, such as railways and inland waterways. This shift would help to reduce the demand for road transport, thereby reducing the need for expanding the capacity of exiting highways and/or limiting the need for building new ones. Greater utilization of railways and inland waterways would also help to reduce the cost of freight transport, increase efficiency in the overall supply and distribution chain, and reduce the carbon footprint of freight transport.

There are many good examples both within and outside the region of integrating different modes of transport through inland interfaces at suitable locations with provisions of related other services such as customs processing, bonded warehousing, distribution facilities and information and communication technology (ICT) services. In Asia, the Container Corporation of India Ltd. (CONCOR) may be mentioned as a good example. CONCOR maintains a network of 62 Inland Container Depots (ICDs) of which 48 are export-import oriented. Many of these ICDs have customs bonded warehouse facilities, are rail linked and serve as inland dry ports.

Recognizing the value of developing an Asian integrated intermodal transport system with AH and TAR networks as its two important building blocks, ESCAP took an initiative in 2010 to develop an intergovernmental agreement on dry ports. In the negotiation process, the institutional, regulatory, technical and operational issues of dry ports were discussed. Subsequently, a working draft of an Intergovernmental Agreement was reviewed and refined through a series of regional meetings. The finalized draft was approved in 2012 and adopted at the Commission’s 69th session in 2013. The Agreement was opened for signature in the same year at the Forum of Asian Transport Ministers in Bangkok, and came into force on 23 April 2016.

### 3.7 Impact of the AH and TAR networks on overland trade and economic development, environmental and socio-political effects: literature review

In recent years the AH and TAR networks have drawn interest among researchers. Many articles and research publications have appeared in the literature which examined the potential of the two networks including their impact on overland trade and economic development, environmental and socio-political effects in the region. This section summarizes the main findings of some of these research works.

Parpiev and Sodikov (2008) investigated the impact of road upgrading and improvement on overland trade in 18 out of 32 AH network countries. Their work suggests a huge potential of overland trade expansion by the AH network. A regression based cost model was used to estimate...
the cost of road upgrading. An estimated $6.5 billion was required to upgrade and improve surface condition of the selected 15,842 km of roads. The gravity model approach was used to quantitatively evaluate overland trade expansion. Two scenarios of road improvement were considered: improvement of road quality indices up to 50 and 75, respectively. The results suggested that in the first scenario total intra-regional trade would increase by about 20% or $48.7 billion annually, while the second scenario predicted an increase of trade by about 35% or $89.5 billion annually.

Another gravity model based study for the Greater Mekong Subregion by Edmonds and Fujimura (2006) suggested that the development of cross-border road infrastructure has had a positive effect on intraregional trade in major commodities with its elasticity in the range of 0.6–1.4.

Computable general equilibrium (CGE) studies have been used to identify potential gains from regional and subregional infrastructure investments in Asia. These studies have found that Asian countries would gain significantly if appropriate investments in regional infrastructure were made along with the adoption of supportive trade policies. A CGE study by Francois and Wignaraja (2008) examined the likely effects of linking East and South Asia through a comprehensive trade agreement and increased regional infrastructure investments on trade costs and welfare gains. Their study found that a comprehensive trade agreement and increased regional infrastructure investments would lead to lower trade costs and minimum global welfare gains of $261 billion by 2017.

In a more recent study by Zhai (2012), a global CGE simulation model was used to investigate the welfare impacts of regional infrastructure development in developing countries of Asia. The major conclusion that has been drawn by the study is that the developing Asian countries would gain significantly from the expansion of regional infrastructure in communications. The quantitative analysis suggests that investment in regional infrastructure holds great promise for Asia's long-term development. With the required annual investment, the estimated total welfare gains for developing countries in Asia were of the order of 10% of their projected gross domestic product (GDP) in 2020.

CGE studies have also been undertaken at the subregional level. Similar potential gains from increased subregional infrastructure investments have been found in such studies. A study by Stone and Strutt (2009) suggested that welfare gains of $8.1 billion could be attained from moderate improvements in physical land transport and trade facilitation in the Greater Mekong Subregion.

