REVIEW OF
DEVELOPMENTS IN TRANSPORT IN ASIA AND THE PACIFIC 2017

TRANSPORT FOR SUSTAINABLE DEVELOPMENT AND REGIONAL CONNECTIVITY

UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

FIRST EDITION

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Introduction

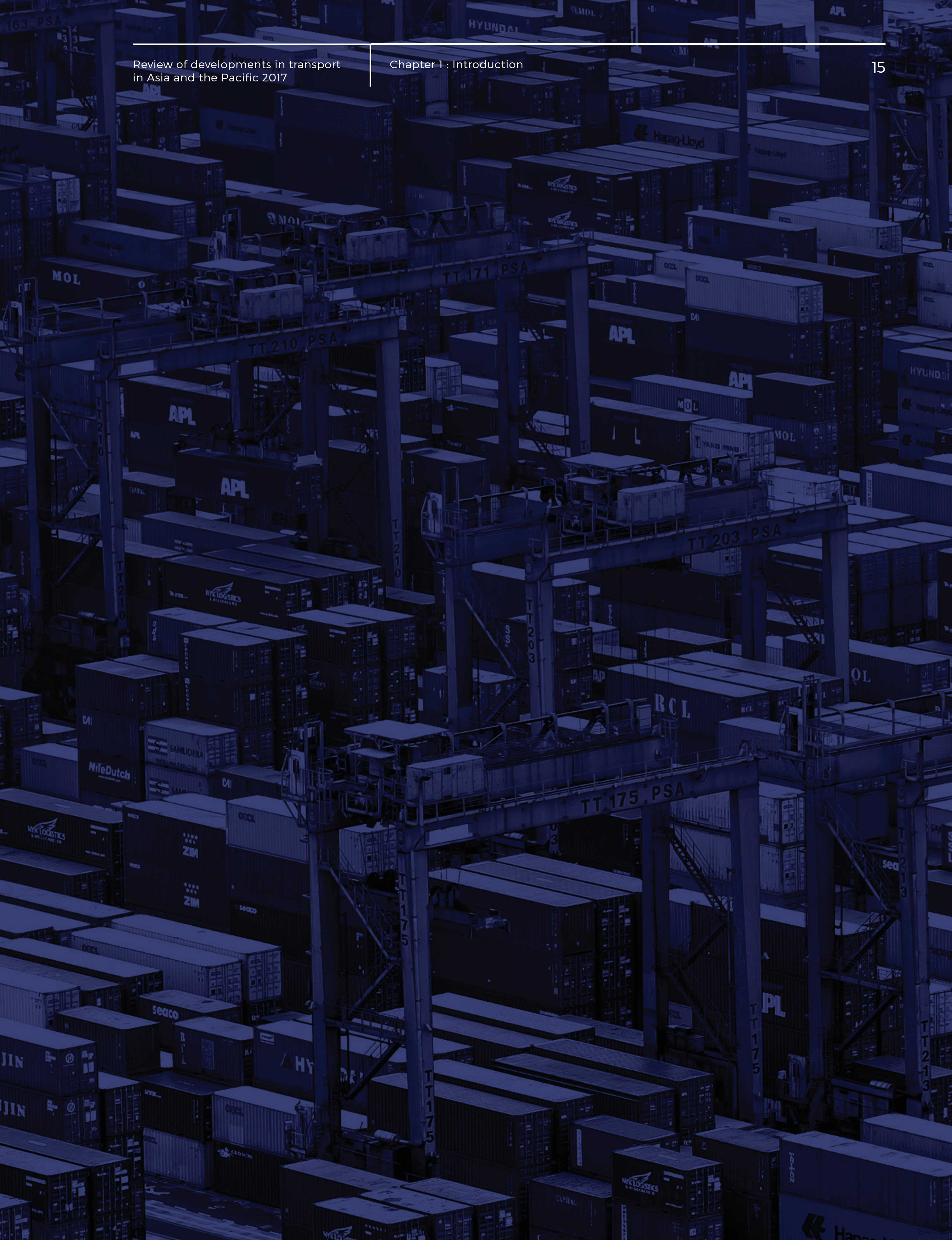
The integration of the economies in the Asian and Pacific region into the global market and supply chains continues to yield region's economic growth. Such growth is dependent on transport connectivity to allow more efficient and greater trade flow. While the efforts to enhance distribution networks by improving the availability and quality of infrastructure and its operational capacities are evidently necessary, the international community has launched a number of global programmes and initiatives which are influencing the scope and implementation of transport-related activities. Most notable among these initiatives was the adoption by the General Assembly in September 2015 of Resolution 70/1 entitled "Transforming Our World: The 2030 Agenda for Sustainable Development", which contains the Sustainable Development Goals (SDGs).

At this early stage in the realization of the 2030 Agenda, there appears to be a broad consensus that the provision of seamless and sustainable connectivity in support of market integration and economic dynamism may offer a way forward in aligning the pursuit of economic growth with a wider distribution of prosperity and greater environmental protection.

The implementation of the 2030 Agenda may pose a greater challenge to the transport sector than to any other industry. Indeed, while the transport sector has been a key driver of economic development and is a provider of employment opportunities, it remains a major consumer of fossil fuels and a leading contributor to greenhouse gas emissions. It also has impacts on social development.

Review 2017 first looks at the critical role of transport in economic development and its direct contribution to national and regional gross domestic product (GDP). At the same time, it focuses attention on the negative aspects of transport due to increasing energy consumption as well as the creation of greenhouse gases, CO_2 emissions and particulate matter. Chapter 1 also discusses the role of transport in improving accessibility to education, social services and jobs — all critical factors for society, particularly the poor — and its contribution to the SDGs.

The Review later looks at how the transport sector in the Asian and Pacific region has progressed in creating enabling conditions and environments for moving to more sustainable modes of transport as well as increased efficiency in transport operations, as they are a key to making the transport sector more sustainable. Current obstacles that are hindering the adoption of intermodal transport systems in the region from utilizing a modal shift, in order to realize optimal efficiency in operations, are mainly: (a) the lack of physical transport infrastructure connectivity among different modes of transport; (b) the high cost and time losses at modal interchange points; and (c) the differences in legal regimes for cross-border and transit transport. The further development of integrated intermodal transport systems will therefore be required to enable sustainable development to be achieved.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APL
MOL
RCL
NileDutch
seaco
ZIM

In terms of regional progress in physical transport infrastructure connectivity, the Asian Highway and Trans-Asia Railway, together with dry ports, are providing an increasingly important transport network across the region with onward connections to international destinations. The two formalized networks have been adopted as two coordinated plans for the development of highway routes and railway lines of international importance within Asia as well as between Asia and neighbouring regions in order to facilitate regional economic integration. The Asian Highway and Trans-Asian Railway currently comprise 143,000 km of highways in 32 countries and 118,000 km of railway lines in 27 countries. Countries and financing institutions in Asia and the Pacific region are making huge investments in related infrastructure to improve standards and upgrade capacity in a coordinated strategy for creating a growing web of prosperity. The region is home to the busiest ports of the world, catering to the ever-growing fleet of container ships carrying cargo to manufacturers in all regions. Demand for capacity to carry air passengers and freight is expanding faster than in any other region. Chapter 2 of the Review looks at how the region has developed air, sea and land transport networks to accommodate increasing volumes of international trade and air passengers.

In terms of progress in operational connectivity that optimize efficiency along transport corridors, regional countries are making real progress in addressing inefficiencies in the international movement of road transport. However, constraints to trading remain, including cumbersome procedures at borders and a lack of international traffic rights, which are still causing substantial delays. In particular, these negative impacts are felt by the least developed and landlocked countries of the region. Similarly, recent initiatives in the rail sector, detailed in this report, have demonstrated the sector's huge potential for carrying increased international trade; however, greater cooperation is required in overcoming operational and physical constraints. Ports are increasing efficiency through new technologies as well as the improvement of rail and road connectivity in order to reach out to wider hinterlands and markets. Chapter 3 discusses these issues in detail.

While international transport is playing a significant role in the global economy, in the next few years more than half of the population in the Asia-Pacific region will be urban residents, needing mobility to reach work, educational facilities, shops and social services. Intra-city transport also requires special attention. Although public mass transit systems have been constructed and expanded, they are failing to keep pace with demand. As a result, roads are being flooded by private cars and other motorized vehicles, causing heavy congestion and concentrated levels of pollution. Selected policies, projects and examples of sustainable urban transport systems are illustrated in chapter 4.

While the mainstreaming of environmental considerations into the transport agenda has made some progress, many Governments in the region are grappling with the challenge of ensuring that their transport programmes result in inclusive and safe transport. Another element that is critical to sustainable development is physical access to rural areas, which remains a regional problem. Rural transport can help create economic opportunities, generate employment and reduce poverty by connecting farmers to markets, and allowing produce to reach consumers. It can also help to address social education and health issues created by the lack of access. Yet many rural areas have still to be connected to economic and social networks. Chapter 5 describes the level of rural transport development and includes some noteworthy examples of rural transport policies and projects in the region.

Transport safety, and road safety in particular, has moved onto the international development agenda because of the growing epidemic of road accidents. Road traffic fatalities continue to burden the region with huge social and economic losses. Despite the many national infrastructural and regulatory interventions being undertaken, the region is unlikely to achieve SDG targets unless attitudes are changed. With the implementation of lower-cost behavioural interventions, such as wearing crash helmets and using seat belts together with enforcement of speed limits and drink-driving laws, substantial short-term progress could be achieved. Chapter 6 provides an overview and analysis of road safety in the region.

Across the transport sector, intelligent transport systems (ITS) are increasingly being deployed by countries in order to improve mobility, efficiency, safety and security. Experience to date shows that the adoption of ITS can play an important role in addressing negative impacts of transport, particularly through advanced traffic management systems that can improve traffic flows, advanced traveller information systems to help drivers make more informed decisions, and advanced public transport systems to enhance efficiency and reliability. Chapter 7 highlights some of the latest developments in ITS that can help urban areas evolve into smart cities and highlights opportunities for tracking international shipments and vehicles, improving security, safety, confidence and efficiency.

The Review 2017 concludes by providing a range of examples showing how countries and the region overall are shaping the transport sector of the future by addressing seven key thematic areas and strategic directions to reach the 2030 Agenda for Sustainable Development as well as targets that specifically reference transport.

A. Transport and the three pillars of sustainable development

1. Role of transport in economic development

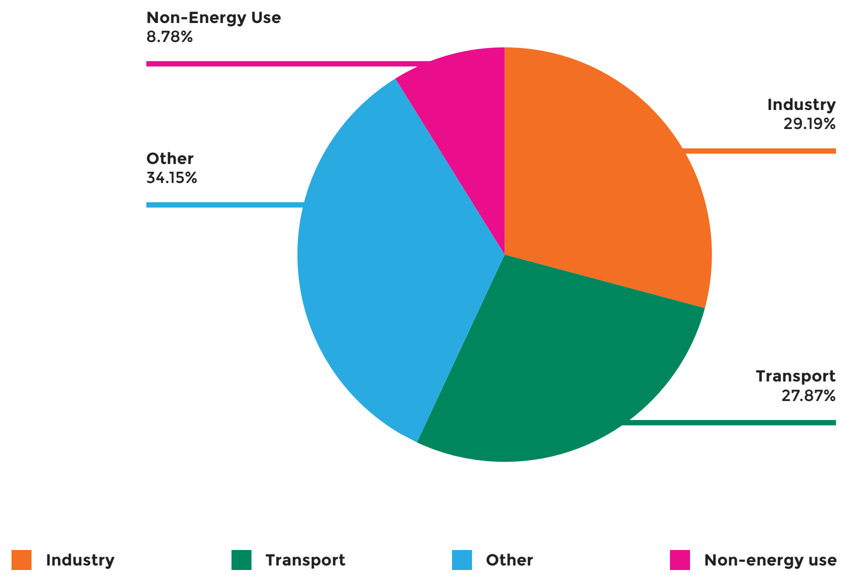
Transport has a major role to play in economic development at the national and international levels. It provides access to economic and social activities and opportunities for individuals as well as businesses. It helps link suppliers and consumers, making division of labour, specialization and full use of comparative advantage possible. Studies also show that improvement in all transport infrastructure sectors will result in a reduction in trade costs as well as encourage increased trade flow.[1]

The transport sector also contributes directly to the economy through investment and employment. In New Zealand, transport investment and expenditure on transport operations accounts for approximately 5 per cent of GDP.[2] Similarly, the transport industry of the European Union accounts for 5 per cent of GDP. The industry employs around 10 million people. In terms of finished products, transport and logistics costs account for 10 to 15 per cent of total cost for European companies. In terms of quality of life, European households spend, on average, 13.2 per cent of their budget on transport goods and services.[3] In the United States, logistics and transport industry's spending equals US$ 1.48 trillion and accounts for 8 percent of United States GDP.[4] In Thailand, GDP from transport reached an all-time high in the first quarter of 2017.[5]

2. Impact of transport sector on the environment

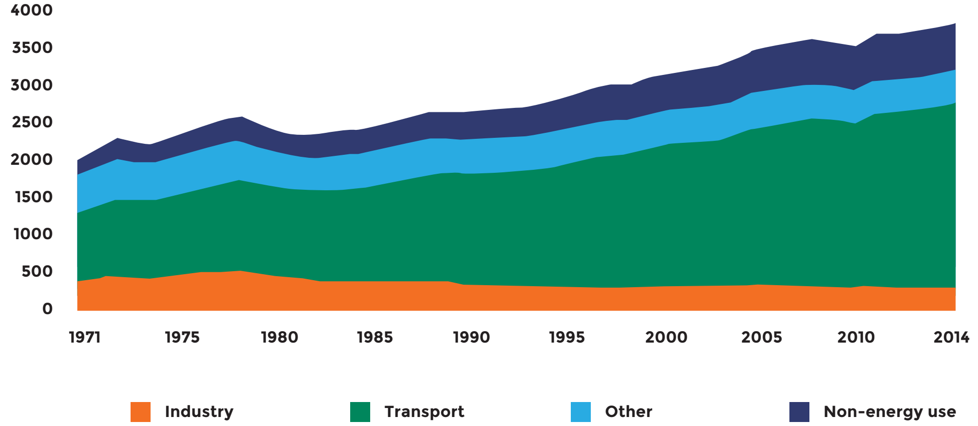
A reduction of energy consumption in the transport sector can have huge benefits for the environment. The transport sector accounts for nearly 28 per cent of total global energy consumption (figure 1.1)[6] and 64.5 per cent of global oil consumption (figure 1.2). The transport sector's share of global oil consumption has grown nearly three times during the past four decades, trend that is continuing to increase. More than 460 million tons of oil equivalent (mtoe) of energy is consumed by the transport sector in the Asia-Pacific region, of which 87.24 per cent is by road transport.7 The share of energy consumption by the road transport is expected to remain dominant.[8]

FIGURE 1.1 SHARE OF WORLD ENERGY CONSUMPTION (TOTAL FINAL CONSUMPTION),2014



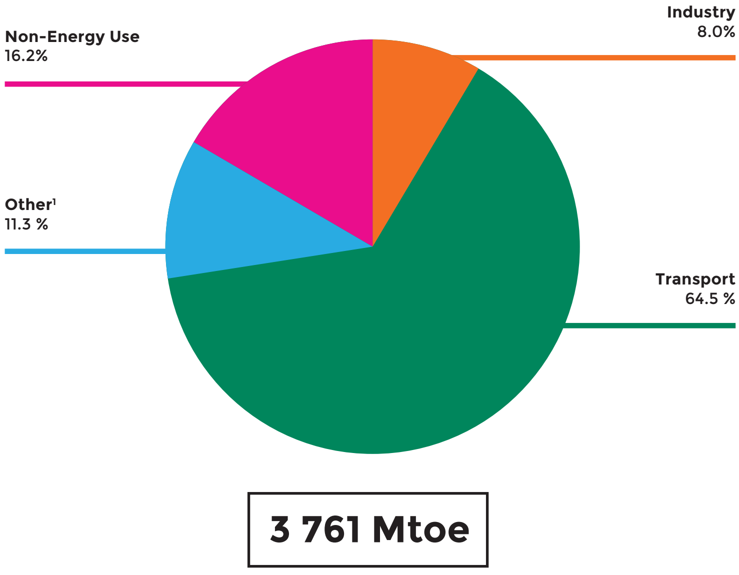
Source : Data from IEA, Key World Energy Statistics 2016.

FIGURE 1.2. TOTAL FINAL OIL CONSUMPTION (MTOE), BY SECTOR, 1971-2014



Source : IEA, Key World Energy Statistics 2016

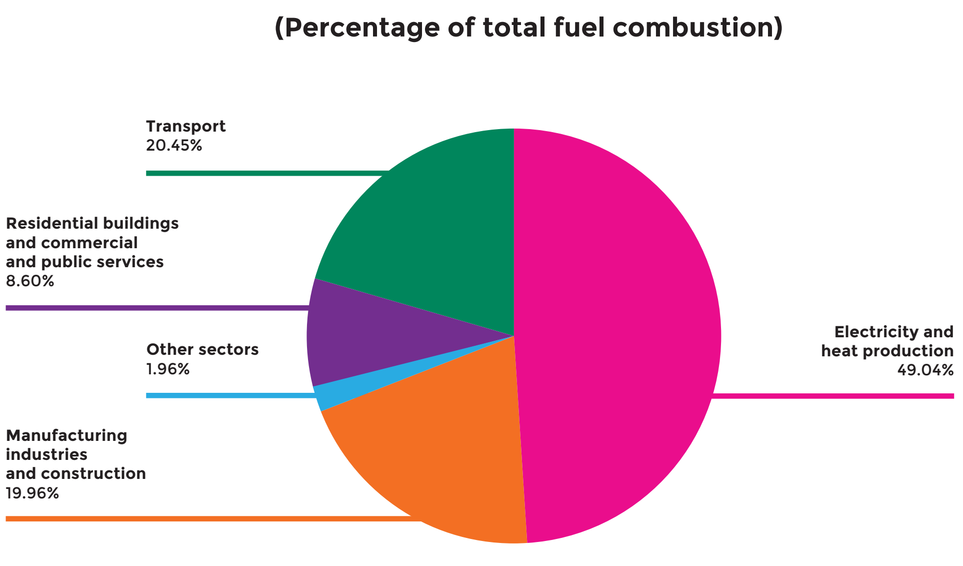
FIGURE 1.3. SHARES OF WORLD OIL CONSUMPTION, 2014



1. Includes agriculture, commercial and public services, residential, and non-specified other

Source : IEA, Key World Energy Statistics 2016

FIGURE 1.4. SHARES OF GLOBAL CO_2 EMISSIONS, BY SECTOR, 2014



Source: ESCAP calculation based on data from World Development Indicators. Available at http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators (accessed 26 May 2017).

As the biggest consumer of oil and oil products the transport sector is the second-largest producer of carbon dioxide, accounting for more than 20 per cent of total global carbon dioxide emissions in 2014 (figure 1.4).[9] A total of 1,451 million tons of carbon dioxide was produced by the transport sector in the Asia-Pacific region, of which 86.65 per cent was attributed to the road sector.[10] Moreover, six out of the 10 countries that emit the most carbon dioxide are in the Asia-Pacific region.[11]

The transport sector also produces particulate matter, nitrogen oxides, sulphur oxide, ozone and volatile organic compounds, all of which damage human health, ecosystems and buildings.[12] The total economic damage from air pollution is estimated to represent up to 10 per cent of GDP in cities such as Bangkok, Kuala Lumpur and Jakarta.[13] In fact, Asia has the highest level of air pollution in the world, of which 80 per cent is from the transport sector,

3. Social importance of transport

Transport contributes to social development by enabling labour mobility and facilitating access to markets, employment, health care, educational opportunities and other social services. Many rural communities are isolated by distance, terrain and poverty from these economic and social opportunities. Transport connectivity helps to narrow these gaps and make access more inclusive. According to the World Bank Rural Access Index, nearly one-third (more than 1 billion) of the world's rural population, 98 per cent of whom are in developing countries, do not have adequate access to road transport systems.[14] Chapter 5 of this report highlights the importance of rural connectivity in poverty reduction, health, education and employment generation as well as overall rural development of the region.

While rural areas are subject to high transport costs and time loss as a result of isolation due to distance, urban areas are also facing similar challenges due to congestion. Rapid motorization and urbanization have resulted in serious congestion, which has been estimated to cost Asian economies 2-5 per cent of GDP every year.[15] Asia's urban population is increasing by 120,000 persons per day and motor vehicle fleets in the region double every five to seven years.[16] By 2035, it is estimated that China alone will have approximately 350 million private cars which is 10 times the figure for 2008. India's private vehicles are also estimated to increase threefold.[17]

Time and energy loss caused by congestion results in significant costs to societies and economies. In Bangkok, the cost of traffic congestion is approximately 6 per cent of GDP annually.[18] In Beijing, the cost of traffic congestion amounts to US$ 11.3 billion per year.[19] In Australia and New Zealand, the cost created by congestion, in terms of lost income and time, is estimated to be US$ 16.5 billion[20] and US$ 1.25 billion[21] per year, respectively. India is estimated to consume an additional US$ 14.7 billion in fuel due to congestion, while annual costs from delays are calculated to be US$ 6.6 billion per year.[22] Chapter 7 of this report discusses intelligent transport systems as a technology option for helping to curb congestion.

In addition to congestion, road transport is the cause of significant negative economic and social externalities. In the Asia-Pacific region, 733,000 people are killed in road traffic crashes each year. While the economic cost of road traffic fatalities and injuries in the region is estimated to be more than US$ 500 billion,[23] the social costs of loss of life and the impact it has on families and societies are immeasurable. Studies have show that even for those who survive, the after-effect from crashes will continue to haunt them, economically, physically and mentally. Chapter 6 provides an overview and analysis of road safety in the region, identifies the major causes of road traffic crashes, and highlights some policies and initiatives for road safety improvement.

B. Transport and Sustainable Development Goals

1. Central role of transport in achieving SDGs

Section A of this chapter shows how transport plays a critical role in economic and social development by: (a) providing access to economic and social opportunities, (b) facilitating the movement of people, goods, labour, resources, products and ideas across the region, and (c) creating opportunities, both for consumers and for producers, to connect to supply chains around the globe. On the negative side, it also points out that the transport sector is one of the leading consumers of fossil fuels, and generates a variety of harmful emissions. Increasing levels of motorization have also resulted in congestion and an increase in traffic fatalities and injuries.

(c) creating opportunities, both for consumers and for producers, to connect to supply chains around the globe. On the negative side, it also points out that the transport sector is one of the leading consumers of fossil fuels, and generates a variety of harmful emissions. Increasing levels of motorization have also resulted in congestion and an increase in traffic fatalities and injuries.

Given the important role of transport in sustainable development, the adopted 17 SDGs that came into effect on 1 January 2016 included goals that specifically mention transport and infrastructure. In addition, the transport sector makes both a direct and an indirect contribution to other goals. Figure 1.5 and table 1.1 show the contribution of the transport sector to SDGs.

FIGURE 1.5. NEXUS DIAGRAM OF THE CONTRIBUTION BY THE TRANSPORT SECTOR TO THE SUSTAINABLE DEVELOPMENT GOALS AND TARGETS

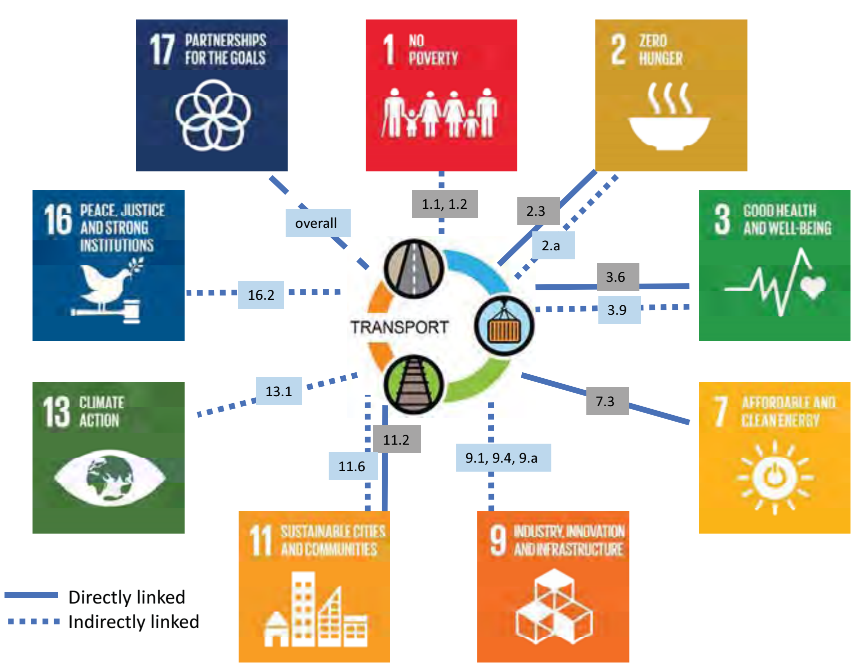


TABLE 1.1. CONTRIBUTION OF THE TRANSPORT SECTOR TO THE SUSTAINABLE DEVELOPMENT GOALS AND TARGETS

SUSTAINABLE DEVELOPMENT GOAL	DIRECT CONTRIBUTION	INDIRECT CONTRIBUTION
Goal 1. End poverty in all its forms everywhere.		1.1 By 2030, eradicate extreme poverty for all peopleamong people everywhere, currently measured as people living on less than US$ 1.25 a day. 1.2 By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions, according to national definitions.
Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture.	2.a Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development, and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, particularly least developed countries.	2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers — , in particular women, indigenous peoples, family farmers, pastoralists and fishers, — including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment.
Goal 3. Ensure healthy lives and promote well-being for all at all ages.	3.6 By 2020, halve the number of global deaths and injuries from road traffic accidents.	3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals, and air, water and soil pollution and contamination.
Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all.	7.3 By 2030, double the global rate of improvement in energy efficiency.	
Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation,	9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human	

SUSTAINABLE DEVELOPMENT GOAL	DIRECT CONTRIBUTION	INDIRECT CONTRIBUTION
	well-being, with a focus on affordable and equitable access for all, 9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities. 9.a Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States.	
Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable.	11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.	11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.
Goal 13. Take urgent action to combat climate change and its impacts.		13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.
Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable and inclusive institutions at all levels.		16.2 End abuse, exploitation, trafficking and all forms of violence against, and torture of, children.

SUSTAINABLE DEVELOPMENT GOAL	DIRECT CONTRIBUTION	INDIRECT CONTRIBUTION
Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development.	Overall.	Overall.

Source: United Nations General Assembly Resolution 70/1. Available at https://sustainable development.un.org/.

2. Status and analysis of modal share in Asia

To fully contribute to achieving the transport-related SDGs listed above, there is a need for transport systems that: (a) optimize the time and cost of transportation of goods and passengers; (b) minimize consumption of energy, land and other resources; (c) reduce emissions of greenhouse gases, ozone-depleting substances and other pollutants; (d) minimize the adverse social impacts arising from transport operations; (e) provide access for rural communities; and make full use of new technology to enhance capacity and operations.

One of the key considerations that will allow transport systems to achieve balanced integration of the three pillars of sustainable development is modal choice. Currently, user modal choice considerations focus mainly on economic benefit and usually do not take into account negative externalities. The next section reviews the current status of modal share in Asia.

Despite being the least environmentally-friendly mode of transport, road transport remains the most commonly used system for passenger travel in all countries and for freight transportation in most countries (figures 1.6 and 1.7). Road transport is used extensively to carry freight in Azerbaijan, China, India, Japan and New Zealand. In Thailand and Turkey, freight is heavily reliant on road transport as it accounts for more than 90 per cent of the total share of freight transport. Similarly, in Myanmar and New Zealand, road freight accounts for more than two-thirds of the total freight volume. In Japan, both road freight and maritime freight transport are heavily used. China's share distribution is balanced between road transport, inland waterways and coastal shipping.