The Institute of Developing Economies (IDE) in Japan has also developed a CGE model to study such impacts. IDE conducted simulations for ESCAP on three routes which form part of the AH network and for which relevant data were available. These routes were:

- **AH1**: Mae Sot (Thailand) – Mandalay (Myanmar) – Dhaka (Bangladesh) – Delhi (India);
- **AH1 + AH2**: Chiang Rai/Mae Sai (Thailand) – Mandalay (Myanmar) – North-East India – Dhaka (Bangladesh) – Delhi (India) – Amritsar (India, near border of Pakistan); and
- **AH1 + AH14**: Kunming (China) – Muse (Myanmar) – Dhaka (Bangladesh) – Delhi (India).

The results of these simulation studies are positive. Although most regions (at the subnational level) remain unaffected by these projects, many will benefit. Some regions will lose but their average losses are rather small – about 0.3 to 0.4%. The potential gains of the positively affected regions are significantly larger, about 2.2 to 2.8%. Three scenarios were considered for the simulation studies: improvement of infrastructure, implementation of customs facilitation, and through traffic through Bangladesh and Myanmar. Total gains were most for the third scenario. An important observation that can be made from the results is that the positively affected regions...
have a lower regional gross domestic product (RGDP) per capita than the negatively affected regions. This implies that these regional projects may also have positive distributional impacts. Further details on the results can be found in UN ESCAP (2012).

The CGE models may not fully capture the externalities from infrastructure investment and comprehensive trade agreements in a dynamic context. Madhur, Wignaraja and Darjes (2009) held the view that the CGE model estimates could be interpreted as the minimum gains from regional and subregional infrastructure and policy programmes. The actual gains could be substantially larger than the results.

The AH and TAR networks have paved the way for the development of intermodal transport systems, which hold the promise to make the overall transport system economically and environmentally more efficient through the use of intermodal interfaces such as ICDs and dry ports. Such interfaces can increase the modal share of more resource-efficient transport modes and help to ease road traffic congestion and reduce emissions. Hanaoka and Regmi (2011) in their article, among other things, reviewed selected case studies of dry port development in Asia. As a case in point, the Birgunj rail-based ICD in Nepal handled 16,928 twenty-foot equivalent unit (TEU) of containers and 237,104 metric ton (MT) of cargo in 2008/09. AH42 in Nepal and the TAR rail link from Haldia port in India (Haldia-Kolkata-Sitarampur-Patna-Raxaul-Birgunj) serve the Birgunj ICD. In the absence of such an intermodal facility, all the freight would have had to be transported by road. The estimated savings in CO2 emissions for 2008/09 were 57,687 MT, which accounted for 82% of the total road emissions.

Often cross-border transport infrastructure has unintended adverse social impacts on local people. Slesak et al. (2012) studied the vulnerability of ethnic minorities to sexually transmitted diseases (STDs) and AIDS along a new AH route in northern Lao People’s Democratic Republic. The new route was constructed between 2004 and 2008 through remote multi-ethnic areas of the country linking a low HIV prevalence area with higher prevalence areas in bordering Thailand and China. The study assessed the HIV vulnerability in four minority villages alongside the new road using structured interviews and voluntary counselling and testing (VCT) for HIV. Of the 470 villagers aged 15–49 years old, 47.0% did not know any ways of HIV transmission. However, 82.1% of them reported sexual contacts. In the case of the last non-cohabitant sex, the majority (86/139 or 61.9%) did not use a condom. No HIV infection was detected among villagers who received VCT in 2006 (924 of 933) and 2008 (538 of 1,249). The findings of the study reveal an alarming HIV vulnerability among the ethnic minorities along the highway. Further culturally adapted prevention efforts were suggested by the researchers.

The perceptions of local people about cross-border transport infrastructure may not be always positive. Lin and Grundy-Warr (2012) in their study sought to find the locals’ thoughts and feelings about the proposed bridge between Chiang Khong in Thailand and Houayxay in Lao People’s Democratic Republic. The bridge would form the crucial link along AH3 connecting Bangkok to Kunming in China. The project was expected to make a significant contribution to the development of the Greater Mekong Subregion. The perception of the locals about the bridge was used to understand the anticipatory cross-border geopolitical relations. The researchers concluded by emphasizing the need to listen to local perceptions. Potential ill-feeling among the locals could risk future cross-border geopolitical ties and trade.

Neupane and Calkins (2012) in their study examined the status of poverty and income inequality in Southern Thailand along the AH network (AH18) in Songkhla province. They adopted descriptive statistics and one-way analysis of variance (ANOVA) method including poverty and income inequality indices to analyse the household survey data collected in the period of July–November 2010. Findings from their study show that the average household income significantly varied by spatial location as well as between urban and rural areas.
An important observation from their study was that the incidence of poverty was much lower along the AH route with the head count ratio of 1.17%.

3.8 Unlocking the development potentials created by AH and TAR networks: transforming transport corridors into economic corridors

It is generally recognized that there is a linkage between transport and economic development. These linkages, however, are not always clear and well understood. While transport is necessary, it is not always sufficient for generating economic development – other intervention measures are often necessary to realize the benefits of improved transport. In view of this fact, many countries and international donors are taking a new approach to development – a coordinated multi-sectoral approach to economic development capitalizing on transport development along a geographic corridor.

In short, a high quality transport (and logistics) corridor is developed with intermodal interfaces facilitating the development of an intermodal transport system. By transport corridor here it is meant a combination of adjacent surface transport networks linking the same major origins and destinations within a defined geographic area. A transport corridor can be transformed into an economic corridor by providing quality urban, industrial and ICT infrastructure, logistics and distribution networks that link production centres, urban clusters and international gateways within that geographic area. Such corridors allow spatial organization of economic activities; they bring together infrastructure facilities, policies and institutions, and investments to generate economic growth (ADB, 2014; Brunner, 2013; and FIAS 2008).

There are national and transnational transport/economic corridors in many parts of the world. For example, in Asia such corridors exist in Japan (between Tokyo and Osaka) and in the Republic of Korea (between Seoul and Busan). India is developing such corridors between Delhi and Mumbai and some other major cities. See Box 3.3 for more on the Delhi-Mumbai Industrial Corridor (DMIC). The corridors in Japan, Korea and the on-going DMIC project in India are domestic economic corridors. The China-Pakistan Economic Corridor (CPEC) is a recent major transnational development initiative along AH4 that will connect Gwadar Port in southern Pakistan to the north-western autonomous region of Xinjiang in China (UN ESCAP, 2015b). There are many good examples of transnational transport/economic corridors in the Americas, Europe and Africa.24

Many AH and TAR routes and other adjacent highway and railway routes, especially along deep inland areas, have the potential to be developed as national and/or cross-border transport corridors.25 Such corridors can support economic growth in inland areas by removing infrastructure bottlenecks and improving access to wider markets. Later on, economic corridors can also be considered along cross-border transport corridors similar to domestic economic corridors. These corridors can lead to a more balanced spatial development and relieve pressure on the major coastal cities in Asia. Obviously, for this to happen other infrastructure facilities, policy interventions and institutions will also have to be in place.

3.9 Some major issues in further development of the AH and TAR networks and their integration through interfaces

The overall progress in developing the AH and TAR networks since their early phases is encouraging. However both the networks require further development. In the case of the AH, about 11,000 km (or 8%) of the network does not meet the minimum class III standards. The development of some of these routes, for example in Myanmar, is critical to ensure intra-subregional
and intraregional road transport connectivity. With the growing transport demand, many sections of the AH network also need to be upgraded. Road infrastructure safety facilities along the network also need to be improved.

There are an estimated 10,500 km of missing links in the TAR network. Construction costs of these missing links alone are estimated to be over US$ 25 billion. Further investments will also be required for upgrading existing routes and constructing border-crossing facilities. Intermodal facilities will also have to be developed and the existing ones upgraded along the AH and TAR networks.