The share of modal choice in Australia, Georgia, Mongolia and the Russian Federation are more environmentally friendly, with rail freight being the most prevalent. The share of rail freight in Georgia, Mongolia and the Russian Federation are notably higher than the share of road freight at 86.51 per cent, 63.14 per cent and 59.27 per cent, respectively. For Armenia and Azerbaijan, pipeline transport is the most dominant mode, accounting for 70 per cent of freight transport. The Russian Federation also moves nearly one-third of its freight transport by pipeline.

For passengers, road transport is by far the most dominant mode for the majority of countries (figure 1.7), with many countries reporting a 90 per cent share for passenger transport by road. China, the Russian Federation and Singapore are among the few countries that have a balanced split between the share of road and rail passenger transport.

FIGURE 1.6 SHARE OF FREIGHT MODE (MILLION TONNES/KM), 2015

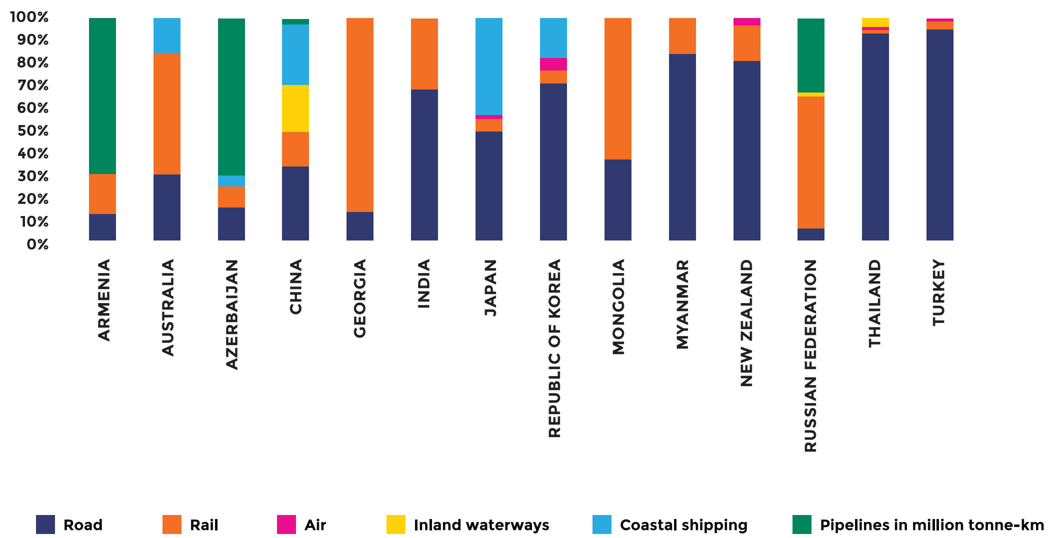
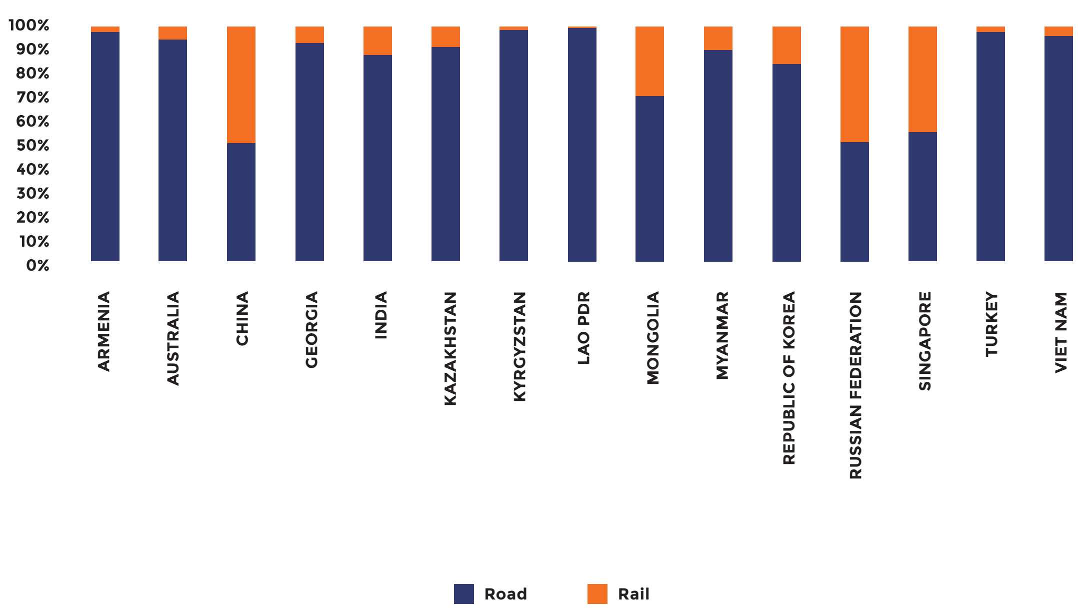


FIGURE 1.7 SHARE OF PASSENGER LAND TRANSPORT MODE (MILLION PASSENGERS / KM), 2015



3. Development of integrated intermodal transport systems for sustainable development

The shift to more sustainable modes of transport and increased efficiency in transport operations are key to making the transport sector more sustainable. Current obstacles that hinder the adoption of intermodal transport systems in the region from utilizing modal shift to realize optimal efficiency in its operations are mainly the lack of physical transport infrastructure connectivity among different modes of transport, the high cost and time losses at modal interchange points and the differences in legal regimes for cross-border and transit transport. The further development of integrated intermodal transport systems will therefore be required to achieve sustainable development. For the development of integrated intermodal transport systems, the following policies have been found useful.

(a) Setting up a network of intermodal terminals/ dry ports

Building and operating a network of intermodal terminals and dry ports within countries and at border crossings is crucial for achieving integrated intermodal transport systems. These facilities would primarily serve to: (a) transfer cargo from one mode to another; (b) aggregate and disaggregate cargoes to convert them to more economically viable shipments, including containerization, between origin and destination; (c) manage inventories; and (d) provide value-added services and customs clearances. India is planning to establish a number of such terminals (box 1.1).

Various arrangements for setting up and managing intermodal terminals are possible. However, for such arrangements to be efficient, representation from all relevant modes of transport is essential.

BOX 1.1. DEVELOPMENT OF MULTIMODAL LOGISTICS PARKS IN INDIA

India's Ministry of Road Transport and Highways (MORTH) is setting up Multimodal Logistics Parks under the Logistics Efficiency Enhancement Programme at 15 locations selected for their high density of freight movement. The programme aims to reduce logistics costs by up to 10 per cent. The multimodal parks, with a share of around 40 per cent of the freight movement in India, are expected to serve the following functions:

- Freight aggregation and distribution;
- Multimodal freight movement;
- Storage and warehousing;
- Value-added services such as customs clearance.

A multimodal company will be established under the overall control of MORTH, with representation from National Highway Authority of India, Indian Railways, Airports Authority of India, Inland Waterways Authority of India and Indian Ports Association. The company will also collaborate with the Container Corporation of India and Dedicated Freight Corporation of India. The multimodal hubs will reduce handling costs and streamline the clearance process. They will also encourage a move away from small/inefficient loads/trucks with slower average speeds in order to further reduce transport costs. The logistics costs in India are in the order of 13-14 per cent of the value of goods, which is nearly double that of developed countries.

Apart from reducing the logistics cost, this initiative will also help to reduce carbon emissions and road congestion.

(b) Policies to enhance efficiency and utilization of each mode within transport networks

For road transport, corridors that connect high-growth areas should be identified and developed with appropriate ancillary facilities. Other measures might include:

• Electronic toll collection to reduce congestion and waiting times along major highways;

• An electronic database of driver licenses and vehicle registrations, with access to appropriate authorities through a user-friendly mobile application;

• Suitable long-term management plans for maintenance of roads is essential to improving transport operations and road safety. A clear commitment to road maintenance can attract greater private participation. Increasing the duration of contracts and the length of roads to be maintained could act as an incentive for private players to achieve scales and invest in better technology to reduce costs;

• The creation of a dedicated programme for construction and maintenance of "last-mile roads", given the advantages of road transport over other modes in providing access to remote areas. The last-mile roads can link rural areas to main roads with onward connections to ports and railway terminals. Last-mile roads are critical to maximizing network efficiency, and a joint planning and operating entity with representation from road, rail and ports can be constituted to ensure the interests of all major stakeholders are addressed appropriately.

For railway transport, depending on the intermodal mix within each country, substantial policy initiatives may be required to encourage a modal shift towards railway transport. This can include:

• The development of dedicated railway freight corridors to promote a shift towards a more environmentally-friendly mode of transport as well as contribute to sustainable development outcomes (box 1.2);

• Similar to road transport, there is also a need to focus on building last-mile rail links to connect, for example, railway lines with ports and logistics parks that can support containerization, and coal mines that can support efficient bulk lifting of commodities;

• Encouraging and developing regulations that allow private players to run or lease block or bulk trains on railway infrastructure.

BOX 1.2. DEVELOPMENT OF DEDICATED RAILWAY FREIGHT CORRIDORS IN INDIA

The project for the development of dedicated railway freight corridors in India (DFCs) entails development of exclusive railway freight corridors for faster movement of freight. The main reason for developing such corridors is to meet the rapidly rising demand for freight transportation and the current inadequacy of the railway infrastructure to meet that demand. Currently, there are plans to develop two dedicated freight corridors – one in the east and another in the west of the country. Dedicated railway freight corridors are expected to provide a substantial modal shift from road to rail.

It is estimated that in the next 30 years the project will strengthen transport connectivity within India in a sustainable manner, and will lead to an 81 per cent reduction in annual carbon dioxide emissions. Heavy investment in creating railway and ancillary infrastructure will also lead to spillover benefits for other sectors of the economy, creating employment opportunities.

For maritime transport, depending on the intermodal mix within each country, the following measures are suggested:

• Develop coastal/inland waterway shipping corridors for less time-sensitive goods, to minimize the cost of transport goods and carbon emissions. This may involve construction of minor ports with adequate facilities. The development of coastal corridors should be integrated with last-mile road and rail programmes in order to ensure integration into the transport network. Under its Sagar Mala programme, India is undertaking numerous projects for port-led development;

• Modernize ports to handle increased volumes of goods efficiently, and create efficient port and hinterland linkages for integrated intermodal transport systems;

• Build container freight stations or dry ports in the vicinity of major ports in order to decongest hinterlands and allow for the clearance of goods and related services outside the port area. This concept is being more widely used to increase efficiency of linkages between ports and hinterlands. It involves constructing railway yards adjoining container terminals, and transferring the containers directly from the yards to nearby dry ports or intermodal facilities for clearance or further transportation to inland locations;

• Build efficient systems for the movement of containers in and out of the ports, using new technologies.

BOX 1.3. SAGAR MALA PORT-LED DEVELOPMENT INITIATIVE OF INDIA

Sagar Mala is a port-led development initiative of the Government of India. The focus of the programme is the modernization of ports, with supporting infrastructure, in order to move goods from ports to hinterlands efficiently and effectively. It plans to integrate the development of ports and industrial clusters with hinterlands through efficient road, rail, inland and coastal waterways connections, with ports becoming the drivers of economic activity in the coastal areas. The overall objective is to raise the competitiveness of exports by reducing logistics costs. The programme has three components:

- Port modernization;
- Efficient integration of ports with rail, road and coastal networks to hinterlands, and promotion of shipping as preferred mode of transportation;
- Coastal economic development – development of coastal economic zones, port-based Special Economic Zones (SEZ) and the promotion of coastal tourism.

Endnotes

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Regional transport infrastructure connectivity

A. Introduction

The successful definition and formalization of the Asian Highway and Trans-Asian Railway networks has played a major role in bringing about a new approach by member States to include an international dimension in the planning of their transport infrastructure. In addition, the identification of a set of dry ports of international importance has facilitated the implementation of the two networks and their integration with ports and other modes. This has enabled the region to accommodate increasing volumes of international trade on mostly existing infrastructure as well as contributed towards aggregating disparate infrastructure systems into a common regional network to serve the region's economic integration, strengthen future economic growth and facilitate the exchange of goods and services.

The region's seaports are expanding rapidly and are leading the world in terms of container handling capacity. Changes in maritime technologies and alliances are seeing larger ships, some in excess of 20,000 TEU capacity, having an impact on port design and development, by necessitating the introduction of bigger berths, greater automation and advanced management information systems to promote efficiency and connectivity to hinterlands.

The Asia-Pacific region leads the world in terms of air passenger and freight traffic, which are continuing to grow with high-load factors. The introduction of low-cost carriers in the region, while still below the world average, is making an important contribution to increasing capacity.

The region's continued economic growth is calling for countries to go beyond the mere development of transport infrastructure on a unimodal basis. Effective integration of the Asian Highway and Trans-Asian Railway, with connections to inland waterways, seaports, river ports, airports and dry ports, can offer seamless transport solutions to the region's vibrant industry. Coupled with efficient maritime connections, it can also facilitate the inclusion of archipelagic and Pacific island countries into the region's mainstream economic success.

B. Assessment of land transport infrastructure across the region

The Global Economic Forum sought the opinion of nearly 15,000 business leaders from small- and medium-sized enterprises and large companies representing the main sectors (agriculture, manufacturing industry, non-manufacturing industry and services) across 141 countries. Asked to rate the quality of road and rail infrastructure on a scale of 1 (extremely underdeveloped) to 7 (extensive and efficient — among the best in the world), the highest scores in the ESCAP region, i.e., 5 and above, were given to Japan, Malaysia and the Republic of Korea (for roads and rail), and China (rail). Singapore also received a high score of 6.3 for roads, although they are mostly city roads. High scores of 4 and above were also recorded for: (a) Australia, Azerbaijan and India for both road and rail; Brunei Darussalam,[1] China, the Islamic Republic of Iran, New Zealand, Sri Lanka, Tajikistan, Thailand and Turkey for roads; and (b) Kazakhstan and the Russian Federation for rail. Meanwhile, the lowest scores, i.e., below 3.5 for both road and rail, were in Bangladesh, Cambodia, Kyrgyzstan, the Lao People Democratic Republic, Mongolia, Nepal and the Philippines.[2]

Rail infrastructure scored higher than road infrastructure in only six countries, i.e., China, Georgia, India, Japan, Kazakhstan and the Russian Federation. This should be of particular concern to Governments of the region given the long distances, i.e., 2,000 km or more, involved in connecting hinterland areas and landlocked countries to international maritime ports (table 2.1) This also points to the need for greater investment in rail infrastructure if the region is to take active measures towards reducing the impact of the transport sector on the environment under the 2030 Development Agenda.

C. Status and challenges of the Asian Highway and Trans-Asian Railway networks

The Asian Highway and Trans-Asian Railway networks play a pivotal role in fostering the coordinated development of regional road and rail networks. The two networks have been formalized through the Intergovernmental Agreement on the Asian Highway Network[3] and the Intergovernmental Agreement on the Trans-Asian Railway Network,[4] which entered into force in July 2005 and June 2009, respectively. There are now 30 Parties to the Intergovernmental Agreement on the Asian Highway Network and 19 Parties to the Intergovernmental Agreement on the Trans-Asian Railway Network.

In accordance with the terms of the Agreements, working groups for the Asian Highway and the Trans-Asian Railway were established as forums to facilitate the implementation of the Agreements, and to discuss issues and exchange information related to the future development, upgrading and operational efficiency of transport in the region.

The Asian Highway and Trans-Asian Railway are evolutionary by nature. Indeed, the formalized networks have been adopted as two coordinated plans for the development of highway routes and railway lines of international importance within Asia as well as between Asia and neighbouring regions to facilitate regional economic integration. The Asian Highway and Trans-Asian Railway currently comprise 143,000 km of highways in 32 countries and 118,000 km of railway lines in 27 countries.

The development of the networks has been incorporated into national plans or strategies in a number of countries, and their routes have supported the definition of several multilateral transport initiatives such as the Central Asia Regional Economic Cooperation programme of the Asian Development Bank and the Singapore-Kunming Rail Link project of the Association of Southeast Asian Nations. The Asian Highway network has contributed to the negotiation of two important Agreements, (a) the "Agreement between the Governments of Member States of the Shanghai Cooperation Organization on Creating Favourable Conditions for International Road Transport" that was signed in Dushanbe in September 2014, and (b) the Intergovernmental Agreement on International Road Transport along the Asian Highway Network, that was signed by the Governments of China, Mongolia and the Russian Federation in Moscow in December 2016.

TABLE 2.1 DISTANCES FROM CAPITAL CITIES OF SELECTED LANDLOCKED COUNTRIES TO MAIN MARITIME PORTS USING EXISTING OR PLANNED TRANS-ASIAN RAILWAY ROUTES (KM)

CITY	PORT OF LIANYUNGANG (CHINA)	PORT OF SAINT PETERSBURG (RUSSIAN FEDERATION)	PORT OF BANDAR ABBAS (ISLAMIC REPUBLIC OF IRAN)
Ashgabat (Turkmenistan)	7 300	4 800	
Astana (Kazakhstan)	5 600	3 400	4 400
Bishkek (Kyrgyzstan)	5 600	4 700	3 400
Tashkent (Uzbekistan)	6 000	5 600	2 700
Ulaanbaatar (Mongolia)	1 800 (Port of Tianjin)	6 800	
	Port of Laem Chabang (Thailand)	Port Klang (Malaysia)	Port of Vung Ang (Viet Nam)
Vientiane (Lao PDR)	810	2 200	570

1. Asian Highway network

Since its inception, the Asian Highway Network has served as a coordinated plan for the development of highway routes of international importance within Asia as well as between Asia and neighbouring regions. Meanwhile, the related Intergovernmental Agreement on the Asian Highway Network[5] has provided a framework within which member countries have been able to improve the conditions of their roads. One of the obligations of the Parties to the Agreement is to bring the routes of the network into conformity with a set of classification and design standards (Annex II to the Agreement), thereby aggregating disparate infrastructure systems into a common regional network that is best able to serve the region's economic integration.

(a) Progress in upgrading Asian Highway routes (by Asian Highway Class)

The Asian Highway classification and design standards provide minimum standards and guidelines for the construction, improvement and maintenance of Asian Highway routes in four classes, i.e. Primary, Class I, Class II and Class III, with the latter being the absolute minimum standard. The distribution of the Asian Highway routes into one class or another depends on such factors as access control, number of lanes and surface treatment. During the decade of 2008-2017, member countries made substantial efforts to improve the quality of road infrastructure (figure 2.1) resulting in Primary Class roads covering 11.8 per cent of the network (up from 9 per cent) and

Class I roads covering 21 per cent of the network (up from 17.9 per cent). Concomitantly, the percentage of the network in the lesser Classes decreased, with Class II and Class III roads falling from 42.3 per cent to 39.7 per cent, and 21.5 per cent to 20.3 per cent, respectively. Meanwhile, the percentage of Asian Highway routes below Class III fell two percentage points to 7.3 per cent.

(b) Surface conditions of the Asian Highway Routes

The efficiency, cost and safety of road operation closely relate to the surface condition of the road. The surface condition of Asian Highway routes falls into the four categories: (a) good; (b) fair; (c) bad; and (d) poor.[7] The surface condition of the Asian Highway network of selected countries can be obtained from the Asian Highway Database,[6] which is updated biennially on the basis of information received from member countries. It contains, among other areas, information on road surface conditions as a minimum required field. Figure 2.2 was plotted using data extracted from the Asian Highway Database.

(c) Scores of the infrastructure component of the World Bank Logistics Performance Index

The Logistics Performance Index (LPI) is a benchmarking tool developed by the World Bank that measures performance along the logistics supply chain within a country. Allowing for comparisons among countries, the index can help in identifying challenges and opportunities as well as improve the logistics performance of countries. Worldwide surveys are conducted of operators on the ground (global freight forwarders and express carriers), providing feedback on the logistics "friendliness" of the countries in which they operate and those with which they trade. The LPI provides scores to member countries on a 1-to-5 scale (1= low and 5= high), based on six dimensions of trade—including customs performance, infrastructure quality and timeliness of shipments—that have increasingly been recognized as important for development. Figure 2.3 shows LPI scores for 2016 and 2014 that were assigned to Asian Highway member countries on the infrastructure dimension of trade logistics.

FIGURE 2.1 PROGRESS IN UPGRADING ASIAN HIGHWAY ROUTES, 2008-2017 (PERCENTAGE)[6]

Note: The data do not include approximately 15,400 kilometres of potential Asian Highway routes in China.

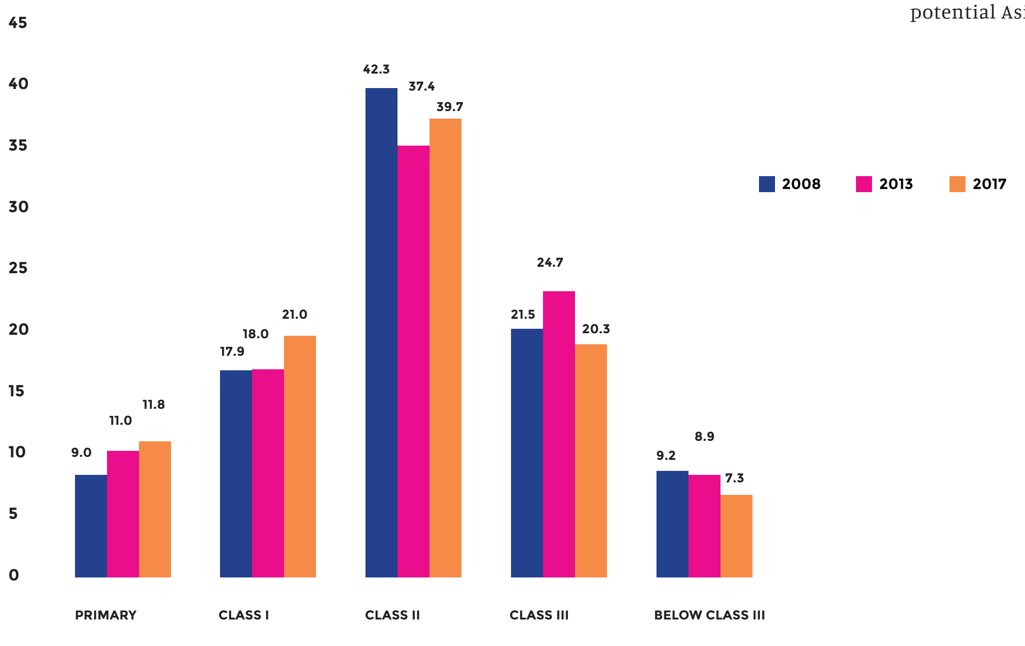
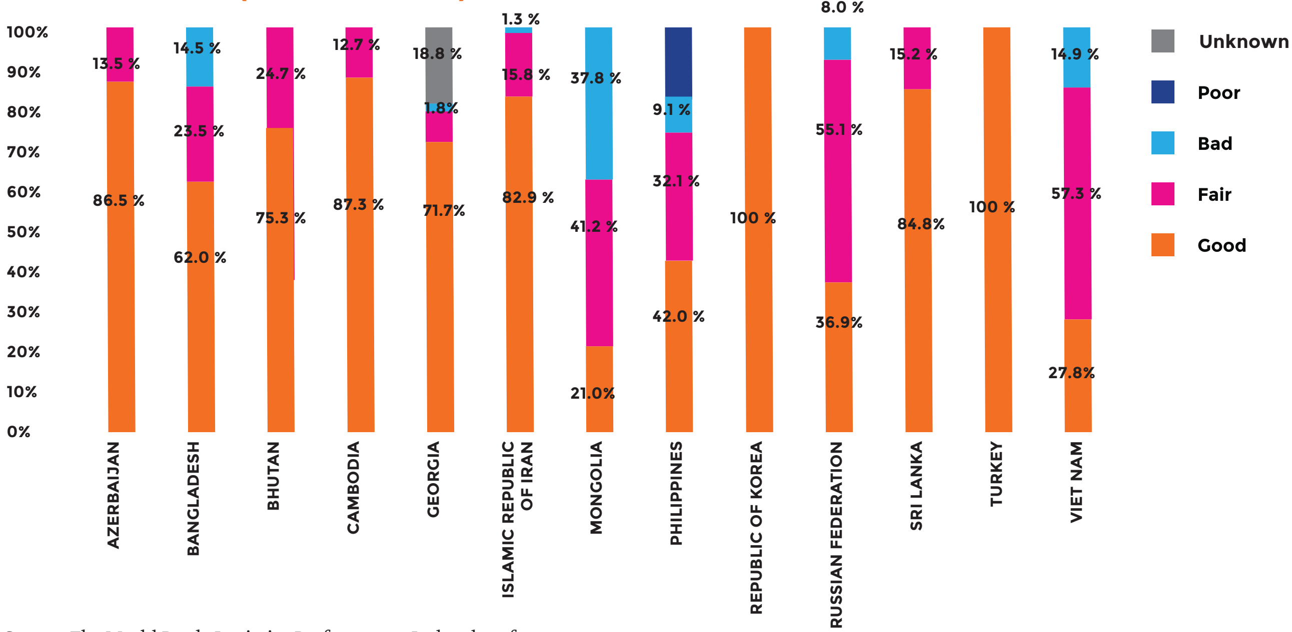


FIGURE 2.2 ROAD SURFACE CONDITION STATUS IN SELECTED ASIAN HIGHWAY ROUTES (SEPTEMBER 2017)



Source: The World Bank: Logistics Performance Index data for 2014 and 2016 (available at http://lpi.worldbank.org/about).

(d) Road pavement type status of the Asian Highway routes

Among road pavement types asphalt concrete pavement is a flexible pavement and widely used in the Asia Pacific region. However, other types of pavements are being used in the region

Annex II to the Intergovernmental Agreement on the Asian Highway Network allows three types. For Primary, Class I and Class II roads either asphalt concrete pavement (AC) or cement concrete pavement (CC) are the specified types. Class III roads may have a double bituminous surface treatment (DB or DBST) type of pavement. It is the cheapest type of road pavement allowed for the Asian Highway. This is recommended for low-volume traffic roads only.

(e) Issues and challenges related to the Asian Highway

The quality of the Asian Highway network across and within member countries is mixed. According to data available from the Asian Highway Database, 1,928 km in Myanmar, 1,480 km in Mongolia, 1,461 km in Afghanistan, 1,138 km in Pakistan and 914 km in Tajikistan did not meet the minimum desirable standards — as last reported in 2015, except for Mongolia, which was reported in 2017. One of the major challenges for the development of the Asian Highway network is infrastructure financing. An ESCAP estimation in 2017 indicated upgrading of the Asian Highway routes would require a total of US$51.4 billion. During the past decade, developing countries in the ESCAP region have been taking measures to promote public-private partnerships as an alternative approach to developing road infrastructure, by utilizing the efficiency and innovation of the private sector.

Section III of Annex II to the Intergovernmental Agreement on the Asian Highway Network requires Parties to consider issues of road safety while developing the Network. Between 2010 and 2013, 16 Asian Highway member countries were successful in reducing road fatalities. In addressing the above issue, the Ministerial Declaration on Sustainable Transport Connectivity in Asia and the Pacific reaffirmed the commitment to improving road safety on the Asian Highway Network, and adopted the "Updated Regional Road Safety Goals and Targets for Asia and the Pacific, 2016-2020".[8] It includes a Goal on developing the Asian Highway Network as a model of road safety.

The member countries of the region are encountering various challenges in implementing the Asian Highway design standards.[9] The lack of funding and incentives for implementation of the Asian Highway design standards is perceived to be a major barrier. To promote the Asian Highway design standards, organizing workshops and seminars at the regional, subregional and national levels would be beneficial. The development partners, including international financial institutions and road safety-related organizations, need to work jointly towards promoting the implementation of the Asian Highway design standards.