Huge capital investments will be required to meet the above-mentioned development needs. For most developing countries, regular allocations from their national budgets are not sufficient to meet the financing needs for the development of AH and TAR networks. Some countries have been successful in making alternative financing arrangements to meet the investment needs.26 Most other countries have remained dependent on external financing – either bi-lateral arrangements or loans from the development banks. Available resources from such sources are not sufficient, however. It is expected that additional financing available from the newly created Asian Infrastructure Investment Bank (AIIB) may improve the situation in the future. Nonetheless, countries will also have to explore alternative and innovative ways to finance transport development projects.

An immediate goal of developing the AH and TAR networks (or for that matter any transport network) is to facilitate greater connectivity27 between countries. However, the physical network (or the hardware) alone cannot ensure connectivity. Identification of networks and their formalization by countries may be considered as a first step towards establishing a regional land

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**Box 3.3 Delhi–Mumbai Industrial Corridor (DMIC)**

India has planned to develop six dedicated rail freight corridors (DFCs) linking the major metropolitan cities and industrial and consumption centres in the country. The DFCs are being developed to meet the rapidly growing transport demand in the country. One of these six DFCs is the 1,500 km long Delhi–Mumbai Western DFC linking ports in Maharashtra and Gujarat to their northern hinterlands.

An industrial corridor development project is also under implementation to transform the Western DFC into an economic corridor. The Delhi–Mumbai Industrial Corridor (DMIC) project along the Western DFC corridor is a US$ 100 billion project involving some eight investment regions and some 13 industrial areas. The project also involves expansion of existing port and airport capacities and development of railway links to ports, investment zones and smart cities, and putting in place new energy and ICT infrastructure. Funds for the projects are to come from both public and private sources. The individual components of the DMIC project are at various stages of their planning and implementation. The project is expected to create three million new jobs, 67% of which would be in manufacturing. A separate organization called Delhi–Mumbai Industrial Corridor Development Corporation (DMICDC) has been established to develop and manage the project.

*Source:* Based on information available at: www.dmicdc.com/ (accessed 27 July 2017); and other sources.
transport system. The two other main elements are facilitation (or the software) and operationalization of the network.

In broad terms, transport facilitation relates to operational connectivity which involves institutions and putting in place the legal and regulatory measures and other necessary rules and procedures to permit (transport) transactions or traffic flows across the national borders. The operationalization of the network relates to measures that allow parties (meaning businesses, functional networks and individual people) to function in order to make the actual transactions or traffic to flow through the borders.

So far the progress on transport facilitation at the regional level is limited. However, progress has been made at the subregional level. In recent years, a number of subregional agreements have been signed in the region.28 Worth mentioning among them are: GMS Cross Border Transport Agreement (CBTA), Shanghai Cooperation Organization (SCO) Agreement on Facilitation of International Road Transport, ECO Transit Transport Framework Agreement, ASEAN Framework Agreement on the Facilitation of Goods in Transit, and Motor Vehicle Agreement between four countries in South Asia. Under the Agreement on Facilitation of International Road Transport signed in 2012 between SCO member countries,29 about 15,000 km of road routes are to be initially opened including a road between Lianyungang, China and St. Petersburg, Russian Federation. Two more ports in China and the Russian Federation will also be accessible for transit traffic to and from Central Asia.

While the work on AH and TAR network development is far from over, greater efforts are needed to be made on facilitation and operationalization aspects. In this regard, ESCAP has developed a Regional Strategic Framework for Facilitation of International Road Transport which has been adopted by the member States. ESCAP is also considering the development of a similar regional strategic framework for facilitation on international rail transport along with other related works. These works need to be expedited.

Once the facilitation arrangements are in place, countries may also need to consider the establishment of transnational governance structures or mechanisms at the operational level for managing the day-to-day operational issues along transport corridors.