FIGURE 2.3 SCORES OF THE INFRASTRUCTURE COMPONENT OF THE LOGISTICS PERFORMANCE INDEX

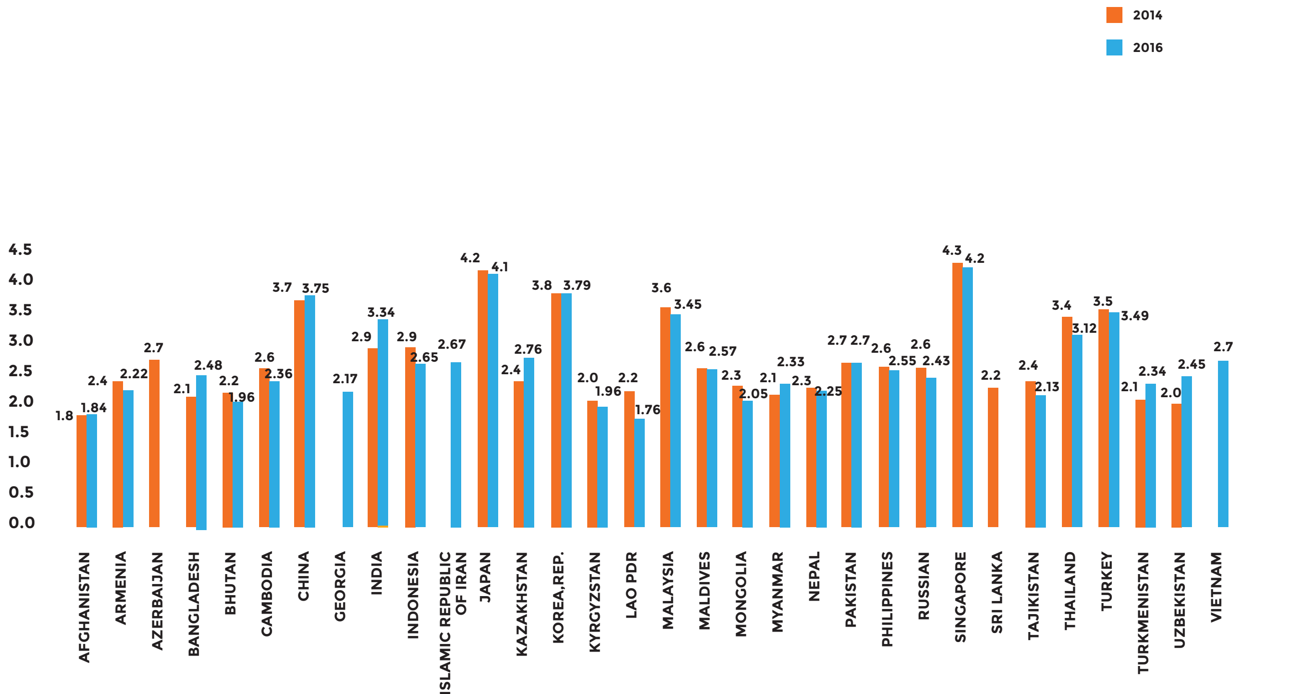
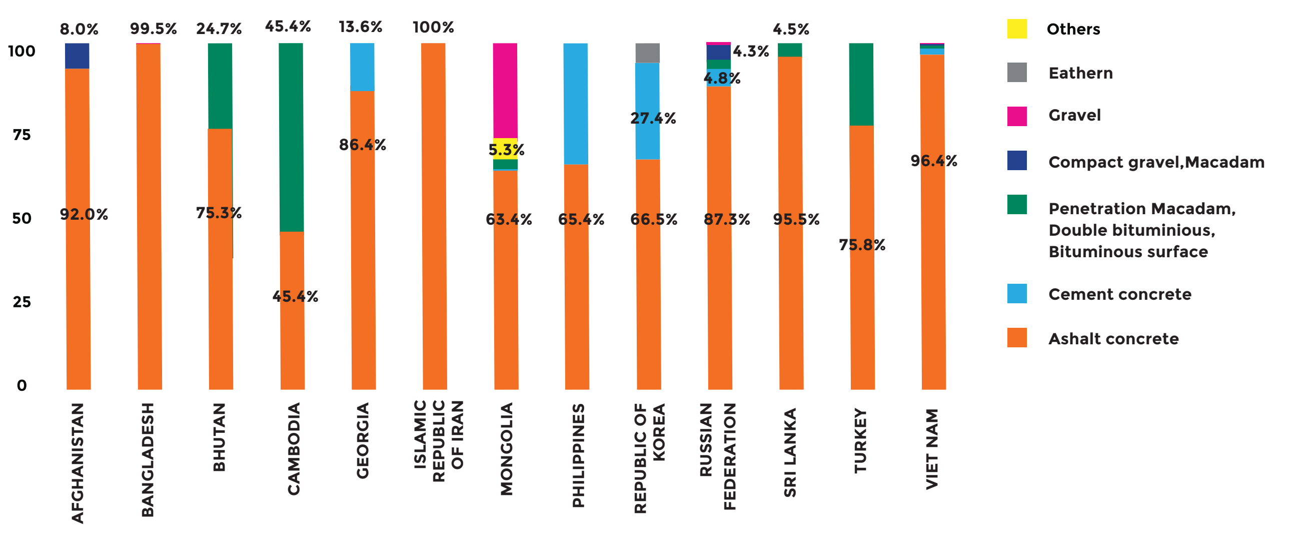


FIGURE 2.4 ROAD PAVEMENT TYPE STATUS OF THE ASIAN HIGHWAY IN THE SELECTED ASIAN HIGHWAY MEMBER COUNTRIES (JULY 2017)[6]



2. Selected highway projects

(a) SASEC Road Connectivity Project in Bangladesh

The main objective of the South Asia Subregional Economic Cooperation (SASEC) Road Connectivity Project in Bangladesh is the upgrading of the 70-km Joydevpur-Elenga road from a two-lane to a four-lane highway (figure 2.5). This is an overlapping part of the AH2 and AH41 routes. It connects Nepal with Chittagong Port in Bangladesh through the SASEC Road Corridor.[8]

FIGURE 2.5 SASEC ROAD CONNECTIVITY PROJECT

The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

(b) Da Nang-Quang Ngai Expressway Development Project in Viet Nam

The road transport sector is crucial for better economic integration of the central region of Viet Nam with the rest of the country. The corridor primarily serves long-distance travel, with 40 per cent of the vehicles travelling the full length of the section between Da Nang and Quang Ngai section of the AH1 (figure 2.6).

FIGURE 2.6 DA NANG-QUANG NGAI EXPRESSWAY DEVELOPMENT PROJECT

The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

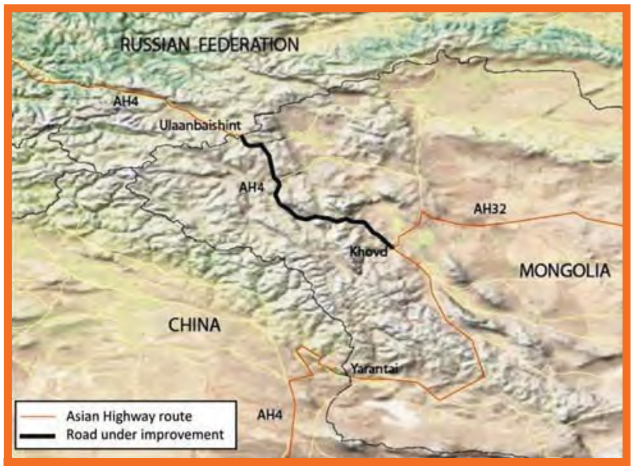
With the financial support of international financing institutions, the Government of Viet Nam constructed a new 130-km alignment four-lane expressway in 2011. Once opened to traffic (expected in 2018), travel time for freight and passenger vehicles is expected to be reduced by 20 per cent and the number of traffic fatalities to decline by 10 per cent along the corridor.[12, 13]

(c) Western Regional Road Corridor Investment Programme in Mongolia

The western regional road corridor route in Mongolia is a part of AH4. It is also a section of the designated Central Asia Regional Economic Cooperation (CAREC) Corridor 4a, and runs north-south from Mongolia's border with the Russian Federation at Ulaanbaishint, to the border with China at Yarantai, a distance of about 743 km. The programme is aimed at inclusive economic growth through enhanced local and regional connectivity. The development is part of a framework financing agreement of 2011 between the Government of Mongolia and the Asian Development Bank (ADB). Under Project-2 of the Western Regional

Road Corridor Investment Programme of ADB, approximately 190 kilometres of paved road between Khovd and Ulaanbaishint was being constructed in 2017.[14, 15] Once the corridor is completed, it will provide connectivity between the Russian Federation and China via Mongolia.

FIGURE 2.7 WESTERN REGIONAL ROAD CORRIDOR INVESTMENT PROGRAMME



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

(d) East-West Roads Project in Kazakhstan

The development objectives of the East-West Roads Project in Kazakhstan (figure 2.8) are to increase transport efficiency along the section of the AH5 (also CAREC corridor 1b and European Road E40) from Almaty to Khorgos (Horgos) of the Western Europe-Western China road corridor, and to modernize highway management. The road section is expected to have a positive impact on the regional economy, as it is a transit link for goods imported from China to Kazakhstan and other Central Asian countries.[16, 17] The road improvements are being undertaken with assistance from international financing institutions.

FIGURE 2.8 EAST-WEST ROADS PROJECT

The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

3. Trans-Asian Railway network

There is growing acceptance that rail transportation has an important role to play in the national and international movements of goods and people. A number of elements favour greater utilization of rail transportation in serving the region's trade and, in particular, facilitating access by landlocked countries to international maritime ports. These elements include: (a) the nearest ports are often located several thousand kilometres away (see table 2.1); (b) the distances linking the main origin and destination, both domestically and internationally, are of a scale at which railways find their full economic justification; (c) the reliance on ports to connect national economies to the world's markets, with the need to clear landside port areas quickly to avoid congestion; (d) the fact that a number of landlocked countries are major exporters of mineral resources in the logistics of which rail transport plays a crucial role; and (e) the continuing surge in the volumes of goods being exchanged. Finally, the 2030 Development Agenda is inviting Governments of the region to give rail transport greater prominence in their transport development plans.

BOX 2.1 EXAMPLES OF INTERNATIONAL CONTAINER BLOCK-TRAIN SERVICES ALONG ROUTES OF THE TRANS-ASIAN RAILWAY NORTHERN CORRIDOR

Since 2010, a weekly service has been carrying automotive parts from Germany to Shenyang, China. In 2014 and 2015, other ventures were tested with the launch of services between Chongqing (China) and Duisburg (Germany), Zhengzhou (China) and Hamburg (Germany), Suzhou (China) and Warsaw (Poland), Yiwu (China) and Madrid (Spain), and Kunming (China) and Rotterdam (Netherlands).

In early 2016, the first container train travelled from Zhejiang province in China to Tehran (Islamic Republic of Iran) through Kazakhstan and Turkmenistan, and in September of that year a train travelled from China's east coast to Hairaton in northern Afghanistan. More recently, in January 2017, more than 700 tonnes of Kazakhstan grain were sent in 32 containers from Zhaltyr railway station to the Chinese port of Lianyungang for onward movement by sea to the port of Ho Chi Minh in Viet Nam.

(a) Issues and challenges

The main challenge for railway transport in the ESCAP region as a whole remains the numerous missing links and different technical standards that prevent the network from functioning as a continuous system.

As regards the Trans-Asian Railway, the four main corridors that were studied to identify the network present a sharp contrast in their operational readiness. The Northern Corridor presents a high level of operational readiness owing to the existence of continuous rail infrastructure, adequate interoperability between railway organizations of neighbouring countries even when a break-of-gauge exists at the border, and a high level of operational and technical competence.[18] Since the completion of the Trans-Siberian main line, this corridor has traditionally been used for cross-border rail movements, and in recent years the introduction of more market-oriented economic policies in China and the Russian Federation has intensified its use with an increasing number of new international container-block train services being launched along the corridor every year (table 2.1).

The railways of China are at the centre of international land-bridge container services. By the end of 2016, such services linked 16 cities in China and 12 in Europe.[19] Although not the first of its kind, the triggering factor for a surge in new services was the success of the service launched in 2011 to carry car parts between factories in Leipzig and Regensburg, Germany and an assembly plant in Shenyang, China. In 2016, 40,000 containers were transported, up by 15 per cent from the previous year, with volumes of 100,000 containers expected by 2020. Service levels have developed, with transit times of 12 to 16 days compared to 23 days when the service was first launched.[20]

In the other corridors of the Trans-Asian Railway, operational readiness is hampered by one or more of the following issues: poor rail infrastructure in some of the countries; rolling-stock assets in insufficient number; a lack of rolling-stock interoperability across borders; and low operational capabilities of railway organizations in some of the countries. Most importantly, the absence of continuous rail infrastructure across borders remains an obvious obstacle to the development of international services in some parts of the region.

In its current configuration the Trans-Asian Railway network comprises 118,000 km of existing or planned railway tracks that have been selected by member countries for their current or future potential to carry international trade. Of this total, 12,400 km are missing, representing 10.5 per cent of the network. This is the sum of the line sections that have been nominated by member States to be part of the network but have yet to be constructed. The total investment required to put in place these missing links is estimated to be US$75.6 billion. (table 2.2)

TABLE 2.2 SUM OF MISSING LINKS BY SUBREGION AND ESTIMATED COST OF CONSTRUCTION

SUBREGION	DISTANCE IN KM (PERCENTAGE OF TOTAL)	ESTIMATED COST OF CONSTRUCTION IN MILLION UNITED STATES DOLLARS (PERCENTAGE OF TOTAL)
ASEAN (Including Yunnan Province of China)	4 763 km (38)	49 580 (66)
Caucasus	346 (3)	3 200 (4)
Central Asia (Including the Islamic Republic of Iran and Turkey)	1 405	5 180 (7)
North-East Asia	3 396 (27)	8 600 (11)
South Asia	2 495 (20)	9 000 (12)
Total:	12 405	75 560

The lack of rail intercountry connectivity is particularly acute in South-East Asia, including links to other subregions, which accounts for 38 per cent of the missing sections in the Trans-Asian Railway network. Beyond the financing issue, a critical challenge that needs to be addressed is for all of the countries concerned by each of the missing links to develop a shared vision of their relevance and level of priority in their respective development plans as well as coordinating their construction schedule (box 2.2).

A similar lack of coordination and prioritization across borders has prevented progress on the 129-km Dohazari—Gundum rail link in Bangladesh, which the Government of Bangladesh has long been hoping to develop as a bridge between South Asia and South-East Asia. However, the Government of Myanmar has not expressed interest in that particular cross-border connection.

In addition, delayed or stalled projects do not facilitate their acceptance by policymakers, development partners and the public, as they often incur cost. Thus, the 102-km Dohazari-Cox's Bazaar line section in Bangladesh, which is part of the above-mentioned link to Gundum, saw its construction cost multiply 10-fold between 2010, when the project was first approved, and 2016 with a change of route alignment requiring an additional US$1.6 billion for extra land acquisition and the construction of more bridges.[21] Similar reasons continue to delay the reconnection of rail infrastructure between Cambodia and Thailand because problems of compensation for people living along the rail line in Poipet (Cambodia) have yet to be resolved.[22]

BOX 2.2 MISSING LINKS IN CENTRAL ASIA AND NORTHERN AFGHANISTAN

Essential to improved connectivity in the subregion is the construction of a rail section from Kashi, China to Elok, Tajikistan through Kyrgyzstan, comprising two parts: (a) a 274-km section between Torugart, the border point between China and Kyrgyzstan, and Karamik, the border point between Kyrgyzstan and Tajikistan and (b) a 296-km section between Karamik and Elok, which is not yet designated as part of the Trans-Asian Railway network. Another option through Kyrgyzstan – also not part of the Trans-Asian Railway network at this stage – is via a shorter 200-km link from Irkeshtam, a border point between China and Kyrgyzstan, to Karamik.

However, these links will find their full justification only if linkages to the Islamic Republic of Iran materialize, either in the form of operationalization of the existing rail networks of Turkmenistan and Uzbekistan, or completion of the proposed rail infrastructure in Afghanistan' This is particularly the case with the 1,300-km east-west line in the northern part of the country from Nizhniy Pyandzh at the border with Tajikistan to Shamtigh at the border with the Islamic Republic of Iran.

Furthermore, the efficiency of international train operations in the network will, in large part, depend upon there being reasonable consistency in the technical design and operating practices of neighbouring railway systems. While this principle applies throughout the network, it is particularly crucial in situations where continuity of track gauge already exists. However, in a number of cases there is no consistency in the length of trains operated on either side of the border. This results in transit delays and cost penalties arising from the necessity to re-marshall or adjust loading at the border. Similar incompatibilities occur in braking systems or loading gauges. As countries complete infrastructure connectivity and launch more cross-border rail services, addressing technical incompatibilities will become a critical issue.

4. Selected rail connectivity projects in the ESCAP region

The Belt and Road Initiative (BRI) launched by the Government of China offers a long-term plan to deepen economic integration, support trade, investment and infrastructure development across the vast expanses of the Euro-Asian continent. A mainstay of BRI is the development of Economic Corridors that would incorporate different modes of transport, consider the development of adjacent land, connect industry clusters, synchronize supply chains and, most importantly, serve the lives of communities, small or large. In a regional context,

BRI Corridors would encourage the joint planning of initiatives based on a shared vision of development. They would also focus on the entire transportation needs along a wide corridor and permit greater rationalization of investment. Finally, they would also create "network effects" by which countries with more limited funding capabilities would be able to implement projects that they could not envisage on their own, while gaining access to technologies and technical know-how.

With BRI as a backdrop, policymakers of the region are giving fresh consideration to, and accelerating the implementation of a number of projects.

(a) Agartala (India)-Akhaura (Bangladesh) rail link

The construction of the 15-km broad-gauge[23] track section between Agartala (India) and Akhaura (Bangladesh) will considerably improve connectivity between Bangladesh and India as well as between India's north-eastern States and central India. Once the project is completed, travel distance between Agartala and Kolkata will be 514 km compared to the current 1,613 km via Lumding and New Jalpaiguri (i.e., the so called "chicken neck"). At the same time, the link will provide India's north-eastern States with faster access to the port of Chittagong in Bangladesh. The state-owned Indian Railway Construction Company will lay the track on the Indian side and Bangladesh Railway will lay the remainder on its side. The overall cost of the project is reported to be US$145 million.

The Development of North-Eastern Region Ministry will bear the cost of the project in India while the External Affairs Ministry will bear the cost in Bangladesh. It will take an estimated 30 months to complete the project. The Government of Bangladesh has signed a memorandum of understanding with Chinese contractors to enhance capacity and harmonize track standards through the double-tracking and re-gauging from metre gauge to broad gauge of the Dhaka—Chittagong main line via Akhaura and Comilla. In the longer term, this link could offer rail connectivity between South Asia and South-East Asia after rail connections between Myanmar and India or Myanmar and Bangladesh are realized.

(b) Afghanistan's rail connectivity developments and its wider geographic implications

In late 2016, an 88-km rail section was opened between Atamyrat, Turkmenistan and Aqina, Afghanistan. Although the part of the section located in Afghanistan is only 3 km, the next stage of the project will extend it by 35 km to Adkhoy with a 420-km section from Adkhoy to Nizhniy Pyandzh at the Tajik-Afghan border planned to be constructed in the near future. This line is a key element in the railway development master plan of the Government of Afghanistan and is part of a 1,300 km east-west corridor from Nizhniy Pyandzh to Shamtigh at the border with the Islamic Republic of Iran. On the Iranian side, construction work has been completed up to the border with a 30-km section to Ghorian station in Afghanistan inaugurated in August 2017, thereby marking the beginning of rail operation between the two countries. Branch lines from Tajikistan, Turkmenistan and Uzbekistan to this corridor would substantially improve transit for the landlocked countries of Central Asia to the Iranian port of Bandar Abbas and in future to the container port currently under development at Chabahar.

In the longer term, this corridor would be part of a wider transport route between China and the Islamic Republic of Iran, once the missing link between China, Kyrgyzstan and Tajikistan has been realized. The link is receiving renewed attention under BRI. Essential to improved connectivity in the subregion, the project would see the construction of a rail section from Kashi, China, to Elok, Tajikistan, through Kyrgyzstan, comprising two parts: (a) a 274-km section between Torugart, the border point between China and Kyrgyzstan, and Karamik, the border point between Kyrgyzstan and Tajikistan and (b) a 296-km section between Karamik and Elok which is not yet designated as part of the Trans-Asian Railway network. Although not part of the Trans-Asian Railway network at this stage, another option through Kyrgyzstan is via a shorter 200-km link from Irkeshtam, another border point between China and Kyrgyzstan, to Karamik at the border between Kyrgyzstan and Tajikistan.

(c) India-Central Asia-Russian Federation corridor

The development of Chabahar into a container port of regional importance has also caught the interest of India which in May 2016 signed a trilateral Agreement with Afghanistan and the Islamic Republic of Iran to develop a transit sea-cum-land corridor which would travel from Mumbai to Chabahar by sea and on to Afghanistan and Central Asia by rail. The Government of India has committed US$500 million to the development of Chabahar, including a 600-km rail connection from the port to the existing Iranian rail network at Zahedan. Eventually, the corridor would support trade between India and Europe via the North—South Transport Corridor through Azerbaijan and the Russian Federation when the Qazvin-Rasht-Astara section has been completed.

(d) Singapore-Kuala Lumpur high-speed line

The planned construction of a 350-km high-speed passenger line between Kuala Lumpur and Singapore is another flagship connectivity project in the region. The project will address demand for cross-border movements which currently exceeds the capacity of the Causeway at Johor Bahru and is seen by the Government of Malaysia as a vehicle to create new dynamism for community development. In July 2017 the Land Transport Authority of Singapore and MyHSR[24] of Malaysia organized an industry briefing to 165 organizations, including rolling stock and system suppliers, engineering and legal consultants, as well as operators and construction companies. One aim of the briefing was to encourage companies to form consortia to participate in the tender to be called in late 2017 for designing, building, financing and maintaining all rolling stock and rail assets of the project. Expected to be completed in 2026, the project will cut journey time between the two cities to 90 minutes.

(e) China-Lao People's Democratic Republic-Thailand rail link

In late 2010, the Governments of China and the Lao People's Democratic People signed a framework agreement to build a "high-speed" line connecting the Lao People's Democratic People and Thailand, with the idea of further facilitating trade and investment among South-East Asian nations through better transport connections and enhanced logistics. Construction work for the 420-km single-track line started in June 2017. The work will require substantial engineering tasks as local topography requires the construction of 75 tunnels and 154 bridges, at an estimated cost of US$6 billion. This new line will connect at both ends, with new rail lines being envisaged or existed ones being upgraded in China and Thailand.

In China, work is ongoing to extend the Kunming-Yuxi line to Mohan on the border with the Lao People's Democratic People via a 504-km section that will be electrified and double-tracked to Jinghong and thereafter single-track to Mohan at the border between China and the Lao People's Democratic People. In Thailand, meanwhile, the Government recently approved US$5. 2 billion funding for constructing a 252-km railway that will cut the travel time between Bangkok and Nakhon Ratchasima from nearly six hours to less than one and a half hours when it is completed in 2021. The second phase of the project will extend the line from Nakhon Ratchasima to Nong Khai and across the Mekong River to Vientiane, thus realizing the first direct rail connection from Kunming to Singapore.

D. Status of dry port development in the ESCAP region

The provision of seamless and sustainable transport connectivity in support of market integration and economic dynamism offers a way forward to meet the increasing demand for mobility of goods and people, while reducing the environmental impact of the transport sector. A key prerequisite for the successful operation of an intermodal transport corridor is the development of intermodal facilities as critical centres where the numerous technical, operational and institutional interfaces that characterize these transport corridors are managed efficiently. This is necessary to guarantee that" (a) freight can switch modes without delays or damage; (b) regulations and procedures can be speedily and efficiently processed: and (c) associated services can be delivered. Dry ports are designed to fulfil these functions.

The concept of seamless connectivity conjures up the vision of an integrated transport system that allows goods and people to travel efficiently and "effortlessly" across modes and national borders. It requires policies to be coordinated, infrastructure gaps to be filled, technical standards to be harmonized, operational procedures to be synchronized, information and communication systems to be developed and cross-border legislation to be aligned. The tools through which these requirements can be tested are international intermodal transport corridors that: (a) incorporate different modes of transport; (b) consider the development of adjacent land; (c) connect industry clusters; (d) synchronize supply chains: and (e) most importantly, serve the lives of communities, small or large.

Indeed, dry ports create economic stimuli by attracting manufacturing, agricultural processing and associated activities. Transport and related services, such as freight forwarding, logistics, customs and sanitary services, would be available at these facilities. Other value-added services would include storage, warehousing, packing, grading, labelling and distribution.

In addition, dry ports could grow into Special Economic Zones with a much broader industrial and service base. Similar growth potential has existed around seaports that have brought prosperity to coastal areas by clustering economic activity and services, which, in turn, has attracted further economic factors of production in a self-perpetuating process.

Dry ports are an essential part of an inland trade distribution system; although related facilities bear different names across the region, they all share the common characteristic that their main functions are to complete customs and other border-crossing formalities for traded cargo, and to transfer this cargo between the different modes used for transportation between a port origin and an ultimate inland destination, or vice versa. In this regard, in acting as a conduit for international trade between origins and destinations or seaports, dry ports — in particular, rail- connected dry ports — are essential for landlocked countries.

Well-managed dry ports, particularly those located at a significant distance from a seaport, help reduce transportation costs and total transit time. Experiences from outside the region show successful dry ports have increased logistics efficiency and allowed a modal shift from road to rail or inland waterways, thereby supporting policies aimed at reducing carbon emissions within the logistics chain. In many countries in the Asia-Pacific region, dry ports and their associated transport links function as a conduit for international trade between inland points of origin or destination and seaports.

The Intergovernmental Agreement on Dry Ports, which entered into force in April 2016, was developed under the auspices of ESCAP to provide a uniform definition of a dry port of international importance, identify the network of existing and potential dry ports of importance for international transport operations, and propose guiding principles for their development and operation. The main objective of developing a regional dry port network is to expand trade opportunities by facilitating the uninterrupted movement of trade consignments between dry ports located in different countries. This can be achieved by consigning goods from a dry port in one country to a dry port in another, by minimizing border inspections and delays as well as by carrying out customs and other border control formalities, and securing the release of goods at the destination dry port.

However, the interconnection of dry ports requires that there be some consistency among them in terms of: (a) the services they provide; (b) their location in relation to trade-generating industry; and (c) their transport connections. While the Intergovernmental Agreement provides guidelines with regard to all of these factors, it is clear that the facilities identified by countries as dry ports under the Agreement fall within a wide range of types, infrastructure links and service functions. Some do not have authority or facilities for customs and other border control functions.

1. Selected dry port development projects in the ESCAP region

(a) Bangladesh

In Bangladesh, the Chittagong port handles the bulk of the country's container traffic, and is linked by rail to the Dhaka Inland Container Depot at Kamalapur, outside Dhaka's main railway station. It has been estimated that around 70 per cent of the container traffic processed at the port is destined for, or originates in the capital Dhaka. However, only 3 per cent of this traffic is moved inland by rail, with 67 per cent moving by road in break bulk form. This results in severe congestion on the Dhaka-Chittagong highway and around Kamalapur ICD.

Facing growing intermodal traffic, and with limited options to expand Kamalapur ICD, the Government of Bangladesh has long been considering the development of a new dry port at Dhirasram, north of Dhaka, under public-private partnership modalities. The proposal is for the dry port to be developed in parallel with a shift of garment-processing industries to areas close to its location on major trade routes to and from India in order to facilitate international trade. The objectives behind the Dhirasram project are to create adequate conditions for a modal shift from road to rail between Dhaka and Chittagong, improve the competitiveness of the garment industry and achieve seamless intermodal transport with countries of South Asia and beyond.

(b) Bhutan

Bhutan is a landlocked country and depends on neighbouring India for access to maritime ports. Much of Bhutan's exports and imports are processed through the Phuntsholing border point located on the border with India's State of West Bengal. With the country ranking 135 out of 160 in the World Bank global logistics performance indicators,[25] and facing an increase in international trade, the Government of Bhutan is giving priority to projects aimed at developing its logistics infrastructure. In this regard, a project was recently started to develop a dry port at Phuentsholing. Due to be built on about five acres of land, the dry port will house a customs department and streamline the work of other entities on-site. By facilitating customs clearance and encouraging the introduction of "one-window" services, the dry port is also expected to promote an efficient tax collection system. An added benefit will be reduced traffic congestion in the town area that all vehicles currently go through. The Asian Development Bank is funding 81 per cent of the US$2.5 million project cost under its South Asia Subregional Economic Cooperation (SASEC) programme. Scheduled for completion in late 2018, the dry port is expected to handle more than 10,000 Twenty Foot Equivalent Units (TEU) per annum. The Government of Bhutan also plans to develop a dry port close to the Phasaka industrial estate, 17 km from Phuentsholing which, when completed, will be the country's first full-scale dry port with a planned annual capacity of 327,000 TEU by 2035.

(c) Islamic Republic of Iran

The geographical location of the Islamic Republic of Iran enables it to act as a transit point for trade between Asia and Europe, and provides Central Asian countries access to ports on the Persian Gulf. A total of nine potential dry ports have been identified in the country, the most important of which is the Aprin dry port located 21 km southwest of Tehran and in close proximity to industrial zones. In late 2016, a contract was awarded to develop the site into the country's largest dry port and a modern rail logistics terminal under a build-operate-transfer (BOT) concession comprising a three-year construction phase and 22 years of operation. Phase I of the project will see the development and operation of a 55-hectare area with an annual capacity of 400,000 TEU.

The project complements the developments by the Iranian Islamic Republic Railways, which has 11,000 km in operation with another 9,500 km, planned or under construction. The project has taken on added relevance with the launch of new international intermodal services such as the container block-train operated between Yiwu in China and Tehran in January 2016. The site will also process customs clearance for inbound containers moved by rail/road directly from the port of Bandar Abbas.

(d) Russian Federation

The Government of the Russian Federation has launched a dry port development policy aimed at rationalizing the use of port infrastructure by moving non-core port activities to inland locations and increasing the efficiency of rail operations in ports. The Sviyazhsky dry port (near Kazan, Tatarstan) is being constructed as one of the key multimodal hubs for transit transportation of goods between Asia and Europe. The facility will comprise a rail and road multimodal terminal with warehouses and container yards, a river port, rail and road links and yards for trans- shipment operations. The project is being implemented with both government and private investment. The first stage of the project was completed in 2015, and the facility is expected to be commissioned in 2017.

In November 2016, the Russian Railways Company and Yingkou Port (China) concluded an agreement on strategic partnership and joint development of multimodal logistical centres. In particular, Yingkou Port will invest in the development of the Bely Rast dry port in the Moscow region. The Russian Railways Company is also developing projects for creating a network of Terminal and Logistics Centres (TLC) that are linked to the railway network across the Russian Federation. The project includes the creation of two railway ports — Primorsky at Ussuriysk, Primorsky Region, and Baltivisky at Shushary (suburb of Saint Petersburg) — that are under construction, with another railway port planned at Tamansky in the Krasnodar region. The railway ports will allow transfer of non-core operation at seaports to the railway ports, while also providing storage consolidation and customs clearance services on site.

(e) Tajikistan

As a landlocked country, and due to limited rail connections with neighbouring countries, Tajikistan has been attaching priority to the establishment of truck terminals at border and inland sites for the purpose of clearing and transferring international cargo from foreign to Tajik trucks. Plans are under consideration for the development of two full-scale dry ports at Tursunzade, 62 km west of Dushanbe on the border with Uzbekistan, and Nizhny Pyandzh, 178 km south of Dushanbe on the border with Afghanistan. Both projects include a rail component. The Government of Tajikistan is also considering the construction of a new terminal at Jirgital near the border with Kyrgyzstan.

(f) Thailand

As part of its policy to develop the Greater Mekong Subregion (GMS) into a hub of economic activities, the Government of Thailand is implementing a three-pronged strategy to: increase connectivity through the development of infrastructure; improve competitiveness through the integration of markets and production processes; and build a greater sense of community through projects that seek to boost local economic activities as well as develop human resources and skills in remote areas. The strategy includes the development of 19 national freight terminal projects, with eight located in border areas and the rest in provincial hubs, that are aimed at linking land freight transport across the country. Among them, the Chiang Khong Intermodal Facilities in Chiang Rai province of northern Thailand is receiving priority. Located at the border with the Lao People's Democratic Republic and close to Yunnan, China, the site is to be developed in two phases through public-private partnerships with an operating concession of 30 years. The Government of Thailand will finance basic infrastructure and land procurement, while the private sector will invest in equipment, management and maintenance of the facility. The first phase, started in June 2017, will last 24 months and will involve construction of the facility, while the second phase will include linking the facility to the rail network of Thailand. Due to become fully operational in 2020, the sites will eventually cover a total area of more than 528,000 m^2 and will have a starting capacity of 270,000 TEU per annum.

(g) Viet Nam

In early 2017, the Government of Viet Nam issued a decree laying down a number of principles related to the development of intermodal facilities such as dry ports. The Decree stipulates newly-constructed facilities must have a minimum area of five hectares and be up-to-date on environmental protection and fire and explosion prevention standards. The Decree further states that these facilities should be able to load and unload goods transported in containers to be further moved to seaports and other locations, and to be able to carry out customs procedures, offer storage capabilities as well as other services such as container repair. The objective of the Government of Viet Nam is to raise to 6 million TEU the annual handling capacity of intermodal facilities across the country by 2020 and 14.2 million TEU by 2030. The policy of the Government also makes room for public-private partnerships for the development of these facilities.

The construction of a dry port outside Ho Chi Minh City has a budget of US$260 million and will occupy 60 hectares, attracting the relocation of enterprises currently operating in the Truong Tho Port area in Thu Duc district, north-east of Ho Chi Minh City. According to the Ho Chi Minh City Department of Transport, annual cargo throughput at the Truong Tho port complex averaged a 12 million tons in late 2015, which was four times higher than the original design capacity planned for 2020.[26] In addition to improving logistics for industries operating in the area, the project is also aimed at reducing growing traffic congestion on the Hanoi Highway and pollution around Truong Tho port.

E. Development of seaports

For most ESCAP member countries, seaports serve as the gateway to freight and passenger transport, and many countries are aiming to develop their ports as one of the key drivers of their economic and social growth. In 2016, port volumes in Asia and the Pacific reached 384 million TEU and, according to estimates, will reach around 430 million TEU in 2020. Ports are facing new challenges due to the deployment of ultra-scale container ships of more than 20,000 TEU, the reorganization of shipping alliances, moves toward sustainable port operation and demand for improved hinterland connectivity.

The main points covered in this section include :

- Port traffic volumes and recent trends;
- Trend of large-sized vessels and impact on port development;
- Competition among ports in the region;
- Investment in infrastructure;
- Developing resilient ports;
- Port management systems;
- Changes in the role of ports;
- Demand for intermodal connectivity.

1. World and Asia-Pacific container traffic

In 2016, global maritime container cargo volume is estimated to have reached 140 million TEU, while global port container cargo volume is estimated to have been 691 million TEU (table 2.3). The port container traffic is several times higher than the maritime container traffic, because both loading and unloading occur twice in the port, and the number of container handling increases in the transshipment process.

The world container traffic volume is expected to grow at a CAGR of 3 per cent from 2013 to 2020, while Asia-Pacific's portion of global container trade volume is expected to grow from 58 per cent to 59.1 per cent during the same period (table 2.3). The projected container growth rate of 3 per cent is around half that recorded during the past decade.

Table 2.4 shows the forecast of container trade in Asia and the Pacific by subregion. China is expected to account for 53 per cent of regional port container throughput in 2020 and 31 per cent of world container throughput.

In China and most Asian countries, export containers were overwhelmingly higher than import containers.

For example, in China, loaded export containers amounted to 46 million TEU in 2015 while imports were 21 million TEU in the same year. Trade is expected to remain unbalanced, with export containers approximately 2.2 times greater than import containers. Regional port traffic in Asia-Pacific is continuing to grow steadily and this trend is expected to continue for the foreseeable future. In particular, the growth of Chinese ports is prominent, with nine ranking in the world's top 20. While Asian port container volume increased, Singapore and Hong Kong SAR traffic declined in 2015, due to an increase in direct calls to individual ports by global shipping companies and the reorganization of their fleets.

The world container traffic volume is expected to grow at a CAGR of 3 per cent from 2013 to 2020, while Asia-Pacific's portion of global container trade volume is expected to grow from 58 per cent to 59.1 per cent during the same period (table 2.3). The projected container growth rate of 3 per cent is around half that recorded during the past decade.

Regional port traffic in Asia-Pacific is continuing to grow steadily and this trend is expected to continue for the foreseeable future. In particular, the growth of Chinese ports is prominent, with nine ranking in the world's top 20 (Figure 2.9). While Asian port container volume increased, Singapore and Hong Kong SAR traffic declined in 2015, due to an increase in direct calls to individual ports by global shipping companies and the reorganization of their fleets.

For some ports, the volume of trans-shipment cargo is much higher than import and export cargo. These ports, with geographical advantages, have adopted key strategies to attract trans-shipment cargo with efficient port services, competitive freight rates and contracts for exclusive terminal use with large shipping companies.

In the case of Tanjung Pelepas port, the trans- shipment cargo volume is above 90 per cent of total throughput. Global alliance shipping companies, such as CKYHE, G6, MSC and Maersk of 2M, and major shipping companies such as CMA CGM, Evergreen and Hapag Lloyd call at the port.

As shown in figure 2.10, trans-shipment cargo by major ports in the Asia-Pacific region is shared between Tanjung Pelepas (92 per cent), Singapore (85 per cent), Busan (52.6 per cent), Port Klang (66.7 per cent), Hong Kong SAR (31.8 per cent), Kaohsiung (46.4 per cent) and Colombo (76.5 per cent).

TABLE 2.3 PROJECTED WORLD AND ESCAP REGION'S PORT CONTAINER TRAFFIC (UNIT: '000 TEU)

YEAR	2013	2014	2015	2016	2017	2018	2019	2020
Container traffic volume	642 308	675 242	682 260	691 085	707 571	728 773	752 017	774 887
ESCAP region (Share, %)	373 147 (58.0)	394 857 (58.4)	400 468 (58.6)	407 419 (58.9)	416 843 (58.9)	429 706 (58.9)	444 128 (59.0)	458 314 (59.1)

Source: Drewry, Container Forecast and Annual Review 2016/2017. * Including empties and trans-shipment.

TABLE 2.4 FORECASTING FOR ESCAP PORT CONTAINER TRAFFIC

Source: Drewry, Container Forecast and Annual Review 2016/2017.
Unit: '000 Twenty Foot Equivalent Units.

SUBREGION	2013	2016	2020
North Asia	59 593	61 650	66 943
Greater China	195 176	215 725	243 404
South-East Asia	89 064	95 199	106 978
South Asia	18 581	23 253	28 005
Oceania	10 733	11 592	12 984
ESCAP total	373 147	407 419	458 314

FIGURE 2.9 TOP 20 ESCAP PORTS IN 2014-2015 (1 MILLION TEU)

Source: http://www.worldshipping.org.
*Keihin Port is Japan's super port hub on Tokyo Bay and includes Yokohama, Kawasaki, and Tokyo.

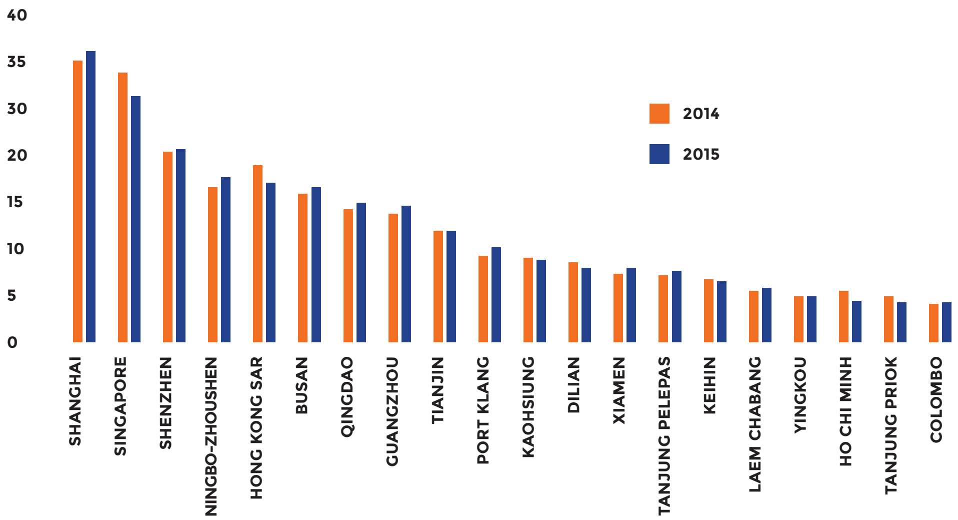
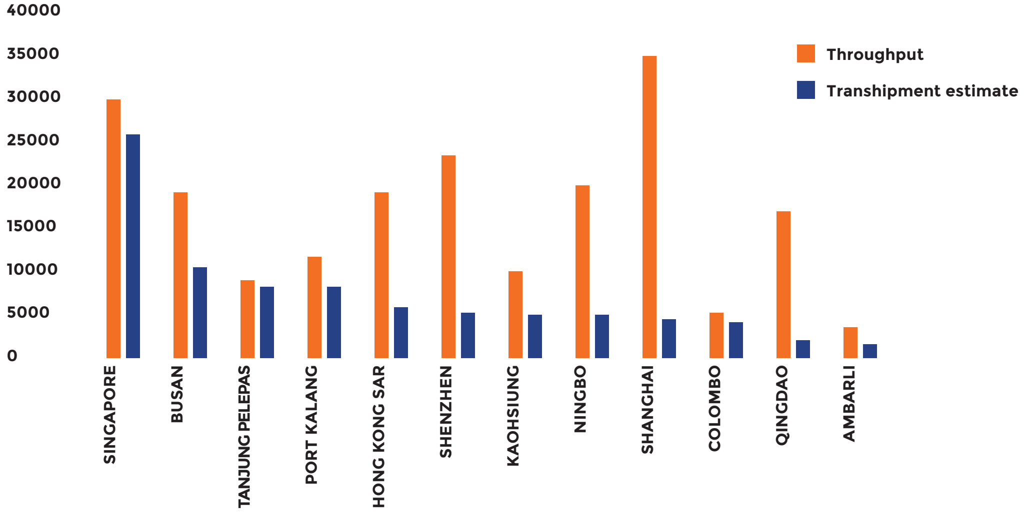


FIGURE 2.10 ESTIMATED GLOBAL THROUGHPUT AND TRANS-SHIPMENT VOLUMES IN ESCAP REGION IN 2016-2017 ('000 TEU)



2. Trends in port development and their impact

Ports in the Asia-Pacific region are facing new demands due to the deployment of ultra-scale container ships of more than 18,000 TEU capacity, the reorganization of shipping alliances, sustainable port operation and improvement of hinterland connectivity.

(a) Large scale of port development

An outstanding feature in the development and operation of major ports around the world is the large scale of port development, most recently driven by vessel upsizing by shipping companies seeking economies of scale. This trend is prominent in container shipping because transportation cost per slot unit is lowered as ship size increases.

Figure 2.11 shows the growth in size of container ships. Since 2010, orders for energy-saving, high efficiency and eco-friendly vessels have increased significantly due to oil prices and environmental regulations. The aggressive growth has led to excessive supply of vessels, exceeding demand. As a result, many shipping companies have suffered deficits due to a decline in freight rates and fierce competition; in 2017, oversupply has continued as previously ordered vessels continue to flow into the market.

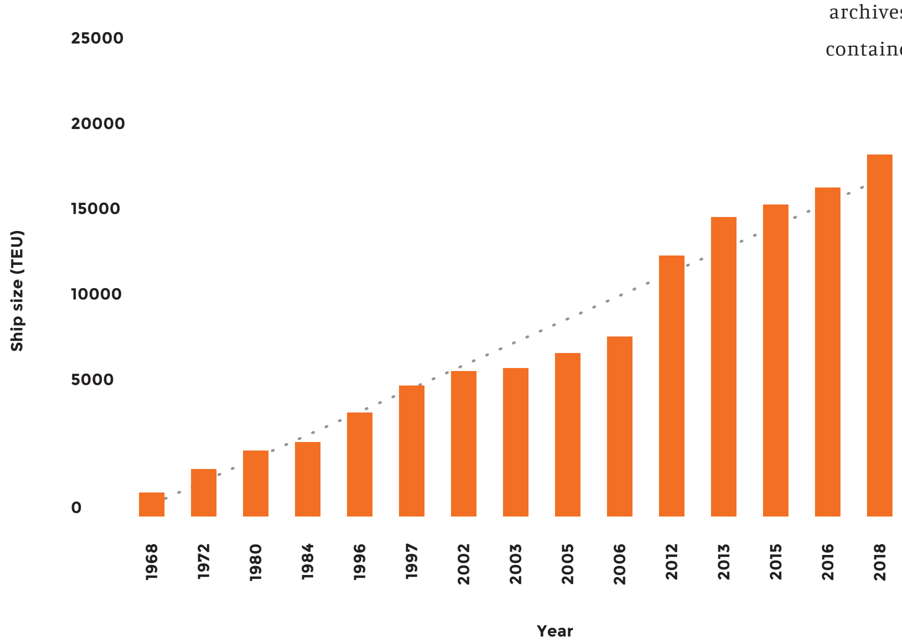
Vessel upsizing has a great influence on development and operation of ports. For example, vessel upsizing requires additional port investment such as the extension of the berth length, and dredging of the waterway and quay to ensure the necessary depth. In addition, high-performance cargo handling equipment has to be added, due to the increase in vessel width and demand for fast turnaround times.

With thousands of containers being unloaded and loaded at the same time, additional marshalling yards are needed, and loading and unloading equipment within the terminal needs to be upgraded together with computer control systems.

Perhaps most importantly is the need to strengthen hinterland transportation networks for distribution of containers to final consumers. This requires addition alintegrated investments in roads, railways and inland waterways.

FIGURE 2.11 FIFTY YEARS OF CONTAINER SHIP GROWTH

Source: http://worldmaritimenews.com/archives/155866/infographic-50-years-of-containership-growth/.Infographic: Allianz.



3. Selected seaport projects in the ESCAP region

The world's biggest automated container terminal, "Shanghai International Shipping Centre, phase 4 of Yangshan deep water port" will be opened in December 2017.

The initial handling capacity of this unmanned terminal is 4 million TEU per year and is planned to reach 6.3 million TEU per year with containers being loaded/unloaded by computer controlled cranes and transported by unmanned automated guided vehicles (AGV). Yangshan port phase 4 currently has 16 gantry cranes, 80 rail cranes, and 88 automated guided vehicles (AGVs) and is among the most advanced in the world. The transport connectivity of Yangshan port will be strengthened through a four-lane, high- speed rail track and a six-lane road link over an 11-kilometre bridge, which is now under construction.

YANGSHAN DEEP WATER PORT

Source: https://www.topchinatravel.com/china-attractions/yangshan-deep-water-port.htm.

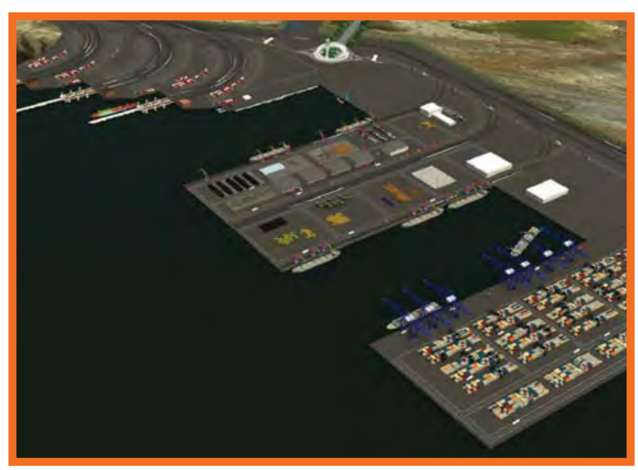
The Indonesian authorities have, since 2014, been implementing a complex set of measures known as the "ninth stimulus package". One trigger for this package was the high cost of logistics, notably determined by port-related regulations and procedures, but also by the execution of mega infrastructure projects without prior comprehensive studies and involvement of all stakeholders (notably the logistics services providers).

The Government included in the "stimulus package" three main directions: (a) a move to a single billing scheme for port services conducted by state-owned enterprises (electronic system); (b) inclusion of the "InaPortnet" (monitoring the flow of goods in harbours) in the National Single Window System; and (c) making the use of the Indonesian rupiah mandatory for payments related to transportation activities.

The implementation between 2015 and 2019 of the measures foreseen in the package, with a budget of US$55 billion, will have an impact on 24 commercial ports (and more than 1,000 non- commercial ports) as well as on the procurement of new vessels. The overarching goal of the "ninth stimulus package" is to reduce logistics costs from 23.5 per cent in 2014 to 19.2 per cent by 2019.[30]

The Government of Azerbaijan has been developing the new "Baku International Sea Trade Port" on the Caspian Sea, which will be finalized in 2018 with a capacity of 25 million tonnes and 1 million TEU. The port will have two terminals (one for containers and one for ferries) and seven berths (two for ferries and five for dry cargo).

BAKU INTERNATIONAL SEA TRADE PORT



Source: Presentation on Transport Infrastructure Development in the Republic of Azerbaijan by the Ministry of Transport, Communications and High Technologies of Azerbaijan, Beijing, 5-6 July 2017.

In Cambodia, the Government approved the Development Concept of Sihanoukville Port up to 2030. It includes a multipurpose terminal to include a dry bulk cargo terminal, an oil terminal and a logistics base, with the procurement of handling equipment including two quayside gantry cranes, five rubber-mounted yard gantry cranes, three top lifters (10 tons), eight tractors and chassis, and the improvement of container terminal management systems together with improvement of port security and maritime safety.

In Georgia, large-scale infrastructure projects include the deep-sea port of Anaklia on the Black Sea, which will be constructed in nine phases and will increase the handling capacity from eight million tonnes in the first phase to 100 million tonnes. The total cost of the project will amount to US$2.5 billion, of which US$600 million has been budgeted for the first phase. The Government contribution amounts to US$100 million and will cover railway/road connections to the port.

THE DEEP-SEA PORT OF ANAKLIA, GEORGIA

Source: Presentation on "Georgia's Contribution to Regional Connectivity by the Ministry of Economy and Sustainable Development of Georgia", Beijing, 5-6 July 2017.

In India, under the long-term Sagarmala initiative, 415 projects, with an investment of approximately US$123 billion have been identified for implementation between 2015 and 2035. They include: port modernization and new port development (six new port locations have been identified); port connectivity enhancement; port-linked industrialization; and coastal community development. Increasing the share of coastal shipping and inland navigation are also key objectives of the Sagarmala Programme.

In Turkey, more than 85 per cent of the country's foreign trade is carried by the maritime sector; thus, high priority is given to port development. Although 80-85 per cent of container transport is operated by private and privatized ports, public investment plans under build-operate-transfer (BOT) schemes include developing the ports of Çandarlı (estimated cost, US$1.24 billion, with 4 million TEU capacity), Mersin Port Container Terminal (estimated cost, US$3.8 billion, with 20 million TEU capacity) and Filyos Port (estimated cost, US$870 million, with 25 million tonnes/year capacity).

4. Increasing demand for cruise terminals

The Asian and Pacific region is one of the fastest -growing areas for the cruise industry.

The Cruise Lines International Association (CLIA) reported that the number of cruises in Asia increased by 40 per cent, from 43 ships operating in 2013 to 60 in 2016, and the number of voyages increased by 81 per cent, from 861 in 2013 to 1,560 in 2016. Furthermore, the number of operating days of cruise ships increased by 84 per cent, from 4,307 days in 2013 to 7,918 days in 2016, while passenger capacity increased 105 per cent, from 1.51 million in 2013 to 3.1 million in 2016.[31] According to CLIA's estimates, China will be the second-largest global cruise market by end-2017.

From 2015 to 2016, the number of cruise ship calls increased from 646 to 1,526 ships in Japan, from 300 to 850 in China, from 377 to 745 in the Republic of Korea and from 316 to 466 in Viet Nam. To cope with such a large increase in the number of cruise ships, Asian countries are developing dedicated terminals as well as various tourist products to attract cruise passengers. A major concern for many countries is the provision of transportation services and touring facilities for cruise tourists when they arrive.

FIGURE 2.12 OVERVIEW OF ASIA CRUISE INDUSTRY,2016

Source: http://www.cruising.org/docs/.
No signs of slowing down.
Unit: 1,000 persons'

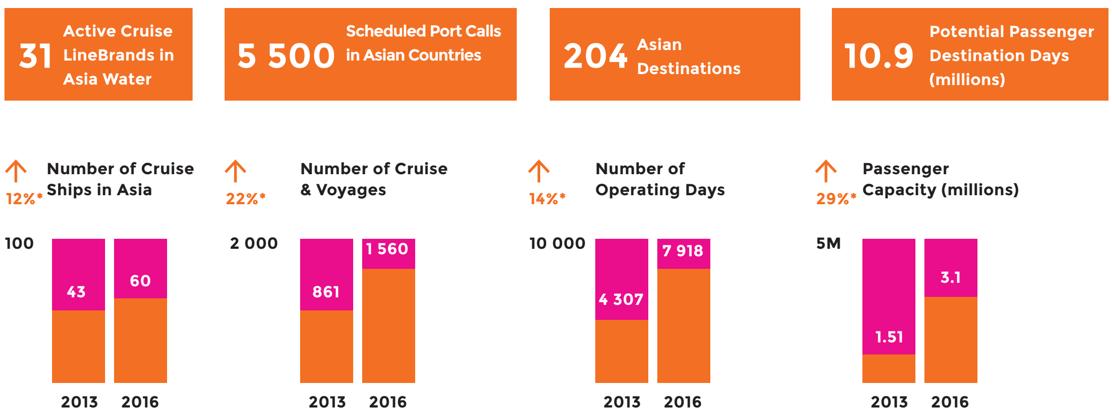
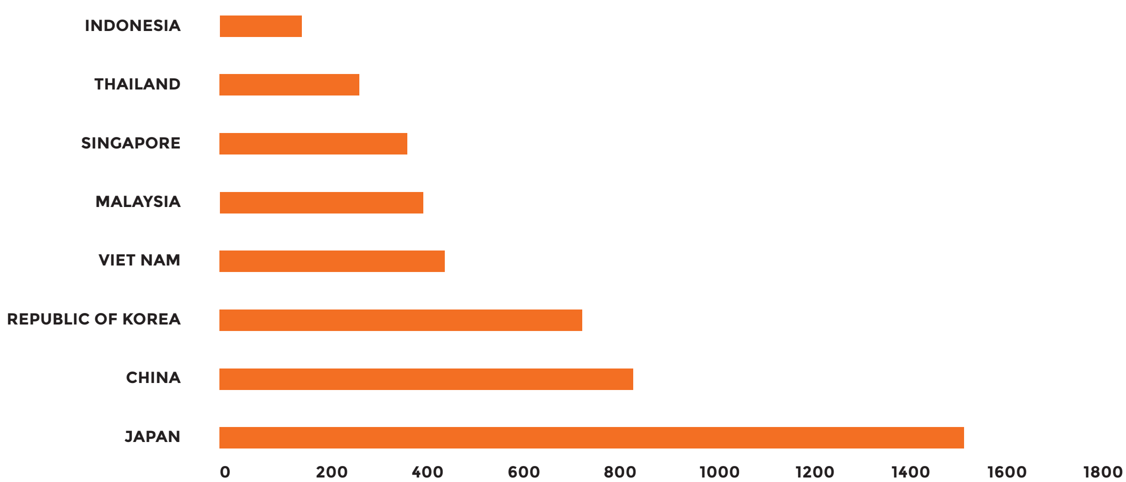


FIGURE 2.13 TOP DESTINATION IN ASIA AND THE PACIFIC BY TOTAL CALLS,2016

Source: "2016 Asia cruise trends" by Cruising Lines International Association (LICA).