3.10 Conclusions

The AH and TAR networks are important regional transport cooperation initiatives aimed at enhancing the development and efficiency of the road and rail infrastructure in Asia and supporting the development of Euro-Asia transport linkages as well as improving connectivity for land-locked countries. An important outcome of these initiatives is that they have encouraged the Asian countries to improve connectivity as an important element in support of regional economic cooperation and integration which is vital for the continued overall development and prosperity of more than three billion people living in the region. Connectivity has become a major priority for the Asian countries, especially in the context of efforts to find new drivers of regional economic growth.

There are many issues related to further development and full operationalization of the AH and TAR networks that need to be resolved. Some of these are technical and regulatory, some are also political in nature. Their resolution requires greater political willingness and deeper and accommodating understanding between countries, and further negotiation on these matters. Investment needs are also huge. It is hoped that the development banks will be able to make a greater contribution in the future. Nonetheless, countries will also have to find other alternative and innovative ways to meet the financing needs.

The identification and formalization of transport networks with the consent of governments are hard tasks. The facilitation measures have even deeper legal, administrative, financial and
other social and environmental cross-border implications. As such, securing intergovernmental agreements on transport facilitation may expected to be no less difficult and would require a considerable amount of effort at different levels. However, with collective political will, commitment, wisdom and understanding to support better regional connectivity, no barriers should be too difficult to overcome.

The success of transport development is not in itself – but how it can help the economy grow and contribute to people’s welfare. Given this, it is important to reconsider how major transport development projects are planned, linked to developments in other sectors, and implemented. The coordinated multi-sectoral development approach with transport as a major component seems to be a better alternative than the current sectoral (or sub-sectoral) approach, and should be supported at all levels – national, subregional and regional.

Disclaimer

The views expressed and analyses presented in the article are those of the author and do not necessarily reflect the views of the UN ESCAP secretariat or of the member States of UN ESCAP.

Notes

1 The author is a former staff member of the UN ESCAP secretariat in Bangkok, Thailand. He gratefully acknowledges cooperation and information received from his former colleagues, especially Mr. Madan B Regmi and Mr. Pierre Chartier, both of whom, among others, were directly involved in the development and formalization processes of the Asian Highway and Trans-Asian Railway networks.
2 Interested readers are referred to Chanda (2007) to know how the Silk Road played a role in these respects. The Silk Road may be considered as one of the earliest vehicles for globalization.
3 It may be of interest to note here that many of the Asian historical capitals were located inland: Delhi, Kyoto, Mandalay and Peking, for example. Maritime transport development took place after the Europeans came (UN ESCAP, 2007).
4 The Economic Commission for Asia and the Far East (ECAFE) was renamed as the Economic and Social Commission for Asia and the Pacific (ESCAP) in 1974 in order to better reflect its Pacific constituencies. ESCAP, one of the five regional commissions of the United Nations, is the development arm for Asia and the Pacific region. ESCAP has 53 members and nine associate members; of which 32 member countries are from Asia, the rest are from the Pacific and other geographic regions. Details of membership can be found at: www.unescap.org/about/member-states (accessed 27 July 2017).
5 India launched an integrated check point (ICP) operation in 2012 at Attari on the India–Pakistan border to facilitate trading. During the first year, imports grew by 81%, and exports grew by 122% in value terms. Trucks carrying exports increased from 3,882 to 41,248, and trucks carrying import cargo increased from 19,087 to 33,599; customs revenue increased 166%. See UN ESCAP (2014b).
6 There are 12 land-locked countries in the ESCAP region. They are: Afghanistan, Armenia, Azerbaijan, Bhutan, Lao People’s Democratic Republic, Kazakhstan, Kyrgyzstan, Mongolia, Nepal, Tajikistan, Turkmenistan and Uzbekistan.
8 Some of these political events include alignment of most countries in the region with two superpowers and political division and tension especially between neighbouring countries; major regional conflicts (wars in Indo–China and South Asia); internal political tensions in China and Indonesia; tension in the Korean peninsula; border tension between China and the Soviet Union; Islamic Revolution in Iran; and isolation of Myanmar (Burma) after military takeover.
9 Some of these studies include: 1) Study for the Development of the AH Network (1993–1994); 2) Study on the Development of a Highway Network in Central Asian Republics; 3) Upgrading of the AH Routes (1997–1999); 4) Study on Road Network Connecting China, Kazakhstan, Mongolia, the Russian Federation and Korean Peninsula (1998–2001); 5) Promotion, development and
formalization of AH, Phases I through IV; 6) Development of a regional intergovernmental agreement on the AH network (2002–2003); and 7) Identifying investment needs and development priorities for the AH network and related intermodal connections and freight terminals.