5. Automation and ICT in port operation

Automation and informatization (the use of information communication technology in assisted knowledge processing systems and networks) are key factors in port development and operation. Various forms of automation exist in major ports in Asia-Pacific, ranging from semi-automation of unloading equipment in container yards to fully automated terminals, including quay cranes. Automation improves port productivity, solves labour problems, prevents human accidents and leads to eco-friendly ports. Terminal automation, which began in Europe, was originally introduced to decrease costs and solve labour problems; however, it is now being introduced to improve overall operating efficiency of terminals. Terminal automation relies heavily on information and communication technologies and is expanding by combining new technologies such as IoT, Big Data and Cloud systems. Automation and/or informatization are now a pre- requisite when opening a new terminal, and are being considered for retro-fitting for older, existing terminals.

BOX 2.3 XIAMEN OCEAN GATE CONTAINER TERMINAL CO

In October 2012 COSCO Pacific Limited, Shanghai Zhenhua Heavy Industry Co., Ltd. (ZPMC) and Xiamen Haicang Investment Group Co., Ltd. signed a cooperation framework agreement for the automation of the container terminal of Xiamen Ocean Gate Container Terminal Co. (XOCT).

The automated container terminal of XOCT is located on berth no.14 and part of berth no.15 in Haicang Bonded Port Area, Xiamen. The planned throughput of the project was 780,000-910,000 TEUs per year, which is equivalent to a 20-40 per cent increase over the original planned capacity using traditional technology. In 2016, the objectives of the cooperation agreement had already been attained. e project used automated simulation systems to develop and analyze elements such as horizontal transportation, loading-unloading handling of yard and route optimization and accelerating the upgrade of the intelligent system.

According to estimates, the unmanned computer-controlled automated container terminal can save at least 25 per cent energy costs and reduce 16 per cent of carbon emissions, compared with a traditional terminal, as a result of using electric power. The automated terminal not only reduces the cost of labour, but also improves safety and reduces noise pollution.

Source: http://www.coscoyh.com.cn/en/AboutUs.aspx?id=53..

In the past, information and communication technologies were used for individual parts of terminal operation — for example, management of the berth, yard and gate. It became common to enhance the operational efficiency of the entire terminal through a port management information system (PORTMIS) or Single Window facility to improve productivity and provide logistics services through information sharing and cooperation with related stakeholders.

Port informatization is now being developed into sharing logistics information between countries and regions, beyond the limits of an individual port or country. The illustrative example of this case is NEAL-Net,[32] put in place through cooperation between China, Japan and the Republic of Korea.

Recent developments in port operation informatization include the use of cutting edge information communication technology, with the Internet of Things (IoT) and Big Data being at the core. Recent experience of the ports of Ningbo-Zhousan (China), Busan (Republic of Korea) and Singapore show that it is also possible to establish monitoring systems that can make advanced predictions and improve plans on various issues such as equipment, facilities and human resources. Many countries in Asia and the Pacific are still using old information systems in which sharing and utilization of information related to transportation and logistics services is limited. Integrated information systems such as Single Windows are becoming common; however, in general they are owned and operated by customs authorities.

6. Sustainable port development and operation

There is a growing consensus that policies and infrastructure facilities that support environmentally -friendly measures are needed at the port level. The concept of eco-friendly ports requires strengthening policies to improve energy efficiency within ports and hinterlands in order to create GREEN Ports, which may stand for "Gas Reducing, Energy Efficiency, Nature- Friendly".

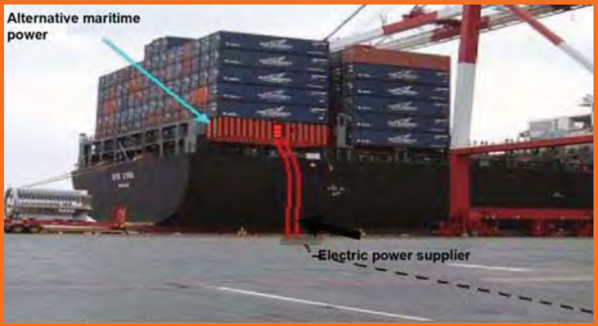
Port authorities are increasingly adopting and applying strategies to build green ports and make existing ports "greener". As shown in the XOCT case of Xiamen in China, equipment in automated terminals can use electricity as a power source so that emissions of carbon dioxide and various air pollutants are greatly reduced. However, legal and institutional support is essential for sustainable implementation of eco-friendly transport policies.

To cope with environmental pollution and climate change, the International Maritime Organization (IMO) has strengthened regulations on (a) pollution caused by marine sewage and waste, and (b) the use of eco-friendly energy resources as well as (c) ship fuel usage, recycling and pollution management.

BOX 2.4 ALTERNATIVE MARITIME POWER

Alternative maritime power (AMP) supplies the necessary energy from onshore to power ship control, interior accommodation and container refrigeration while the ships are at berth, as an alternative to the onboard auxiliary engine, thus reducing the emission of harmful substances and air pollution.

The implementation of the Convention on Climate Change to reduce greenhouse gas emissions is emerging globally as a key issue. In many countries, AMP has been adopted for reducing the emission of harmful substances in port areas.



Source: Korea Maritime Institute study on "National Strategies to Build Eco-friendly Port Construction and Management, 2016".

Environmentally-friendly port policies contribute to the achievement of the 2030 Agenda for Development by responding to climate change and meeting the goals of sustainable transport connectivity. National targets and strategies for ports and hinterland logistics complexes will contribute to the achievement of the Sustainable Development Goals. Australia, China, Japan, the Republic of Korea and Singapore have all made progress in promoting the construction of eco-friendly ports. However, in most countries work remains at an early stage; although environmentally-friendly port systems have not been established, environmentally-friendly policies have been introduced for emission reduction and energy saving in some ports or specific terminals in those countries, and many provide alternative maritime power supply.

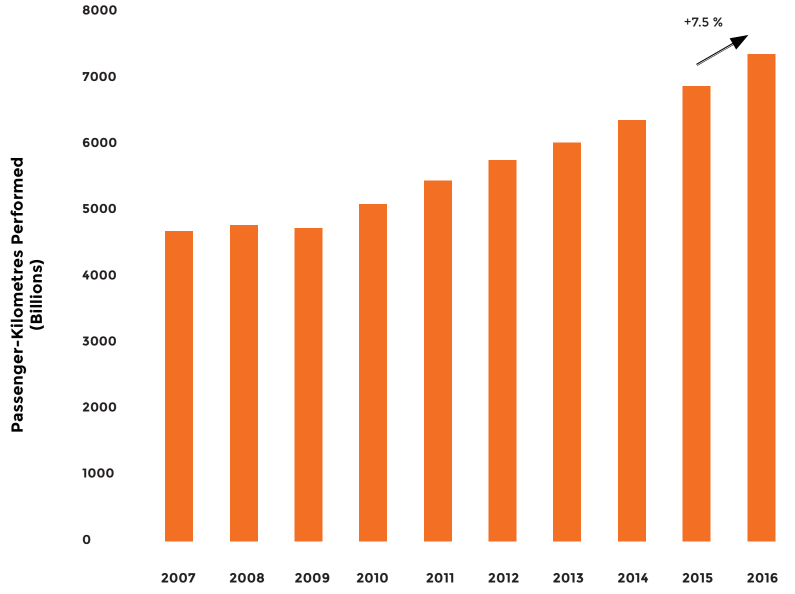
F. Air transport

In 2016, the total number of passengers carried on scheduled services rose to 3.8 billion, which was 6.6 per cent higher than 2015, according to preliminary statistics compiled by the International Civil Aviation Organization (ICAO). The number of departures reached 35.4 million globally in 2016, a 3.6 per cent increase compared to 2015.

Passenger traffic, expressed in terms of total scheduled revenue-passenger-kilometres (RPK) performed, posted an increase of 7.2 per cent, with approximately 7,124 billion RPK performed in 2016. Asia/Pacific remained the largest region for passenger traffic, with 33 per cent of total world traffic and posting 10.2 per cent growth in 2016, followed by Europe with 27 per cent of world traffic and growth of 5.5 per cent. North America, which accounts for 24 per cent of world traffic, grew 4.3 per cent. The Middle East region, representing 9 per cent of world traffic, recorded a growth rate of 11.2 per cent. The Latin America/Caribbean region accounted for 5 per cent of world traffic and grew 4.4 per cent. The remaining 2 per cent of world traffic was accounted for by African region airlines, who recorded growth of 6.9 per cent.

FIGURE 2.14 PASSENGER KILOMETRES PERFORMED – TOTAL SCHEDULED TRAFFIC

Note: More comprehensive air transport data are available at http://www4.icao.int/newdataplus.



International scheduled passenger traffic grew 7.4 per cent in RPKs in 2016, the same as in 2015. The main drivers of this growth were the carriers of China (which saw its international RPKs increase 26.4 per cent), Qatar (27 per cent increase), Republic of Korea (9.9 per cent increase) and the United Arab Emirates (10 per cent increase). European air carriers saw growth of 5.7 per cent and accounted for the largest share of international RPKs, at 37 per cent of the total. Asia-Pacific retained the second-largest share at 29 per cent, with growth of 9.5 per cent. The Middle East, which in 2015 had overtaken North America as the third-largest region, accounted for 15 per cent of international RPKs and recorded growth of 11.8 per cent in 2016. North America, which accounts for a 17 per cent share of international RPKs, grew 3.6 per cent. African carriers, which account for 3 per cent of international RPKs, grew 7.3 per cent compared with a negative growth of 0.2 per cent in 2015. Carriers in Latin America/Caribbean, which account for 4 per cent of international RPKs, experienced the largest decline in growth from 11 per cent in 2015 to 7 per cent in 2016.

Domestic scheduled passenger traffic grew 6.8 per cent in RPKs in 2016, down from the 7.6 per cent growth recorded in 2015. The main drivers of this growth were the carriers of the United States, China and India, which saw increased growth of 4.6, 11.8 and 23.4 per cent, respectively. North America, the world's largest domestic market (with a 42 per cent share of domestic RPKs), experienced 4.6 per cent growth in 2016, compared to 5.9 per cent growth in 2015. The Asia-Pacific region, with a share of 40 per cent, also grew strongly by 11 per cent in 2016 (9.9 per cent in 2015). Carriers of Europe, accounting for 9 per cent of domestic RPKs, saw growth of 4.2 per cent in 2016, compared with 7.3 per cent in 2015. The Latin America/Caribbean region, which accounts for a 7 per cent share, saw growth of 1.7 per cent. Carriers of the Middle East and Africa, which together account for 2 per cent of domestic RPKs, saw a decline of 1.1 per cent and a growth of 4.3 per cent, respectively.

Growth of freight traffic, expressed in terms of scheduled total freight tonne-kilometres performed (FTKs), was at 3.8 per cent in 2016, up from 1.3 per cent recorded in 2015. This growth was mainly due to the strong second half of 2016 for air freight, pointing to improving trade activity in 2017. Approximately 53 million tonnes of freight were carried in 2016. Middle East carriers recorded growth of 7.2 per cent, followed by Europe with 5.7 per cent, Asia-Pacific 2.9 per cent, Africa 2.8 per cent and North America 2.1 per cent. Carriers of Latin America and the Caribbean saw their growth rates contract by 1.8 per cent compared with the previous year.

1. Passenger traffic

(a) Passenger traffic performance

Asia and the Pacific region air carriers recorded an annual 10.2 per cent growth of RPK in 2016, up from the 9.8 per cent growth in 2015. The 2016 growth was supported by the expansion of air carriers such as China Eastern Airlines (+15.2 per cent), Hainan Airlines (+29 per cent) and Indigo (+28.1 per cent), along with most of the region's airlines. Those air carriers expanded their network and benefited from the strong demand for air transport by the Chinese domestic market (+11.8 per cent), and more globally to and from the Asia-Pacific region. Airlines of China (including Hong Kong SAR and Macao SAR), Japan and India accounted for 56.6 per cent of Asian and Pacific air carriers' total passenger traffic, and showed a traffic variation of +13.4 per cent, +5.8 per cent and +16.7 per cent in terms of RPK, respectively.

International traffic of air carriers in Asia and the Pacific represented 54.9 per cent of the region airlines' total RPK and they recorded 9.5 per cent annual growth in 2016. China is the largest domestic market in Asia and the Pacific, with more than 58.9 per cent of domestic traffic in the region. India and Japan ranked second and third, respectively, in the domestic market. Domestic traffic in Asia and the Pacific showed an 11 per cent growth in RPK in 2016 with capacity growth of 9.5 per cent.

(b) Capacity

Airlines in Asia and the Pacific increased capacity in available-seat-kilometres (ASK) by 9.4 per cent in 2016, up from 7.9 per cent in 2015. The capacity in ASK increased 9.3 per cent for international services and 9.5 per cent for domestic services. In absolute terms, States that contributed the most to increased capacity were China (including Hong Kong SAR and Macao SAR, 13 per cent), India (16.2 per cent) and Viet Nam (29.9 per cent).

(c) Passenger load factor

The passenger load factor increased 0.6 percentage points in 2016, to reach 79.7 per cent compared with 79.1 per cent in 2015 (figure 2.15). The passenger load factor was 78.5 per cent for international services and 81.1 per cent for domestic services (figure 2.15).

2. Freight traffic

Cargo traffic performed by carriers of Asia and the Pacific recorded an annual growth of 2.9 per cent in 2016 in terms of freight-tonne-kilometres (FTK), compared to a 2.1 per cent increase in 2015 (figure 2.16).

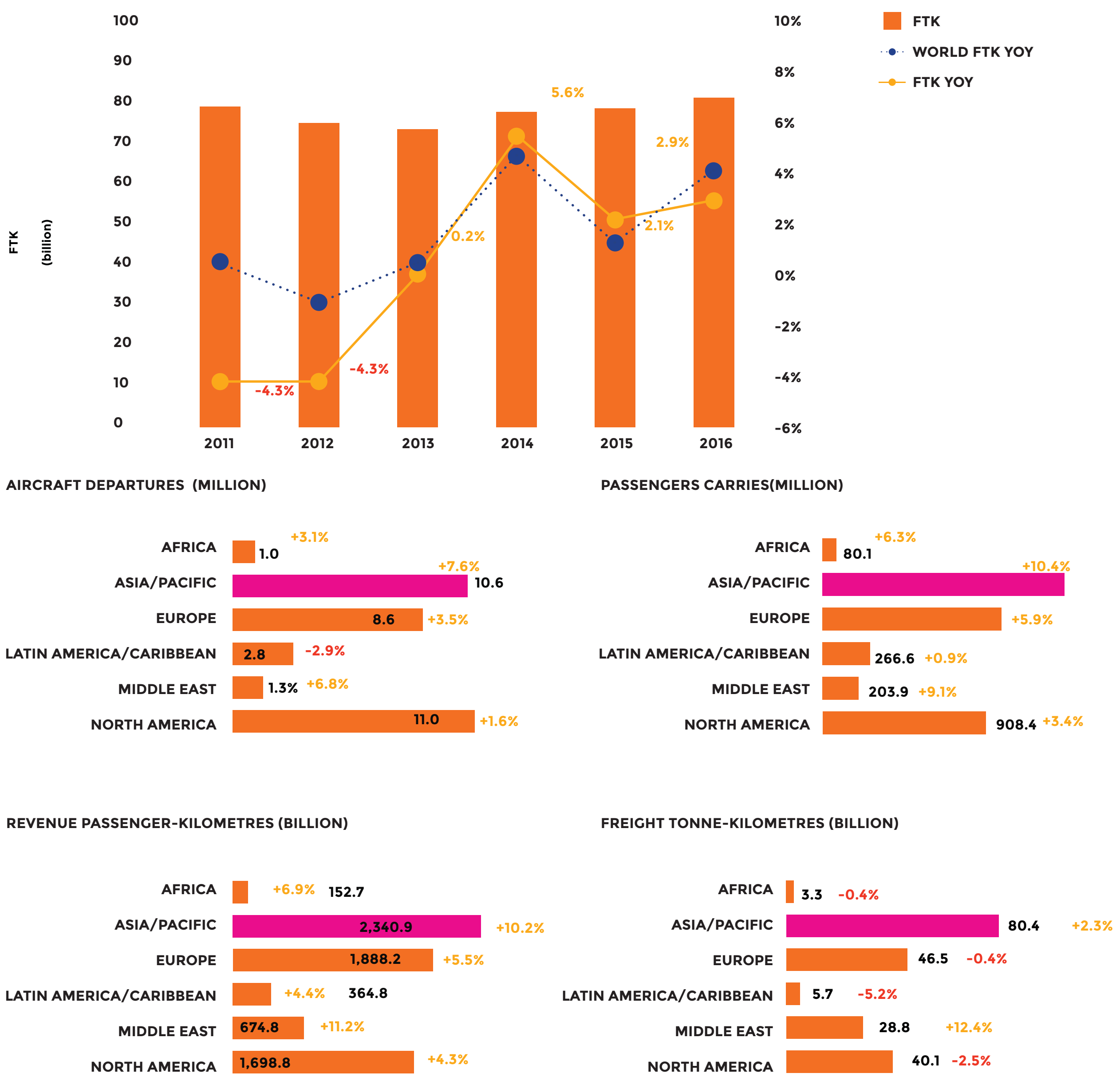
The air freight market of Asian carriers is mostly international. Carriers of China (including Hong Kong SAR and Macao SAR) and the Republic of Korea, both accounting for 55 per cent of the regional traffic, recorded annual growths of 5.2 per cent and 1.7 per cent, respectively.

FIGURE 2.15 RPK, ASK AND PASSENGER LOAD FACTOR

Note: More comprehensive air transport data are available at http://www4.icao.int/newdataplus.

FIGURE 2.16 KEY REGIONAL STATISTICS

Key regional Statistics	2016 versus 2015	RPK	▲+10.2%	ASK	▲+9.4%
		FTK	▲+2.9%	LF 79.7 %	▲+0.6 pts



3. Key regional statistics for air transport

(a) Top 15 airlines

In terms of RPK in 2016, the top 15 airlines accounted for 51.6 per cent of traffic performed by carriers from Asia and the Pacific (figure 2.17).

China Southern Airlines was the largest carrier in Asia and the Pacific in terms of RPK. The airline recorded 7.3 per cent growth in RPK in 2016 (2.5 per cent for domestic and 19.2 per cent for international services). China Eastern Airlines, the second largest Asian carrier in RPK, recorded an increase of 15.2 per cent in 2016, both for domestic (6.3 per cent) and for international services (33.1 per cent).

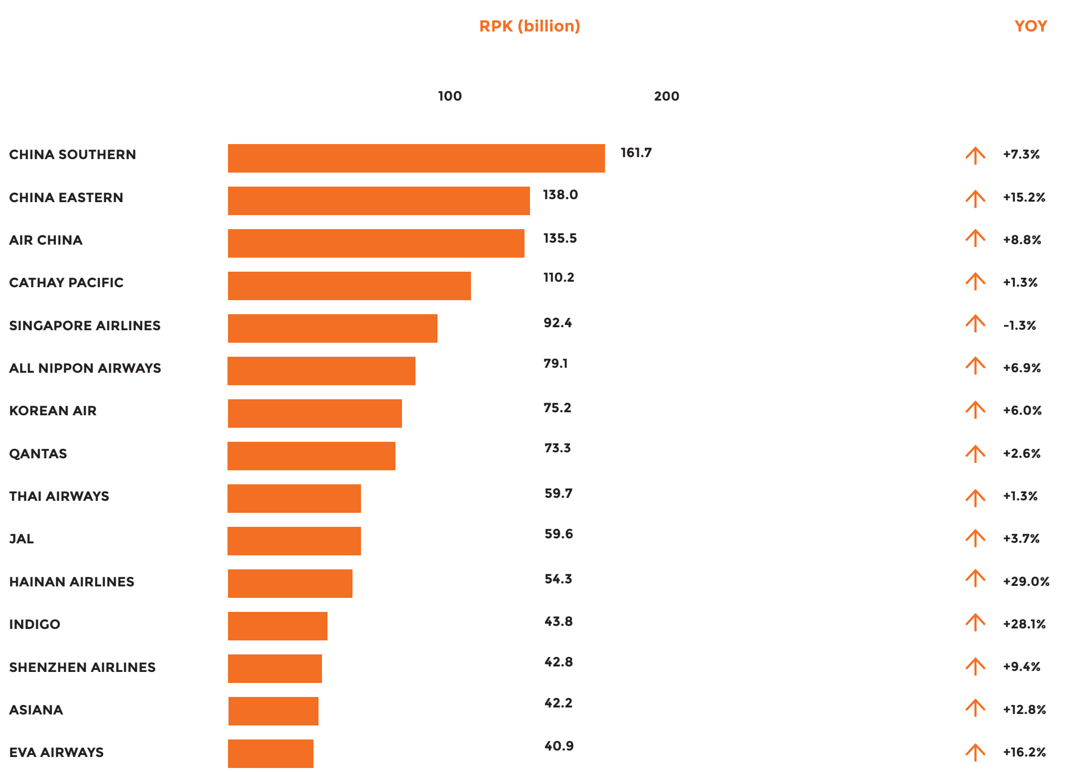
All airlines recorded an increase of traffic in terms of RPK except for Singapore Airlines, which recorded a decrease of 1.3 per cent.

(b) Top 15 countries in traffic performed by national carrier,(in RPK)

In 2016, the top 15 States recorded growth and accounted for 97.1 per cent of RPK performed by airlines from Asia and the Pacific (figure 2.18)

China ranked first and Chinese air carriers recorded a global increase of 13.4 per cent of traffic in RPK in 2016 compared to 2015. The top three carriers — China Southern Airlines, China Eastern Airlines and Air China — posted increases between 7.3 and 15.2 per cent. Other carriers such as Hainan Airlines and Shenzhen Airlines recorded growth of 29.0 and 9.4 per cent, respectively.

FIGURE 2.17 TOP 15 AIRLINES (IN RPK)



Source: ICAO Form A and ICAO estimates.

* China includes Hong Kong SAR and Macao SAR.

Traffic performed by Japanese air carriers grew 5.8 per cent, with the two main contributors, Japan Airlines (JAL) and All Nippon Airways (ANA), posting 3.7 and 6.9 per cent growth, respectively.

Traffic performed by India airlines achieved a 16.7 per cent global increase in 2016 compared to 2015. Indigo recorded a 28.1 per cent increase.

Airlines from Pakistan, Viet Nam and India posted the highest increase of traffic in RPK with 21.3, 19.3 and 16.7 per cent, respectively.

(C) Top 15 airports in 2016

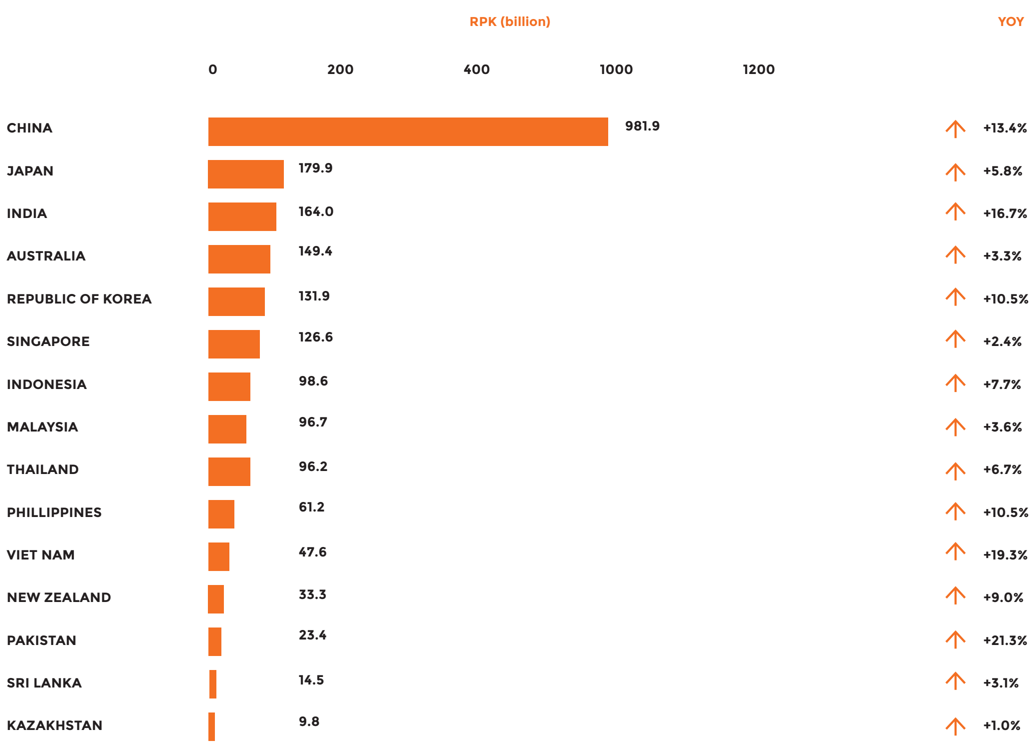
Beijing ranked first for both departures and passengers in the region (figure 2.19). New Delhi airport recorded two-digit growth both for departures (16.4 per cent) and for passenger traffic (21 per cent).

The number of passengers in all airports in the top 15 recorded growth in 2016. Incheon airport recorded the second-highest increase of 11.3 per cent and 17.1 per cent in departures and passengers, respectively.
In terms of the number of departures, all of the top 15 airports recorded growth in 2016.

The number of passengers in all airports in the top 15 recorded growth in 2016. Incheon airport recorded the second-highest increase of 11.3 per cent and 17.1 per cent in departures and passengers, respectively.
In terms of the number of departures, all of the top 15 airports recorded growth in 2016.

Hong Kong airport ranked first for freight (figure 2.19).

FIGURE 2.18. TOP 15 STATES IN TRAFFIC PERFORMED BY NATIONAL CARRIERS (IN RPK)



Source: ICAO Form A and ICAO estimates.

* China includes Hong Kong SAR and Macao SAR.

FIGURE 2.19 TOP 15 AIRPORTS IN 2016

Source: ACI.

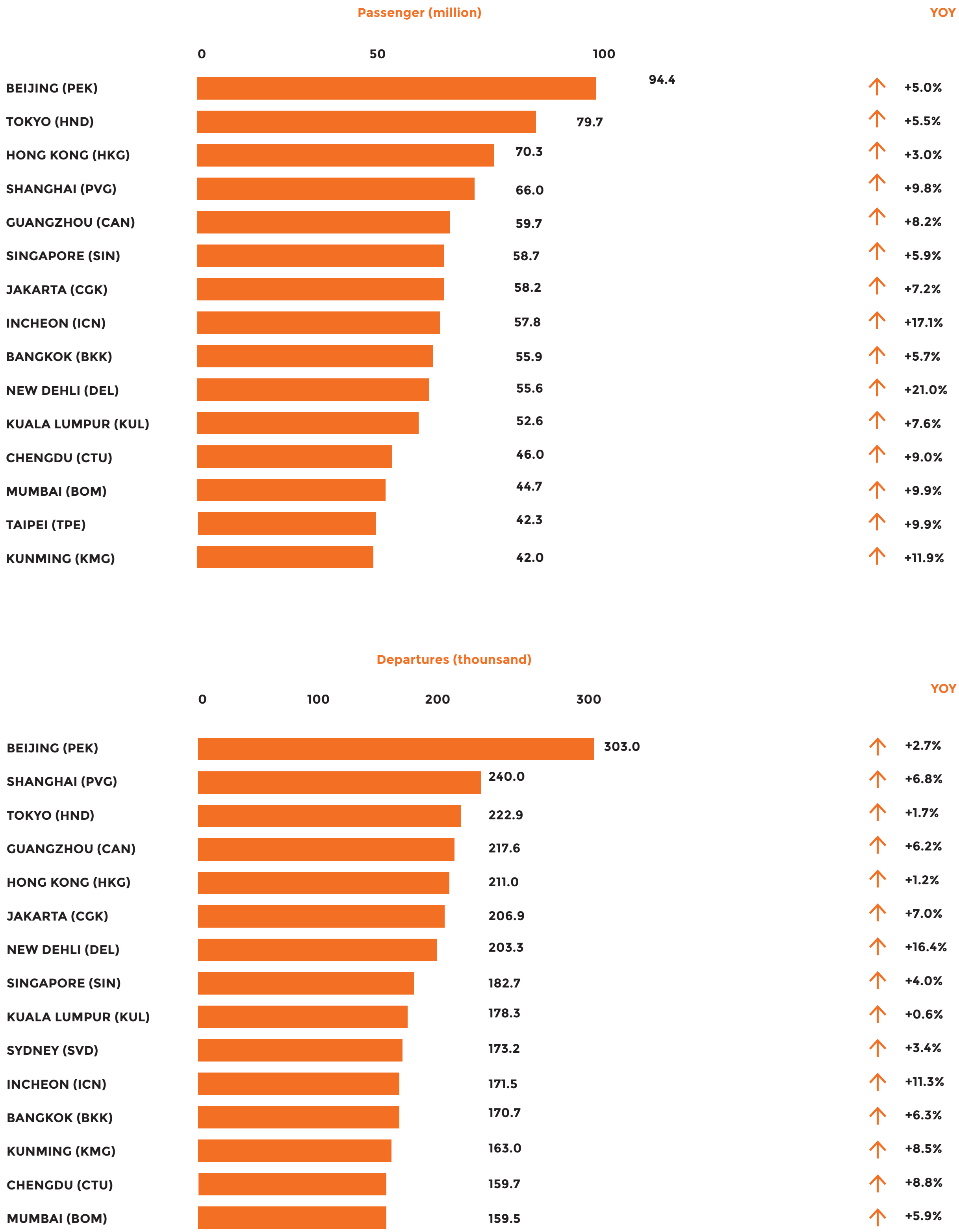
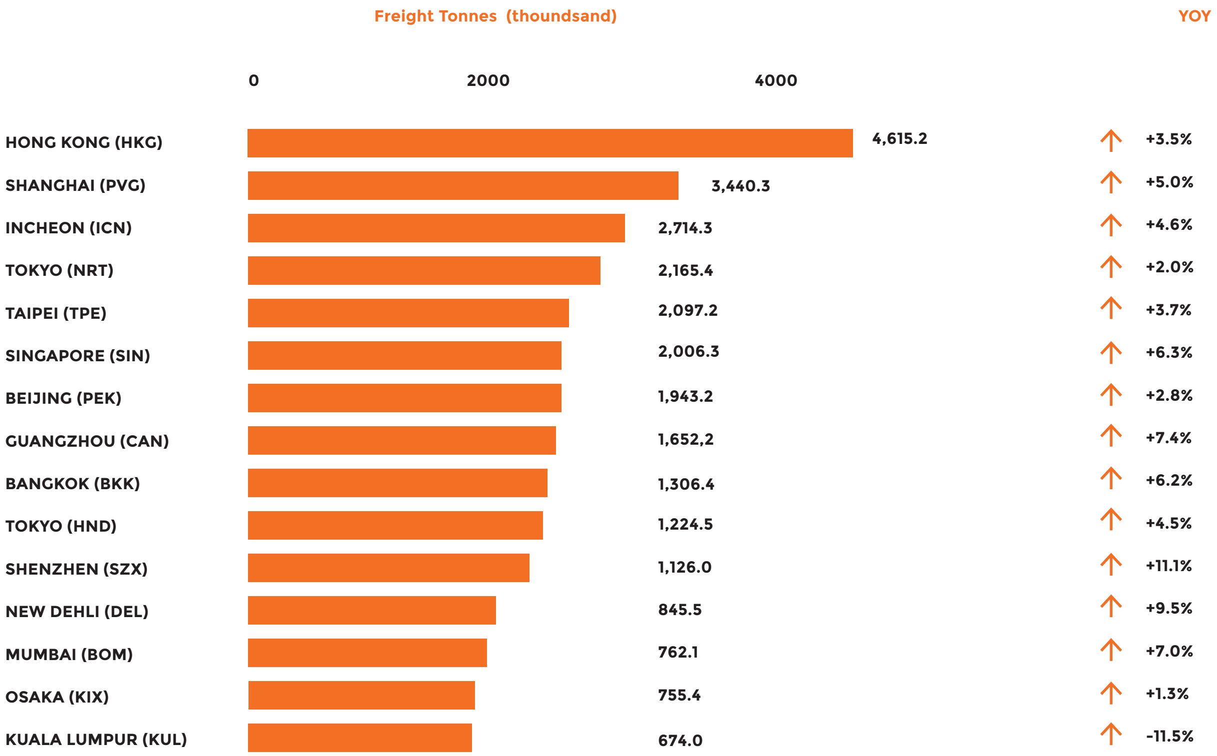


FIGURE 2.19 TOP 15 AIRPORTS IN 2016 (Con't)



(d) Low-cost carriers

The Asia-Pacific region has had a lower LCC traffic share than the world average in the past 10 years. In 2016, 27 per cent of available seats within the region were offered by LCCs, lower than the world average of 30 per cent (figure 2.20).

The number of seats within the region offered by LCCs has been continually increasing since 2007 (figure 2.21). In 2007, there were about 94.2 million seats offered by LCCs, growing to around 444.5 million seats in 2016.

Asia and Pacific has had a slightly higher penetration of LCC than the world average. In 2016, 91 per cent of States in the region had LCC traffic, 15 per cent higher than the world average.

The number of States having LCC traffic in the region has increased from 2007 (70 per cent) to 2016 (91 per cent), except a slight drop in 2014. This growth was faster than world average growth. In 2007, 30 States in Asia and the Pacific had LCC traffic and in 2016 the number increased to 39.

(e)Capacity

All regions, posted an expansion in capacity in March 2017 with a 6.1 per cent year-on-year increase in capacity worldwide. Two regions, the Middle East and Asia/Pacific, posted faster expansion than the world average (figure 2.22). Africa posted the smallest increase in capacity.

FIGURE 2.20 LOW-COST CARRIER TRAFFIC, INTRA-REGION

Source: ACI.

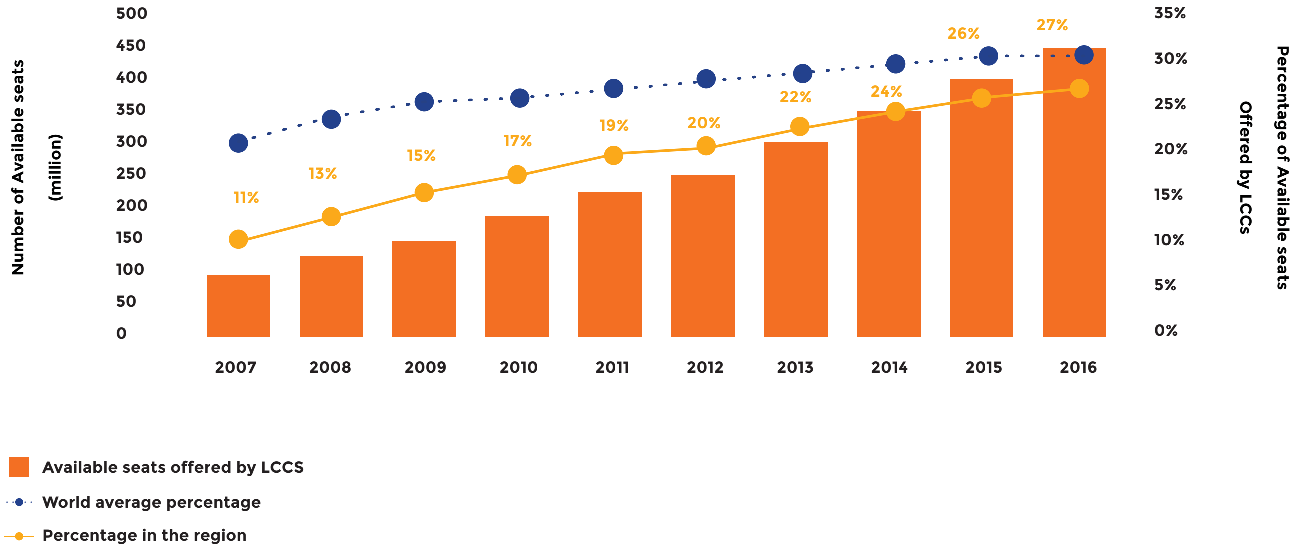


FIGURE 2.21 NUMBER OF STATES WITH LCC TRAFFIC IN THE REGION

Source: ICAO, OAG.

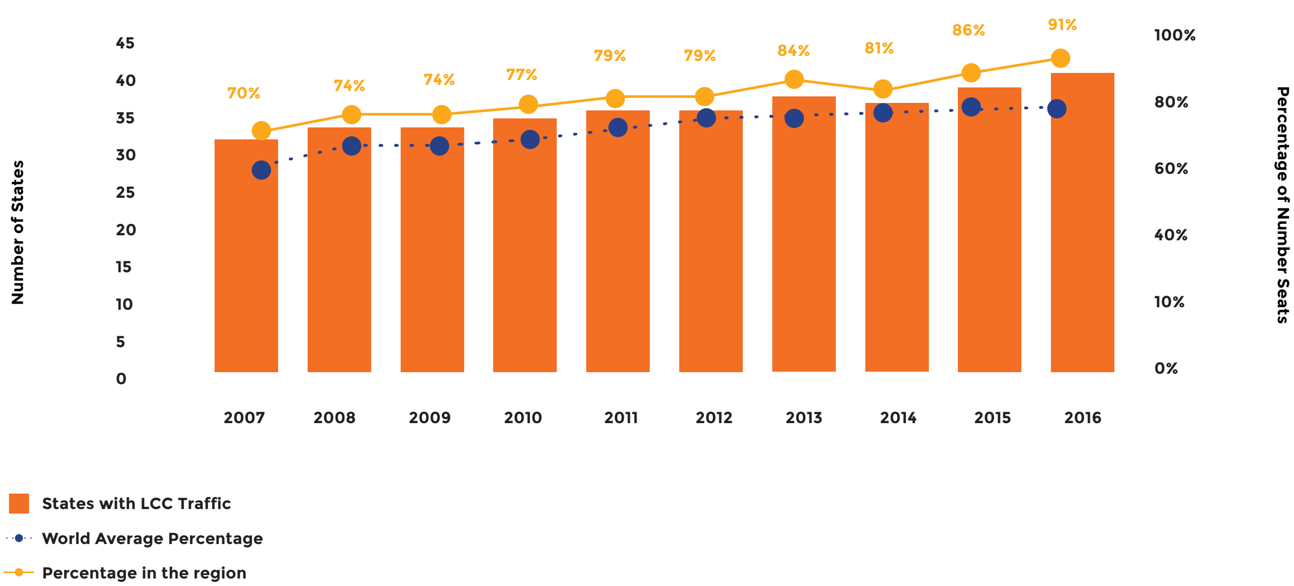


FIGURE 2.22 AVAILABLE SEAT-KILOMETRE GROWTH IN 2017

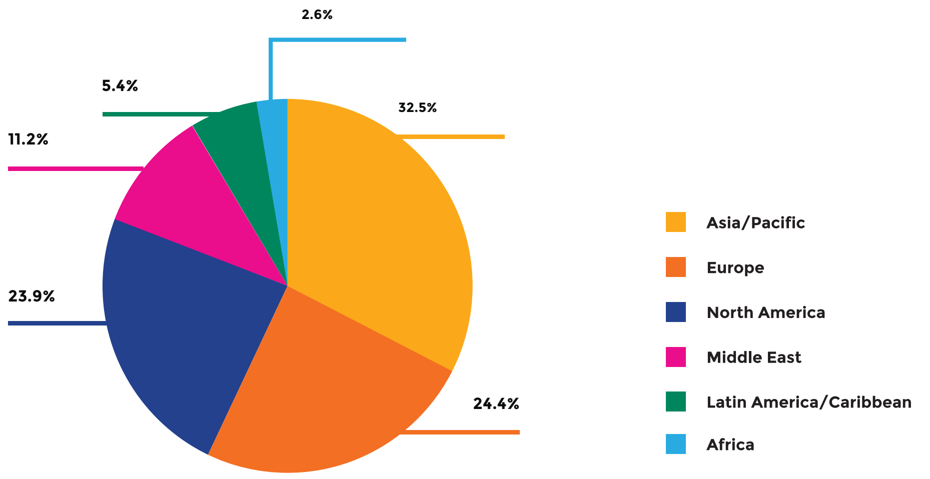
Source: ICAO, IATA,OAG

Note : Total scheduled services

CAPACITY BY REGION (ICAO Statistical Regions)

MAR 2017: +6.1% YoY in terms of World ASK

% Share of Capacity by Region



	YoY	YTD
Africa	+1.9 %	+2.5 %
Asia and The Pacific	+8.0 %	+7.1 %
Europe	+5.3 %	+5.3 %
Latin America and the Caribbean	+5.3 %	+3.2 %
Middle East	+9.3 %	+9.2 %
North America	-3.3 %	+2.3 %
WORLD	+6.1 %	+5.5 %

Endnotes

1 Brunei Darussalam does not operate a rail network.
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3 United Nations, Treaty Series, vol. 2323, No. 41607.
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8 E/ESCAP/MCT(3)/11.
9 The ESCAP Secretariat conducted a survey in June 2017 in the Asian Highway member countries to learn about the implementation status of the Asian Highway design standards.
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16 Available at http://documents.worldbank.org/curated/en/989541482446456878/pdf/ISR-Disclosable-P128050-12-22-2016-1482446447275.pdf.
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23 1,676 mm.
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30 "Mitigating High Logistics Cost. A country perspective", Iman Gandi, Technical Advisor to PT. YCH Indonesia, ESCAP Regional Conference for Logistics Service Providers, Jakarta, 23 June 2016.
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32 Transport review 2016 and http://www.nealnet.org/nealnet/web.

Regional transport operational connectivity

A. Introduction

Logistics is a major industry, accounting for 12 per cent of global GDP.[1] The quality and cost of providing logistics services gives a good indication of the degree to which transport infrastructure and operational connectivity is a reality, both at the national and the international levels. At the same time, good operational connectivity results in lowering the cost of logistics and increases the value-added of these services as part of GDP. The connection between GDP and logistics services is clearly shown by a study published by the Korea Transport Institute[2] in December 2016. The study analyses the evolution of logistics costs in China, Japan and the Republic of Korea between 2001 and 2014. The conclusions can be summarized as follows.

In China, the share of transport by road has increased sharply and constantly, taking over parts of waterway transport and surpassing railway transport volume since 2008. In terms of cargo volume, road transport accounted for 75.9 per cent of the total traffic volume in 2014 (figure 3.1). Rail transport has steadily decreased since 2005, to reach 8.69 per cent in 2014. The volume of waterway transport has slowly but steadily increased year by year, to account for 13.64 per cent in 2014. This may be explained by the relative slowness in improving railway facilities and efficiency, while the operation of inland waterways and coastal shipping has continued to develop with investments in improving facilities and operational efficiency, and attracting additional bulk cargo transportation.

In terms of mt-km, inland coastal waterways have showed a steady upward trend since 2001, with a share that peaked at 63.39 per cent in 2007 and accounted for 49.9 per cent in 2014. The road sector accounted for 32.83 per cent of the total mt-km traffic while railways accounted for 14.8 per cent in 2014, a significant decrease from 33.5 per cent in 2001.

National logistics costs in China represented 23.8 per cent of GDP in 1991; this figure then declined annually, reaching 16.7 per cent in 2014 or US$1,580 billion (figure 3.2). The decrease in the percentage of GDP was due to total logistics costs increasing at a slower pace than the increase in GDP. This slower pace was due to investments in improving infrastructure and increasing operational efficiency. When logistics costs were broken down by function, transportation costs accounted for 52.8 per cent of the total, warehousing costs were 34.9 per cent and management costs were 12.3 per cent in 2014.

FIGURE 3.1 MODAL SPLIT IN CHINA, 2001-2014 (% OF VOLUME)

Source: Korea Transport Institute.[2]

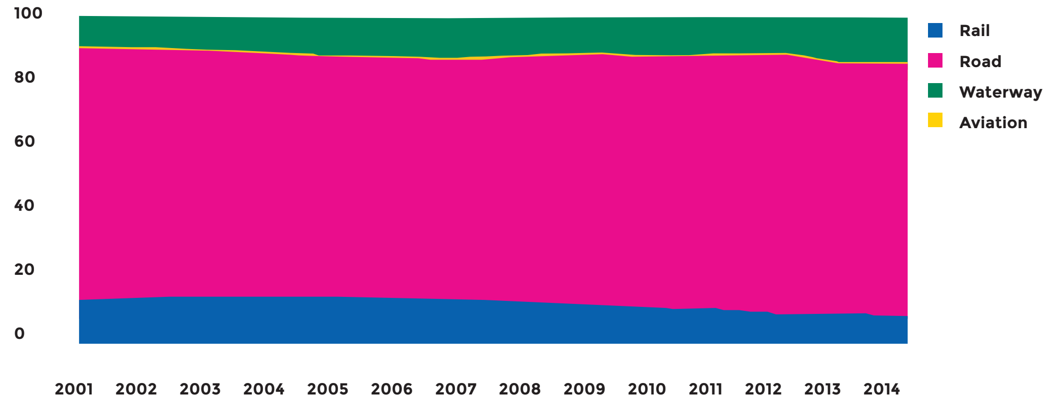
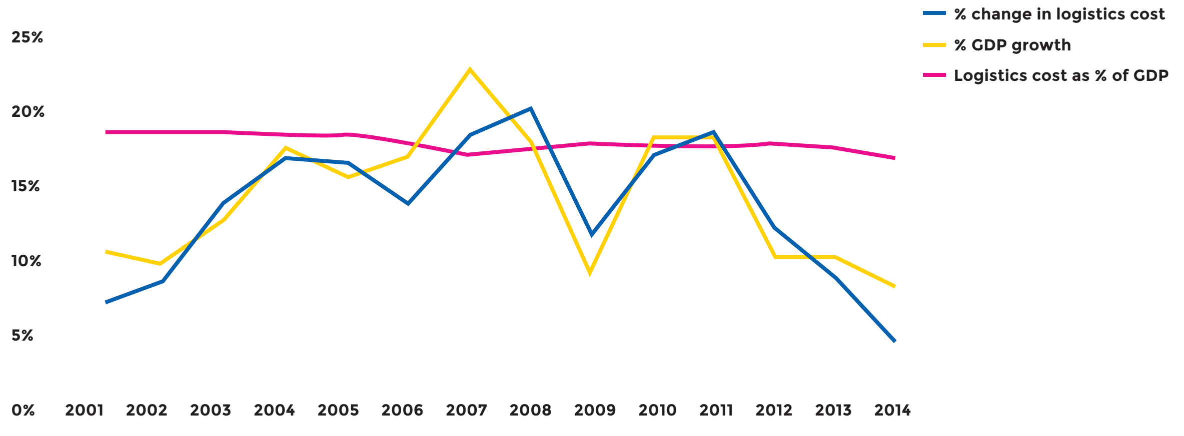


FIGURE 3.2 EVOLUTION OF LOGISTICS COST AND GDP: CHINA, 2001-2014

Source: Korea Transport Institute.[2]



In Japan, total transport volume declined from 6,034 million mt in 2001 to 4,769 million mt in 2013. Road transport accounted for more than 91 per cent of total freight transportation in 2013 (figure 3.3) while rail and aviation represented only 0.92 and 0.02 per cent, respectively, in the same year. The mt-km-based transport-sharing structure is slightly different, with the road sector still having the highest share at 50.84 per cent, while the shipping sector accounts for 43.9 per cent on the mt-km basis. This is explained by shipping's comparative advantage over road on long-distance operations.

The national logistics costs of Japan in 2013 were estimated at US$397.8 billion. The ratio of national logistics cost to GDP was at its lowest at 8.05 per cent in 2010, but gradually increased to 9.17 per cent in 2013 (figure 3.4). Transportation costs accounted for 67.1 per cent of total logistics costs, warehouse costs accounted for 29.2 per cent and management costs accounted for 3.7 per cent in 2013.

FIGURE 3.3 MODAL SPLIT IN JAPAN, 2001-2013 (% OF VOLUME)

Source: Korea Transport Institute.[2]

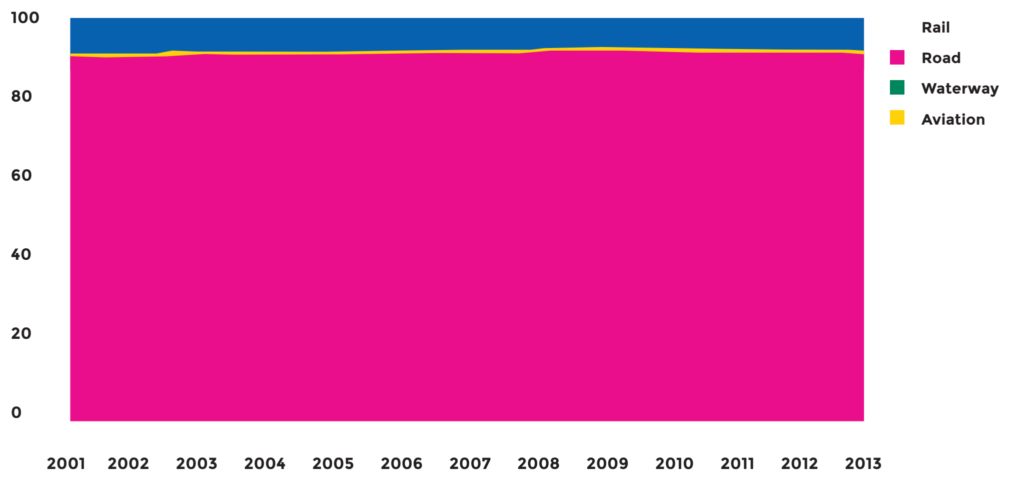
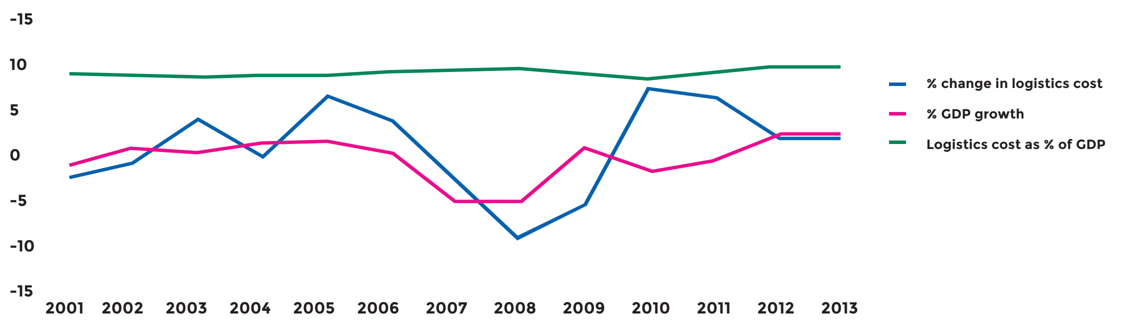


FIGURE 3.4 EVOLUTION OF LOGISTICS COST AND GDP: JAPAN, 2001-2013 (%)

Source: Korea Transport Institute.[2]



In the Republic of Korea, total cargo volume recorded an annual average increase of 1.63 per cent between 2001 and 2014. During that period road and air transport increased by 3.95 per cent and 12.00 per cent, respectively, while the rail and shipping sectors decreased by 6.14 per cent and 7.33 per cent, respectively.

In terms of modal split by transport mode and volume, road transport accounted for 92.22 per cent in 2014 (figure 3.5), a high proportion that continues to increase. In terms of mt-km, road transport accounted for 76.01 per cent in 2014, while the share of shipping transport shrank from 26.4 per cent in 2001 to 18.2 per cent in 2014; however, the figure is still high compared to the tonnage due to shipping being used for long-distance transport.

The national logistics costs of the Republic of Korea have been more than US$118.8 billion for eight consecutive years since 2006, and reached US$168.9 billion in 2014, of which transportation costs accounted for 75 per cent, while inventory cost was 18 per cent and management cost was 3 per cent. Transportation costs include all cargo transportation by road, railway, shipping, aviation and forwarding. In 2014, the road sector accounted for 77.1 per cent of transportation costs and shipping accounted for 14.5 per cent. As shown in Figure 3.6, logistics costs as percentage of GDP has steadily decreased, as a consequence of performance improvement of logistics industry as a whole.

FIGURE 3.5 MODAL SPLIT IN REPUBLIC OF KOREA, 2001-2014 (% OF VOLUME)

Source: Korea Transport Institute.[2]

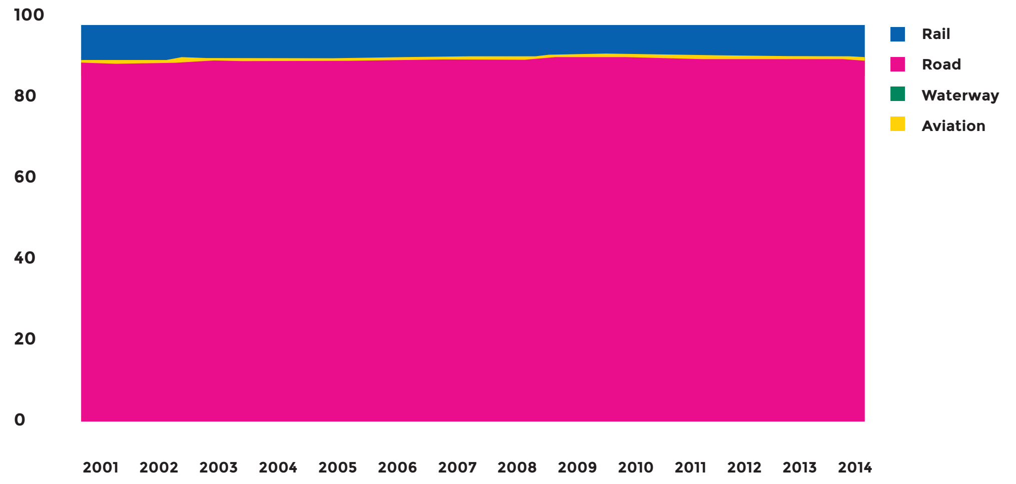
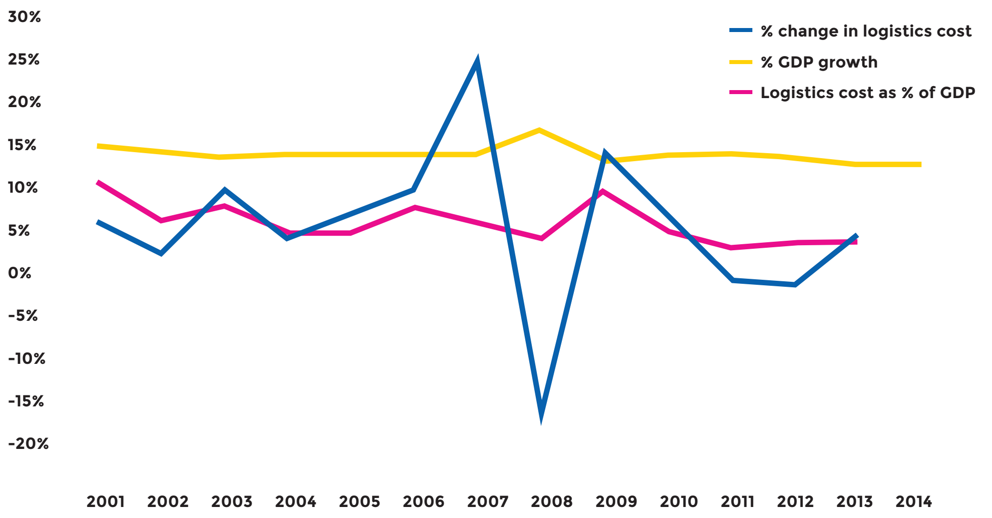


FIGURE 3.6 EVOLUTION OF IOGISTICS COST AND GDP: REPUBLIC OF KOREA, 2001-2004 (%)

Source: Korea Transport Institute.[2]

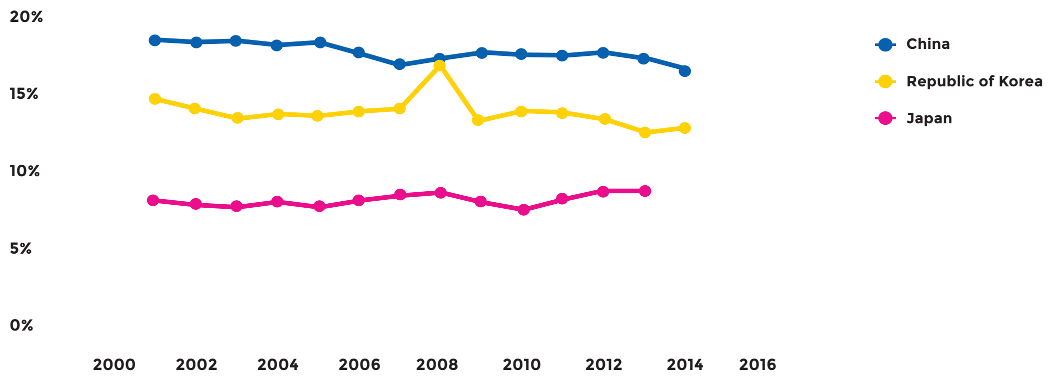


Currently there are no well-established international databases for logistics cost statistics because the criteria and items included in the calculation methodology are significantly different among countries. However, it is clear in all countries that transportation costs account for the highest share in logistics costs, followed by inventory costs and management costs.