These four studies were: 1) Feasibility study on connecting the rail networks of China, Kazakhstan, Mongolia, the Russian Federation and Korean Peninsula (1996) – Northern Corridor; 2) Development of the Trans-Asian Railway in the Indo-China and ASEAN subregion; 3) Development of the Trans-Asian Railway, Trans-Asian Railway in the Southern Corridor of Asia–Europe Routes (1999); and 4) Development of the Trans-Asian Railway, Trans-Asian Railway in the North–South Corridor, Northern Europe to the Persian Gulf (2001).


The AH and TAR are not static networks. Since the AH Agreement was adopted in 2003, many new links were added to the existing routes by the countries following the specified process for such inclusions in the AH Agreement. Similar changes have also been made to the TAR network.


The database is maintained by the ESCAP secretariat and may be found at: www.unescap.org/resources/asian-highway-database (accessed 27 July 2017). Detailed information about the AH routes in each country are available in the database.

The rest of the countries are yet to ratify or accede to the Agreement. The details can be found at: https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XI-C-5&chapter=11&lang=en (accessed 27 July 2017).

The TAR network is composed of five different track gauges: 1,676 mm (broad gauge in the Indian subcontinent); 1,520 mm (Russian gauge in Russian Federation and Central Asia); 1,435 mm (standard gauge in China, Iran and Turkey); 1,067 mm (Indonesia); and 1,000 mm (metre gauge in South-east Asia and parts of Bangladesh and India).

Such measures include unification of track gauges, conversion to dual gauge, transshipment and other technical solutions involving bogies.


These included investments in all modes of transport – road, railway, port, airport and telecommunications.

Gains and losses are defined as differences in the simulated regional GDPs in 2030 between the baseline in 2005 and each specific project scenario. Three scenarios were considered: improvement of infrastructure, implementation of customs facilitation, and through traffic through Bangladesh and Myanmar.

The Asian Highway route AH3.

Mention can be made of the Ports-to-Plains Corridor involving Mexico, USA and Canada; the Pan-European Corridor VIII between Italy, Albania, Macedonia and Bulgaria (there are ten such corridors in Europe); and Southern African Development Community (SADC) corridors in Africa.

The Greater Mekong Subregion corridors in the Greater Mekong Subregion and Central Asia Regional Economic Cooperation (CAREC) corridors in Central Asia are some of the present transnational initiatives to develop transport corridors in Asia. These initiatives are being supported by international organizations, development banks and bilateral donors. There are however many other potential transport corridors along the AH and TAR networks. Some examples are: Liayungang (China) – Central Asia; Bandar Abbas – Almaty; Lahore – Delhi – Dhaka; and Kathmandu – Chittagong.

Such arrangements include tolls and user fees, public–private partnerships, debt financing, special funds, indirect beneficiary payments, etc.

The term connectivity refers to the degree to which exchange activities are facilitated, both within and across national boundaries, and includes physical and institutional infrastructure plus functional networks which are required to make exchange activities or transactions.

ESCAP estimates there are some 42 such agreements in the region, only some of these agreements are in force, however. Also, more than 100 bilateral agreements on road transport have been signed in the region. See UN ESCAP (2014a), pp. 42–46 for more on these facilitation agreements.

ESCAP provided assistance to the member countries for the SCO and CBTA facilitation Agreements.
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