The examples of China, Japan and the Republic of Korea demonstrate that the share of logistics costs as a percentage of GDP (figure 3.7) tends to decrease with economic development. Also, changes in logistics costs reflect major economic changes, such as the financial crisis in 2008.

FIGURE 3.7 COMPARISON OF NATIONAL LOGISTICS COST AS % OF GDP

Source: Korea Transport Institute.[2]



Recognizing the importance of transport and the logistics sector in its direct effect on socio-economic development, countries, Governments and private stakeholders often recourse to different benchmarking tools to assess logistics performance in their respective countries of interests.

In this context, the World Bank releases the Logistics Performance Index on a biannual basis as a benchmarking tool on logistics performance. According to the latest Logistics Performance Index released in 2016, the Asia-Pacific region is on a par with the world average, scoring 2.9 points out of 5.[3] However, within the region, there is considerable variance in country and subregional performance (figure 3.8). There are substantial differences between the best and worst performers in the logistics sector. East and North-East Asia scored 3.5 points in logistics performance in 2016, which is comparable to developed economies/regions such as the European Union28 while South and South-West Asia as well as North and Central Asia were accorded 2.7 and 2.5 points respectively. Notable improvement in logistics performance took place within the Asia-Pacific region between 2007 and 2012, but progress has stalled somewhat since then.

FIGURE 3.8 LOGISTICS PERFORMANCE INDEX-ESCAP REGION

Source: World Bank Logistics Performance Index 2016.

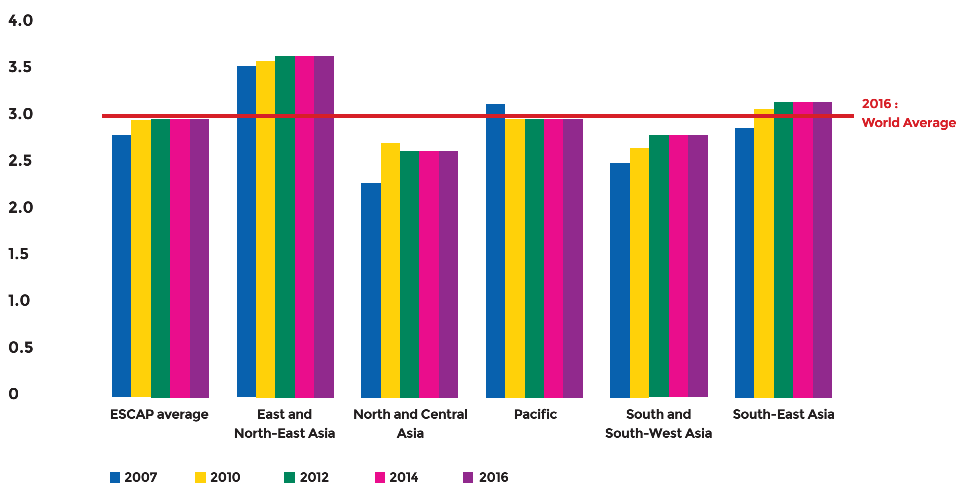
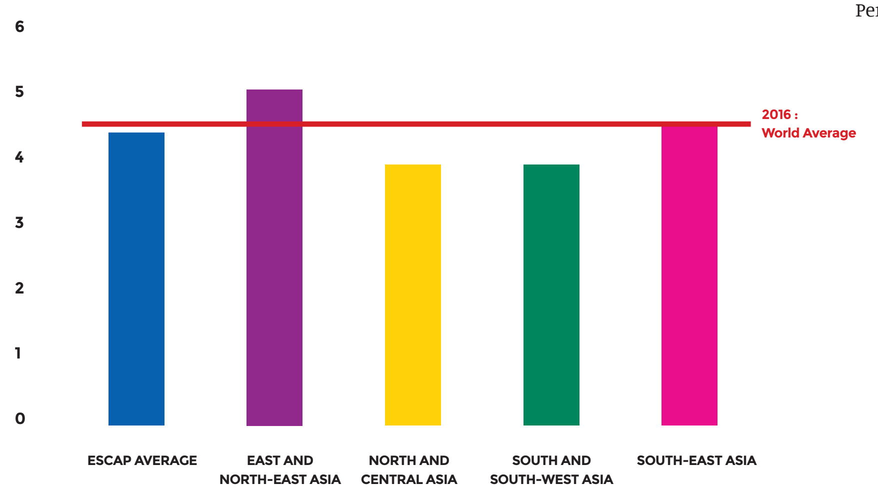


FIGURE 3.9 ENABLING TRADE INDEX, 2016-ESCAP REGION

Source: World Bank Logistics Performance Index 2016.



Given the intertwined relationship between trade and transport/logistics, the World Economic Forum produces the Enabling Trade Index,[4] which can be used as a barometer for logistics performance on a macro level. Efficient logistics networks contribute substantially to facilitating the seamless movement of goods and services, hence encouraging both cross-border and national trade. The similarity of evaluation results between the Logistics Performance Index and the Enabling Trade Index clearly confirm this lineal relationship. As shown in figure 3.9, subregions with efficient and effective logistics systems, such as East and North-East Asia, also performed well in the Enabling Trade Index, while subregions with weaker transport and logistics networks achieved lower scores in the Enabling Trade Index.

Variables evaluated to calculate the overall Logistics Performance Index relate to customs, infrastructure, international shipment, logistics quality and competence, tracking and tracing, and timeliness. Figures 3.10(a) and 3.10(b) show that the East and North-East Asia subregions outperform both the Asia-Pacific average and the world average in all categories, while there is considerable room for improvement in all categories among some other subregions. Countries in the Pacific are on a par with the Asia-Pacific/world average, with customs efficiency outperforming the world average. Nevertheless, the Pacific subregion, comprising many small island developing States, underperformed in the "international shipment" indicator — which measures the ease of arranging competitively priced shipments — due to their geographical remoteness and distance. Similar weakness is also reflected in UNCTAD's Liner Shipping Connectivity Index. In South-East Asia, infrastructure quality falls below the world average.

FIGURE 3.10A LOGISTICS PERFORMANCE INDEX, 2016, BY VARIABLES – ESCAP REGION

Source: World Bank Logistics Performance Index 2016.

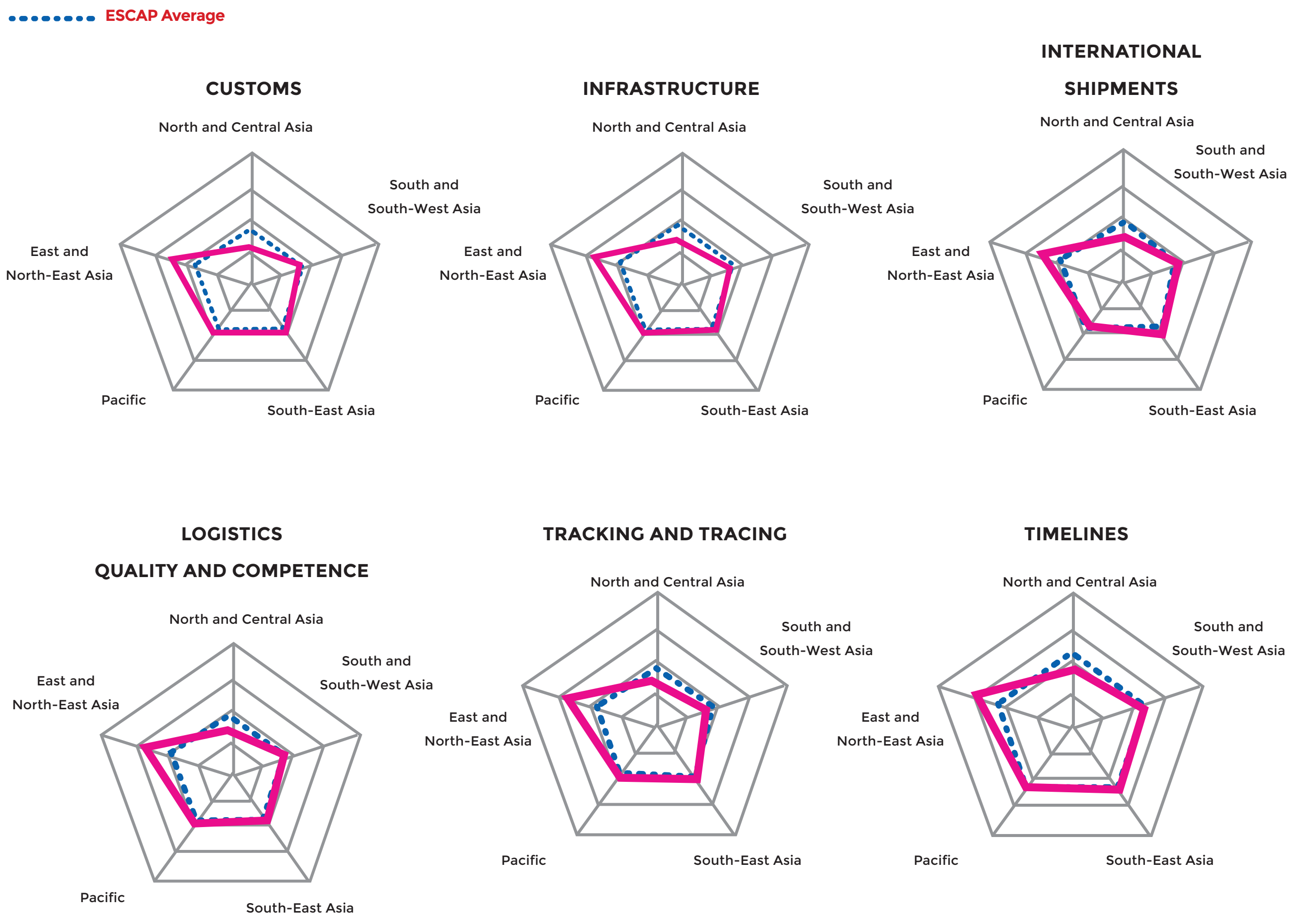
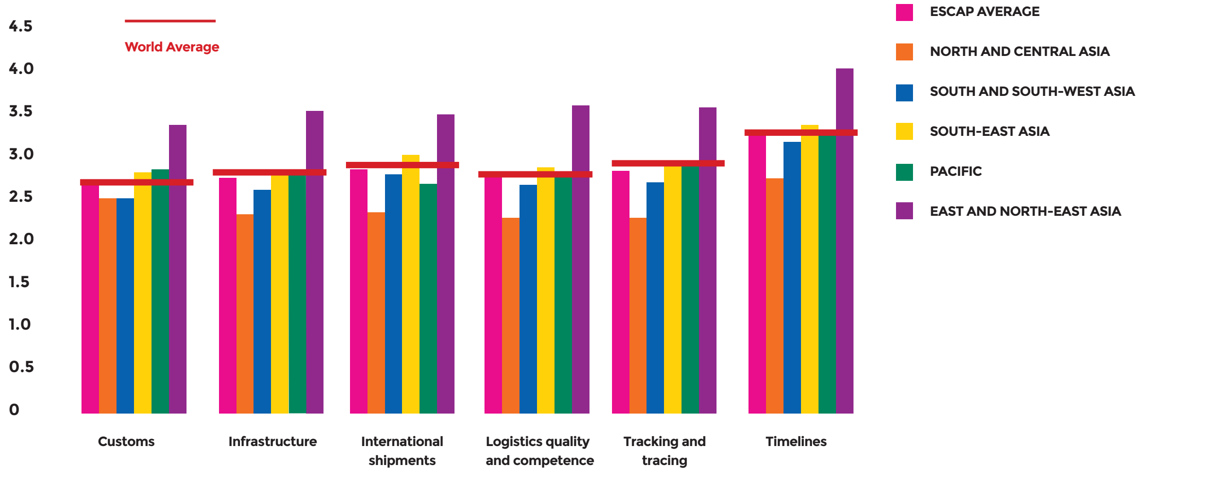


FIGURE 3.10B LOGISTICS PERFORMANCE INDEX, 2016, COMPARISON WITH WORLD AVERAGE – ESCAP REGION

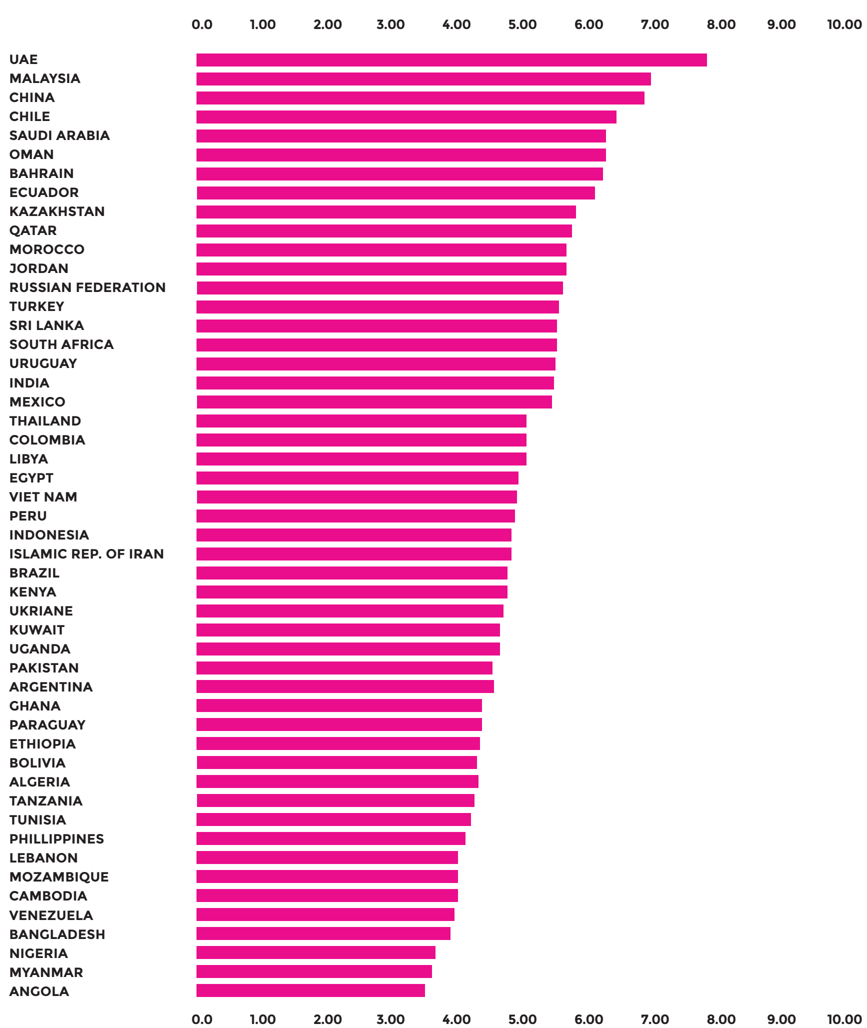
Source: World Bank Logistics Performance Index 2016.



There is a big variance in the level of development among countries in South-East Asia, ranging from highly developed economies to least developed economies. Thus, the ability to undertake cost-intensive infrastructure investment and maintenance differs. For example, 83 per cent of the road network is paved in Thailand, 57 per cent in Indonesia, 24 per cent in Myanmar and only 11 per cent in Cambodia, according to the ASEAN Statistics Leaflet published in 2015.[5] The difference in infrastructure quality among countries in South-East Asia is further confirmed by the Agility Emerging Markets Logistics Index (2017): Market Connectedness Sub-Index (figure 3.11). The sub-index, which assesses individual countries' domestic and international transport infrastructure and connectivity,[6] concluded substantial variances exist in infrastructure quality among countries in South-East Asia. For example, among 50 selected countries, Malaysia was ranked second with a score of 6.91 points while Cambodia and Myanmar were ranked 45 and 49, respectively. Thailand and Indonesia, ranked at 20 and 26, respectively, were among the average performers in ranking. The Agility Emerging Market Logistics Index is a benchmarking tool for logistics performance, which is published by Agility Global Integrated Logistics and Transport Intelligence, a private sector organization.

FIGURE 3.11 AGILITY EMERGING MARKETS LOGISTICS INDEX (2017): MARKET CONNECTEDNESS SUB-INDEX

Source: Agility Global Integrated Logistics and Transport Intelligence.[6]



Countries in Asia and the Pacific are fully aware that decreasing logistics costs is a key factor in improving competitiveness. In China, logistics costs were reduced from 15.4 per cent in 2015 to 14.5 per cent in 2016.[7] The Government of China aims to further reduce the costs to 7 per cent by 2020.

Logistics costs in India are 13-15 per cent of product cost, while the global average is 6 per cent. The current losses caused by inefficient logistics is equal to 4.3 per cent of GDP, and, if not corrected will increase to 5 per cent of GDP or US$100 billion by 2020.[9]

In Viet Nam, the current logistics costs amount to 20-25 per cent of product cost. The Ministry of Industry and Trade has drafted an Action Plan that is expected to reduce the costs to 18 per cent by 2020.[10]

According to Thailand's Office of the National Economic and Social Development Board (NESDB), logistics costs as a percentage of GDP in Thailand declined significantly during the past 10 years, from 18 per cent in 2007 to about 14 per cent in 2016.[11] Thailand has made significant progress in reducing transport and logistics costs compared to its neighbour, the Lao People's Democratic Republic. For example, for the 490 km from the capital, Vientiane, to Savannakhet province the cost has been calculated at US$2.5 per kilometre while the 450-km route from Bangkok to Khon Kaen in Thailand costs only US$1.1 per kilometre.[12]

Logistics costs in Cambodia are about 33 per cent higher than in Thailand and 30 per cent higher than in Viet Nam. A study by the World Bank on rice monitoring in 2014 showed the transport cost of one ton of rice from a farmer to a rice miller was US$247 in Cambodia compared with US$126 in Thailand and US$122 in Viet Nam.[13]

In Indonesia, the current logistics costs represent 26 per cent of GDP; however, the Government has adopted policies and measures aimed at reducing the costs to 19 per cent by 2020 and 9 per cent by 2035.[14]

In Pakistan, freight journeys via road normally take twice as long as they would in Europe, mainly due to the outdated transport fleet as well as poor and unreliable infrastructure, which raise the logistics costs to 30 per cent of the production cost.[15] Similarly, in Kazakhstan the share of logistics costs is up to 25 per cent of the cost of the final product. Clearly logistics costs are very high and far exceed the average of developed countries.[16]

B. International road transport

Efficient international road transport is a key element of an integrated intermodal transport system. Despite the progress made so far, less than efficient practices combined with the lack of traffic rights, excessive documentation and cumbersome procedures at borders continue to make the facilitation of international road transport a challenge for the Asia-Pacific region. This section summarizes and analyses the existing situation and challenges to international road transport.

1. Regional developments, issues and challenges

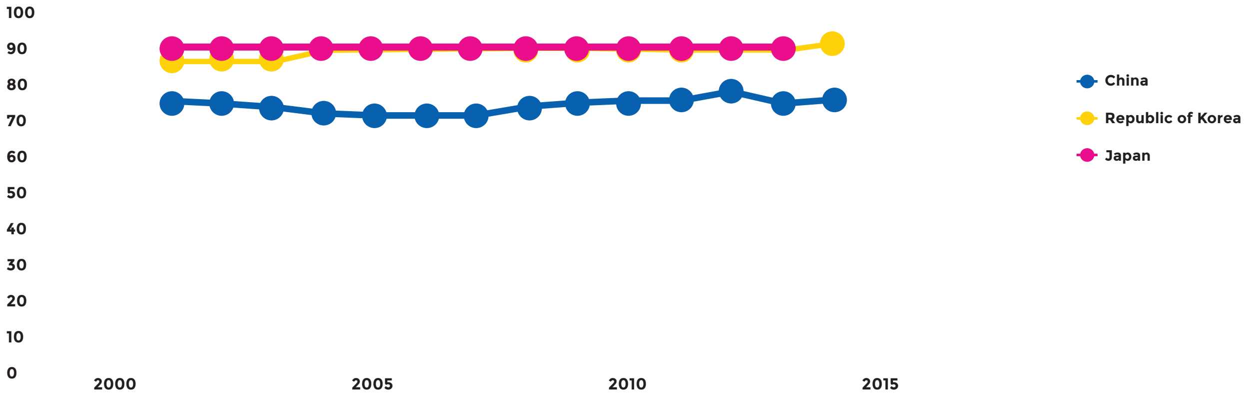
The demand for transport in the region has grown rapidly as a result of high economic growth in many countries, and is a trend that is likely to continue. Road remains the dominant mode of transport in most countries in the Asia-Pacific region, including developed countries (figure 3.12).[17]

Given the dynamic nature of globalization and the emergence of new challenges for border agencies (such as those related to security) the facilitation of international road transport is a necessary long-term target for the region.

To cope with the present challenges, an efficient international road transport system for moving goods along transport/transit corridors or networks is paramount. Such a system includes not only efficient roads but also smooth operations at border crossings, which implies a coherent, consistent and tenacious effort by countries to find an optimal balance between transport facilitation and controlling/regulatory measures.

FIGURE 3.12 PERCENTAGE OF ROAD TRANSPORT IN TOTAL VOLUME OF CARGO (MT) TRANSPORTED IN CHINA,JAPAN AND THE REPUBLIC OF KOREA, 2001-2014

Source: Korea Transport Institute.[2]



Less than efficient practices combined with the lack of traffic rights, excessive documentation and cumbersome procedures at borders make the facilitation of international road transportation a continuing challenge for the region.

As a fundamental premise, international road transport cannot exist without traffic rights. In general, these arrangements are part of bilateral or subregional agreements regulating international road transport. However, many of the existing legal instruments have not been effectively implemented by the parties concerned, and in some instances countries have substantially different transport agreements with each of their neighbours. The latter situation creates challenges for authorities while enforcing them as well as for transport operators in complying with the various sets of requirements.

Existing regional, subregional, bilateral and multilateral agreements that include transport facilitation provisions are not being optimally implemented yet. Despite steady progress, the region still has a long way to go in realizing the vision of transport operational connectivity, mainly due to the fragmented approach to the facilitation aspects.

Countries in Asia and the Pacific use quite different approaches to arranging international road transport operations, especially with regard to traffic rights.

The level of liberalization of these operations ranges from limiting their geographical scope to routes in border areas only, to granting the right of performing international road transport operations throughout the territory of a given country without the requirement for any permits.

There is a large number of overlapping regional and subregional institutions that are largely intergovernmental and which support Asian transport integration in order to achieve seamless transport connectivity. ESCAP member States are members of the following regional institutions and programmes:

(a) The Association of Southeast Asian Nations: Brunei Darussalam, Cambodia, Indonesia, the Lao People's Democratic Republic, Malaysia, Myanmar, the Philippines, Thailand, Singapore and Viet Nam;

(b) The Bangladesh-China-India-Myanmar Forum for Regional Cooperation (BCIM);

(c) The Bangladesh, Bhutan, India, Nepal (BBIN) Initiative;

(d) The Economic Cooperation Organization (ECO): Afghanistan, Azerbaijan, the Islamic Republic of Iran, Kazakhstan, Kyrgyzstan, Pakistan, Tajikistan, Turkey, Turkmenistan and Uzbekistan;

(e) The Shanghai Cooperation Organization (SCO): China, Kazakhstan, Kyrgyzstan, the Russian Federation, Tajikistan and Uzbekistan. India and Pakistan will become full members by 2017;

(f) The South Asian Association for Regional Cooperation (SAARC): Afghanistan, Bangladesh, Bhutan, India, Nepal, the Maldives, Pakistan and Sri Lanka;

(g) The Eurasian Economic Union (EAEU): Armenia, Belarus, Kazakhstan, Kyrgyzstan and the Russian Federation;

(h) The Commonwealth of Independent States (CIS): Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, the Russian Federation, Tajikistan and Uzbekistan;

(i) The South Asia Subregional Economic Cooperation (SASEC): Bangladesh, Bhutan, India, Maldives, Nepal and Sri Lanka;

(j) The Central Asia Regional Economic Cooperation (CAREC): Afghanistan, Azerbaijan, China, Kazakhstan, Kyrgyzstan, Mongolia, Pakistan, Tajikistan, Turkmenistan and Uzbekistan;

(k) The Greater Mekong Subregion (GMS): Cambodia, China (specifically Yunnan Province and the Guangxi Zhuang Autonomous Region), the Lao People's Democratic Republic, Myanmar, Thailand and Viet Nam;

In 2016, the ESCAP Secretariat conducted a survey to research cross-border road transport-related challenges on the basis of bilateral transport relations between the 26 member countries of the Asian Highway Network. Based on the survey, a Handbook on Cross-Border Transport Along the Asian Highway was developed. According to the Handbook, 18 of the countries do not have bilateral road transport agreements with one or more of their neighbours, and therefore cargo must be trans-shipped at those borders. There are also a few countries that do not have any transport relations with each other.

The level of harmonization of technical standards for vehicles or qualification standards for drivers is still low, and borders remain difficult to cross. The Handbook revealed cross-border transport permits were required at 44 borders; at 28 of these borders, the number of permits is limited and based on an annual quota. At another additional 20 borders no cross-border transport permit is required; in a few cases, the situation is not clear. In 28 cases, countries have designated some routes on which cross-border transport is allowed to travel, while in 36 cases, countries do not impose fixed routes.

Visa requirements for professional drivers and crew of road vehicles continues to be a barrier to the smooth movement of goods and passengers across borders, as, in general, they are treated like any other visa applicant. The suggested target indicated in the Regional Strategic Framework for the Facilitation of International Road Transport[18] of issuing multiple-entry visas valid for one year for professional drivers and crew, together with a harmonized set of documents and basic procedures, has not yet been attained.

Regarding the temporary importation of road vehicles, no tangible progress has been made since 2012 when ESCAP member States adopted the Regional Strategic Framework for the Facilitation of International Road Transport, which comprehensively identified the non-physical barriers affecting international road transport. In addition, no ESCAP member State has acceded to the Customs Convention on the Temporary Importation of Commercial Road Vehicles (Geneva, 1956). Only two ESCAP member States have acceded to the Convention on Temporary Admission (Istanbul, 1990); however, neither of them accepted, without reservation, annex C to the Convention on the temporary importation of means of transport.

Insurance for vehicles remains another challenge that impedes efficient international road transport operations. It continues to be a common requirement for insurance be purchased at each border crossing throughout the region. Only four ESCAP member States — Azerbaijan, the Islamic Republic of Iran, the Russian Federation and Turkey — have acceded to the

Green Card system. Two countries currently have no requirements for insurance of vehicles. Third-party liability insurance of vehicles remains the most common scheme used.

The harmonization of standards for permissible vehicle weights and dimensions remains an important factor for improving the efficiency of regional road transport operations. Tables 3.1, 3.2 and 3.3 summarize the diversity of national weights and dimensions in the countries on the Asian Highway Network.

TABLE 3.1 MAXIMUM PERMISSIBLE WEIGHTS

TYPE OF VEHICLE	MAXIMUM PERMISSIBLE WEIGHTS, METRIC TONS (MT)	NO. OF COUNTRIES
Rigid	12.00	1
	24.00	1
	25.00	3
	30.00	2
	32.00	4
	34.00	2
	35.00	1
	44.00	1
Articulated	36.00	1
	38.00	4
	40.00	5
	43.00	1
	44.00	6
	48.00	1
	50.00	1

TABLE 3.2 WEIGHT PER AXLE

WEIGHT PER AXLE	MAXIMUM PERMISSIBLE WEIGHTS (MT)	NO. OF COUNTRIES
Single axle (lead)	6.00	2
	8.00	1
	10.00	7
	11.50	6
	13.00	2

TABLE 3.3 MAXIMUM PERMISSIBLE DIMENSIONS

Source: ESCAP Handbook on Cross-Border Transport along the Asian Highway.

MAXIMUM PERMISSIBLE DIMENSIONS	TYPE OF VEHICLE	PARAMETERS (METRES)	NO. OF COUNTRIES
Length	Rigid	12.00 12.20	12 7
	Articulated	16.00 17.40 18.00 20.00	6 1 1 11
Width	All types	2.50 2.55 2.60	10 8 1
Height	All types	3.80 4.00 4.20 4.50 4.75	1 12 5 1 1

Excessive and/or poor loading of road vehicles can have a significant negative impact on safety, productivity and infrastructure quality outcomes. This, in turn, can erode wider economic and social benefits through increased transport costs, diminishing returns on infrastructure investment, and reduced amenity and safety for road users and local communities.[19]

Different standards for maximum permissible vehicle weight between countries oblige complying transport operators to sub-load their vehicles when undertaking transportation of goods or, for the same volume, to take more trips. On the other hand, non-complying operators are either fined or make informal payments to continue their trip, leading to delays and increases in transportation costs. Hence, the non-harmonized standards for vehicle weights have adverse effects on the efficiency of international transport operations and on the environment.

BOX 3.1 CHAIN OF RESPONSIBILITY

To harmonize the way weights standards are enforced, ESCAP member States that are also members of the Asia-Pacific Economic Cooperation (APEC)[20] are discussing the possibility of adopting Chain of Responsibility legislation, which extends the responsibility for compliance with heavy vehicle regulations beyond the truck driver. It ensures all participants in the logistics chain have duties to ensure regulatory compliance, including the truck owner, the transport operator (including senior executives), the consignor, the freight forwarder and the consignee. The intent of this approach is to ensure everyone in the logistics chain is legally accountable for safe road transport. Chain of Responsibility provisions are important because often the conduct of the driver is a symptom – rather than the cause – of non-compliance. Each party in the Chain of Responsibility has an obligation to avoid or prevent breaches by ensuring they do not directly or indirectly impose requirements on a driver that will result in the driver overloading the vehicle, committing a dimension breach, contravening work or rest times or exceeding an applicable speed limit. Every person in the Chain of Responsibility is responsible for ensuring that mass, dimension, load restraint, fatigue management and speeding compliance requirements are met. It is not sufficient for a Chain of Responsibility party to say they were not aware of problems or had no reason to believe there were problems. To avoid liability, all parties in the Chain must put in place reasonable measures to prevent breaches of the legislation.

Source: "A regulatory toolkit for overloaded and poorly loaded road vehicles"- Discussion Paper by APEC Transportation Working Group, May 2017

In the Asia-Pacific region, North and Central Asian countries are the most advanced in terms of liberalization of transport arrangements. Bilateral agreements between countries in North and Central Asian subregions have much in common. For bilateral transport between the Russian Federation, Kazakhstan, Kyrgyzstan and Uzbekistan no permits are required for interstate, bilateral or transit transport. Except for the agreement between Kazakhstan and Uzbekistan, no permits are required for transit transport from or to a third country. In addition, Armenia, Kazakhstan, Kyrgyzstan and the Russian Federation are members of the EAEU and have completely removed customs control for the carriage of goods by road transport across internal borders between themselves.

In 2016, Kazakhstan[21] transported a total of 3.7 billion mt of cargo, which was 0.2 per cent less than in 2015, while freight turnover for this period was 514.7 billion mt-km. The share of road transport in the total volume of goods transported in 2016 was approximately 85.45 per cent; railway transportation followed with 8.92 per cent, pipeline with 5.51 per cent and other types of transport (air, inland water and sea) with 0.12 per cent.

In 2016, the volume of goods transported by road in Kyrgyzstan[22] increased 4 per cent compared with 2015, and cargo turnover increased by 7 per cent. During the first four months of 2017, the volume of cargo transported between Kyrgyzstan and Kazakhstan grew 14 per cent compared with the same period in the previous year. This increase may be a consequence of the application, since 2016, of unified tariffs for transportation of goods by transport through the territory of the EAEU.

Transportation of goods and freight turnover of road transport in the Russian Federation[23] in 2016 amounted to 5,138.2 million mt and 234.5 billion mt-km (1.9 and 0.8 per cent, respectively, compared with 2015). The freight turnover of road transport increased 0.8 per cent compared with the previous year, which was 1.8 per cent below the average growth in freight transport. The greatest volume of growth in the structure of cargo transportation in recent years has been in the segment of less-than-load (LTL). Market participants estimate the volume of this segment at about 75 billion roubles (US$1.2 billion).[24]

An important trend in 2016 was the continuing increase in the cost of international road transport while freight rates declined in real terms. The increase in the cost of road transport in 2016 was caused by the increase in fuel costs, insurance rates and the Green Card. In addition, the Russian Federation introduced a road user charge in 2016 for cargo trucks on federal roads — the so-called "Platon" system. The fare was set at R1.53 per 1 km of road. For carriers, this has resulted in significant increases in costs, and many small businesses have been forced to withdraw from the market as payments exceeded their monthly earnings.[25] According to the Association of International Carriers (ASMAP), in 2016 the number of its member companies decreased by 171 and the international road transport fleet by 11 per cent (4,000 units) compared to 2015. In addition, the introduction of the road user charge also affected foreign carriers; for example, Kazakhstan carriers claim the average distance which Kazakhstan truck drivers cover in the Russian Federation reaches 2,500 km so they have to pay about 380 million tenge (US$1.3 million) a year in road user charges.[26]

In 2016, the geography of the Russian Federation's exchanges using international road transport continued to change. Russian Federation transport operators had a share of 44-45 per cent in the international freight transport by road to/from the Russian Federation. Their share in European destinations continued to decline, with a sharp decrease of operations to/from Turkey and Ukraine, while their share in transports to/from China increased significantly.[27]

The situation of international road carriers of member States of the Eurasian Economic Union is expected to improve with the adoption and expected entry into force on 12 January 2018 of the new Customs Code of the EAEU. The code promotes the EAEU's transit attractiveness by reducing the time for processing goods in transit from 24 hours to 4 hours as well as creating the possibility of fully electronic document turnover. The new concept of the authorized economic operator, proposed in the Code, to meet international standards and best practices is expected to: (a) simplify the procedures for transport and border crossings; and (b) reduce the transport component in the price of transported goods. This will also positively affect the volumes of road transport between the Russian Federation and other member States of the EAEU as well as transit.[28]

In order to comply with the unified requirements for the development of border-crossing points across the customs border of the EAEU, six checkpoints were equipped in 2016 with an automatic detection system of weights and dimensions of cargo vehicles. To respond to increasing demand, a new road border-crossing point was commissioned on the border of the Russian Federation and China at Bolshoy Ussuriisky-Heixiazi Dao.[29]

Currently, bilateral road transport between the Russian Federation and China can only be carried out through established border-crossing points, and only on designated routes open for international road transport over a limited distance into each country. The business communities in both the Russian Federation and China are waiting for the effective opening of a new transit route between their countries through Mongolia, based on the new Intergovernmental Agreement on International Road Transport along the Asian Highway Network. These new routes will reduce the distance from the south of China to the European part of the Russian Federation by 1,400 km and the total travel time will be four days. According to preliminary estimates, by 2020, cargo traffic will grow 17-20 per cent, due to the redistribution of traffic flows to new routes; future growth of up to 10 per cent per year is possible, corresponding to the average annual growth in the volumes of foreign trade between the Russian Federation and China.[30]

The commercial vehicle fleet in the Russian Federation is becoming dominated by older trucks, a trend that statistics show is increasing year by year. According to the results, in the first eight months of 2016 the number of new trucks added to the fleet amounted to 31,300 units, 3.4 per cent lower than in the same period of 2015.

In Uzbekistan, approximately 1.5 billion mt of cargo was transported by road in 2016, a 5.3 per cent increase compared with 2015. The cargo turnover was approximately 36 billion mt-km (a 6 per cent increase). The share of road transport accounts for about 10 per cent of Uzbekistan's foreign trade and 88 per cent of domestic freight traffic. The annual rate of growth in the volume of road transport services was 20 per cent in 2015.[31] More than 75 per cent of Uzbekistan's road haulage capacity belongs to the private sector, which has more than 34,000 trucks. To meet the growing volumes of cargo transportation it will be necessary to increase the private sector fleet of trucks to 56,000 trucks by 2020. In response to this trend, in February 2017 the Government of Uzbekistan abolished the 40 per cent excise tax on new vehicles manufactured and imported from Kazakhstan, the Russian Federation and Ukraine, in an attempt to support private sector efforts to renew and expand the fleet.[32]

The World Bank's South Asia Regional Strategy recognizes regional cooperation and integration as a key strategic objective. It pinpoints limited intraregional trade and connectivity, cumbersome procedures, non-tariff barriers, and costly road transport and logistics services as key impediments to increasing trade in the region. The South Asia subregion, which includes Bangladesh, Bhutan, India, Nepal and Pakistan, is largely characterized by limited operational connectivity, including inefficient cross-border arrangements. There are no bilateral agreements specifically addressing transport between those countries, and they lack mutual recognition of permissible weights and dimensions standards, vehicle inspection certificates and rules of origin, permits and licence requirements among others.

In Pakistan, road transport dominates the other modes, accounting for more than 90 per cent of freight and passenger traffic. Although the transport sector contributes about 10 per cent of GDP and 6 per cent of total employment, the international movement of goods by road is hampered by the lack of transport rights with neighbouring countries.

India, Bhutan and Nepal have bilateral agreements on trade and transit that cover transport-related issues implicitly, but to a limited extent. Land-locked countries, such as Bhutan and Nepal, rely heavily on their road transport links with India, as the bulk of their exports and transit cargo go to, and through, India. Exports originating from Bhutan and Nepal must be transported to the nearest ports of Kolkata and Haldia, located on the east coast of India, to be shipped overseas. Similarly, imported goods from overseas markets must enter these two gateway ports before being transported to their final destinations in Bhutan or Nepal.

A recent study[33] undertaken by the Asian Development Bank revealed that road transport continues to be predominant in overland transportation in India, and that even when other modes are used the last mile takes place by road. The study identifies key road transport-related challenges to promote seamless logistics in India. They include: (a) multiple systems in operation in different States; (b) the inefficient process of obtaining transit passes (manual in some States, only possible at the border post in some cases); (c) manual checking and inspection, leading to delays and long queues; (d) multiple check-posts; and (e) authorities asking truck drivers for backup documents and details that a truck driver may not have. These challenges are even more important considering the fact that India is the only transit country for Nepal. In addition, Nepal's trade with and through Bangladesh has to rely on Indian transit corridors, and India has extended Nepal direct transit routes to Bangladesh for bilateral and third country traffic. Nepal can also access third countries through India without any quantitative restrictions. Within Nepal,[34] about 90 per cent of all freight is transported through the country's road network. With better surfaces on the newly constructed or rehabilitated access roads, travel time and vehicle operating costs have been substantially reduced, thereby lowering the cost of transporting exported and imported goods. For example, the average operating cost per vehicle was reduced by 23.1 per cent on the Bhairahawa access road and by 20.5 per cent on the Birgunj access road.

In Bangladesh,[35] strong economic growth during past decades has been accompanied by even faster growth in transport demand, estimated at 9 per cent per year. Much of this growth has been met by road transport, the dominant mode of transport, which accounts for 88 per cent of total transport needs. Road transport cannot fulfill its role as a growth enabler because of the poorly managed road network (only 40 per cent of main roads are in good condition) and poor connectivity, leading to higher transport costs. However, analysis[36] of the time required for completing export procedures from Bangladesh to Bhutan at Burimari dry port shows that transport and border-crossing processes account for 9 per cent and 1 per cent, respectively, of total trade time. While further improving transport and border crossing processes should remain a permanent priority, this is an encouraging development. In terms of export costs, the same analysis shows that when taking all procedures (including one-time procedures for new traders) into consideration, transport is among the costliest, accounting for about 27 per cent of total cost. When the one-time procedures are excluded from the analysis, the transport of goods to the port of departure is the most expensive trade procedure at 75 per cent of the total trade cost.

In Myanmar,[37] road transport remains the preferred mode of transport, carrying almost 90 per cent of long-distance freight. The road transport industry is characterized by intense competition and low rates as well as by poor operational performance, caused mainly by the condition of the road infrastructure. Truck speeds are very slow, typically below 30 kilometres per hour, limiting annual vehicle utilization and raising costs. The comparison of the underlying economic costs of each mode of transport — without considering the impact of subsidies and underpricing — shows that at their current levels of efficiency rail and river transport are only competitive beyond 800 km vis-à-vis trucks.

The Yangon-Mandalay corridor bears about 60 per cent of all transport in Myanmar, yet trucks are not allowed on the Yangon-Mandalay expressway and have to use a parallel road in poor condition. If trucks were allowed to use the expressway, with a moderate improvement to its running surface and safety, US$10.7 billion in transport cost savings could be achieved during the next 15 years. Myanmar has no bilateral transport agreement with its neighbouring countries and goods transported by road have to be trans-shipped at or near borders, thereby increasing cost. For example, the Greater Mekong Subregion (GMS) North Road corridor linking Myanmar to China bears 13 per cent of all freight in Myanmar and 70-90 per cent of its official border trade; improving this corridor could realize US$7.7 billion in savings during a 15-year period, but with no exchange of traffic rights. Chinese trucks can cross into Myanmar only as far as 12 km from the border while Myanmar trucks can cross into China only as far as 8 km from the border.

Another example is the GMS East-West Road corridor linking Myanmar to Thailand, which carries 1,030 per cent of Myanmar's border trade; improving it could potentially generate more than US$1.7 billion in savings during 15 years. The maximum axle load allowed for Myanmar trucks is only 10 mt; increasing it to 11.5 mt would reduce Myanmar's road freight transport costs by 13 per cent with a benefit of US$2.8 billion during 15 years. Associated infrastructure costs would amount to only US$260 million, if higher pavement requirements are integrated into new construction and rehabilitation efforts.

Countries in mainland South-East Asia have progressed significantly in terms of cross-border transport facilitation. Cambodia, the Lao People's Democratic Republic, Thailand and Viet Nam have bilateral road transport agreements, thus enabling more efficient movement of goods and people. For example, Thai and Lao cargo trucks can travel to Viet Nam and back without trans-shipment due to an agreement under which 500 multiple entry permits are issued annually by each country for operating cross border transport of goods. A guarantee for the temporary importation of a vehicle is not required in the bilateral transport between the Lao People's Democratic

Republic and Thailand, and between the Lao People's Democratic Republic and Viet Nam. In addition, maximum permissible vehicle weights and dimensions are harmonized to a large extent, with permitted weight limit of 40 mt for articulated vehicles in Cambodia, the Lao People's Democratic Republic and Viet Nam. However, the weight limit in Thailand is 50.5 mt for an articulated vehicle.

During the past two years, three ESCAP member States — China, India and Pakistan — acceded to the Customs Convention on the International Transport of Goods under Cover of TIR Carnets (TIR Convention), of 14 November 1975. Despite the benefits shown in its more than 60 years of existence, the TIR transit system cannot produce positive effects on transport and trade facilitation unless traffic and transit rights are in place. These three countries will now have to focus on concluding bilateral and multilateral arrangements that will allow them to optimize their ratification of the TIR Convention.

Some ESCAP member States have already made efforts to open more international routes on the Asian Highway Network and to improve the efficiency of border crossings for goods to move seamlessly across the region, as detailed below:

(a) China, Mongolia and the Russian Federation were the first countries to agree on operationalizing the Asian Highway Network, by signing the Intergovernmental Agreement on International Road Transport along the Asian Highway Network. Once in force, the agreement will be open for accession by all the members of the Asian Highway Network;

(b) In South Asia, Bangladesh, Bhutan, India and Nepal signed a motor vehicle agreement in June 2015, which is not yet in force. Currently, the protocols for the agreement are being finalized;

(c) With the finalization of Protocol 7 Customs Transit System in 2015 to the Association of Southeast Asian Nations Framework Agreement on the Facilitation of Goods in Transit pilot implementation was undertaken during 2016 in Malaysia, Singapore and Thailand. It is expected its full implementation will significantly facilitate transport among ASEAN member countries, thereby supporting the objectives of the ASEAN Economic Community;

(d) The Intergovernmental Agreement of the Shanghai Cooperation Organization Member States on the Facilitation of International Road Transport, signed in September 2014, entered into force in January 2017. This Agreement will significantly underpin regional and subregional transport operational connectivity and integration between China, the Russian Federation and Central Asian countries.

2. ESCAP support

Basic infrastructure and facilities to establish mutually beneficial intra- and interregional transport linkages already exist in many countries. What is still needed is the development of the operational transport connectivity.

The Third Session of the Ministerial Conference on Transport, organized by ESCAP from 5 to 9 December 2016 in Moscow, approved a Ministerial Declaration and a new Regional Action Plan for Sustainable Transport Connectivity in Asia and the Pacific, phase I (2017-2021) to promote sustainable transport development in the Asia-Pacific region.

The Ministerial Declaration on Sustainable Transport Connectivity in Asia and the Pacific provides a framework for promoting sustainable transport connectivity in the region, and serves as a key road map for developing the transport sector and strengthening regional cooperation and integration. It also provides new impetus for achieving the vision of seamless connectivity based on quality infrastructure and supportive policy and legal frameworks.

The Conference also approved the model bilateral and subregional transport agreements and a model multilateral permit for international road transport, which were developed within the two regional frameworks for regional harmonization of legal instruments on cross-border and transit transport. The Model Subregional Agreement on Transport Facilitation[38] has been elaborated on the basis of comparative studies between major subregional agreements on transport facilitation, to which some ESCAP member States are parties. The Model Subregional Agreement is intended to serve as a common framework for agreements on transport facilitation. It can be used for drafting and negotiating new agreements as well as for amending existing ones, which will help to expedite the negotiation process of a subregional agreement and to facilitate its subsequent practical implementation.

The Model Subregional Agreement provides a checklist of issues typically addressed in subregional agreements on transport facilitation. The focus of the model has been on international road transport; thus, the checklist of issues is related, to a large extent, to road transport rather than other modes.

It proposes a structure and a brief description of the main elements and specific substantive issues that would be covered by a subregional agreement, but does not contain uniform wording to be used for all issues.

The Model includes a list of recommendations for issues to be settled through additional subregional agreements due to their complexity or specific nature.

The Model Bilateral Agreement on International Road Transport[39] has been elaborated based on comparative studies of existing bilateral agreements concluded between the countries of the Asia-Pacific region.

The Model proposes ways to harmonize the provisions of existing bilateral agreements that ESCAP member States could follow while negotiating new bilateral agreements or amending the existing ones.

Due to different approaches to arranging international road transport operations, it would be difficult to propose a uniform model bilateral agreement that all countries of the region would be prepared to follow with regard to traffic rights, at least within a short-term perspective.

Keeping in mind both the long-term target and currently existing differences in approaches to traffic rights and permit systems, the Model Bilateral Agreement on International Road Transport provides three options.

The first option is addressed toward countries that are not yet prepared to grant general access to their territories for international road transport operations and which still prefer to limit the scope of such operations to designated routes and border crossings. This option of the Model also provides for permits being required for most types of transport operations.

The second option makes no reference to designated routes and border crossings, but provides for permits with quantitative restrictions (quotas) with regard to most types of international transport operations. This approach is common in the region.

The third option provides for a permit-free legal regime for occasional transportation of passengers as well as for bilateral and transit transport of goods. The permits are required only for regular transportation of passengers and for third-country transport of goods. Several countries in the region currently follow a similar approach in their bilateral agreements on international road transport.

The wording of other provisions of the Model is uniform in all the three options, to provide the countries with a reference guide that could be followed during negotiations of new bilateral agreements.

The Model Multilateral Permit for International Road Transport[40] is recommended at a time when insufficient transport facilitation measures are still a serious issue in the region. Implementing the Model Multilateral Permit for International Road Transport will help to eliminate the existing inefficient trans-loading practices at borders, which currently increases transport and logistics costs. Transport operations would be accomplished directly, which would contribute equally to an uninterrupted and clear line of contractual responsibility for the final delivery of the cargo in time and in an undamaged state. The driver of the originally contracted carrier would remain in full control from the point of loading to the point of unloading at final destination. On this basis, transport security is increased and the relationship of trust between business partners would be considerably improved.

Well-functioning multilateral permits will create a virtuous circle, as solving the traffic rights problems translates into enhanced access to international road freight transport markets along the Asian Highway Network and beyond. Permits, as transport facilitation measures, may give impetus to vehicle fleet modernization, improved vehicle technical, environmental and safety standards, reduced exposure to border-crossing bureaucracy and possible illegal activities (rent-seeking, bribes etc.) and increased physical cargo security.

While facilitating road transport by exchanging permits, Governments will continue to retain full control of issuing permits to domestic and foreign transport operators; they will have the right to carry out regular checks of permit use and apply specific disciplinary action against non-complying operators.

3. Conclusion and recommendations

Transport plays a key role in implementing the 2030 Agenda for Sustainable Development, considering its role in providing people, industry and agriculture with access to economic and social opportunities and in combating climate change. It is considered an enabler for achieving the Sustainable Development Goals.

The existence of non-physical barriers negatively affects the efficiency of international road transport and increases logistics costs. As such, eliminating those impediments is important, notably through harmonization of rules, regulations as well as technical and operational standards, and simplification of documentation and procedures.

In moving forward, effective regional road transport will require political commitment and institutionalization of the integration processes, including removal of non-physical barriers to transport, and ensuring harmonization of regulations and norms together with standardizing technical requirements and cross-border procedures.

C. International railway transport

Due to the imperatives of sustainable development and, consequently, to encourage sustainable modes of transport, many countries in the region are developing railways as a preferred mode of transport. These initiatives need to be supported, as railway transport is energy-efficient and environmentally -friendly; however, railways require huge investments and therefore railway transport projects need to planned and implemented so that they create maximum synergies.

1. Current trends in the development of international railway transport in the region

(a) International railway freight traffic in Asia-Pacific countries that are members of the Organization for Cooperation between Railways

The international railway freight carried by countries having common membership of ESCAP and the Organization for Cooperation between Railways (OSJD) increased 17 per cent in 2015 compared with 2014 (table 3.4).

Table 3.4 reveals that 74 per cent of international railway freight carried among common members of ESCAP and OSJD in 2014 was handled by the Russian Federation. The figure fell to 63 per cent in 2015 due to the increase in freight carried mainly by Kazakhstan and China, while the quantity handled by the Russian Federation remained constant.

The share of Kazakhstan and China increased from 17 per cent and 1.7 percent in 2014 to 24 per cent and 5.3 per cent in 2015, respectively.

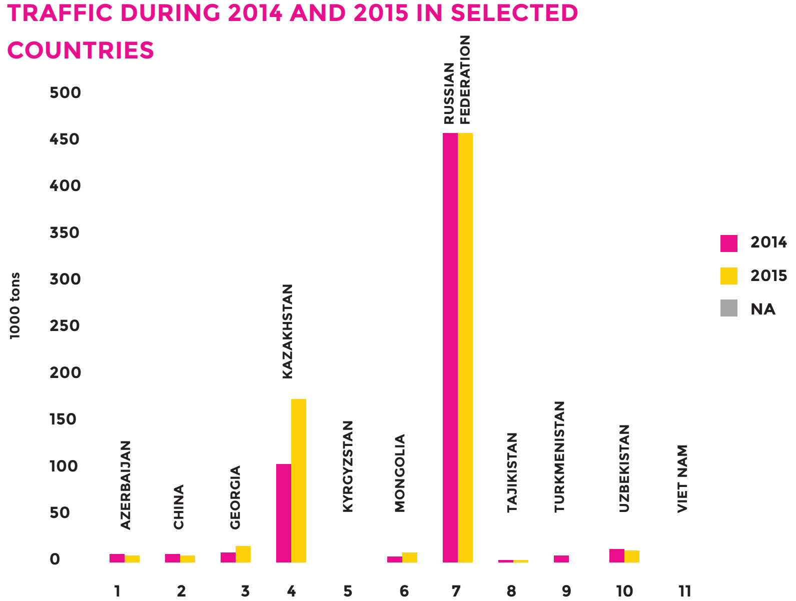
TABLE 3.4 TRENDS IN INTERNATIONAL RAILWAY FREIGHT TRAFFIC IN 2014 AND 2015 ESCAP COUNTRIES THAT ARE MEMBERS OF OSJD

NO.	COUNTRY*	INTERNATIONAL RAILWAY FREIGHT (FREIGHT HANDED OVER) (IN 1,000 MT)		INCREASE/ DECREASE (PERCENTAGE)
		2014	2015	
1	Azerbaijan	8 738	7 590	-13
2	China	10 300	37 750	+266
3	Georgia	11 141	18 120	+63
4	Kazakhstan	103 908	172 409	+66
5	Kyrgyzstan	784	586	-25
6	Mongolia	6 191	11 275	+82
7	Russian Federation	450 560	450 560	0
8	Tajikistan	2 252	1 787	-20
9	Turkmenistan	7 829	––	––
10	Uzbekistan	14 431	12 815	-11
11	Viet Nam	13	120	+823
	Total	607 409	713 012	+17

Source: OSJD Bulletin of Statistical Data on railway transport for 2014 and 2015.

* Data are not available for Afghanistan, the Republic of Korea and in the Islamic Republic of Iran. These countries are members of ESCAP and OSJD.
– Data for 2015 for Tajikistan are not available.

FIGURE 3.13 INTERNATIONAL RAILWAY FREIGHT TRAFFIC DURING 2014 AND 2015 IN SELECTED COUNTRIES



Source: OSJD Bulletin of Statistical Data on railway transport for 2014 and 2015.

* Data are not available for Afghanistan, the Republic of Korea and in the Islamic Republic of Iran. These countries are members of ESCAP and OSJD.
– Data for 2015 for Tajikistan are not available.

The statistics also show that in 2015 international railway freight by China increased by 266 per cent. This trend corroborates the increasing number of freight trains originating from China to many cities in Europe.

Another trend emerging from the data is the increase in international railway freight carried through transit countries. The freight carried increased in 2015 by 63 per cent, 66 per cent and 82 per cent for Georgia, Kazakhstan and Mongolia respectively over the previous year. These countries are major transit countries for railway traffic between Asia and Europe.

(b) Current status of international railway transport in other subregions

In South Asia, India has made efforts to strengthen its railway connections with its neighbours. A regular container service between India and Nepal is already functional, carrying more than 50 per cent of Nepal's transit traffic. A demonstration container train between India and Bangladesh was planned during the first half of 2017. Indian Railways, in its Business Plan for 2017-2018, have also indicated the possibility of a container train linking Istanbul to Dhaka via Tehran, Islamabad and New Delhi. In addition, as indicated in box 3.2, the Business Plan of Indian Railways aims to introduce numerous measures to increase freight transportation by rail.

Many countries in the region have developed Master Plans for railway transport. For example, Bangladesh has developed a Master Plans for Railways with a 20-year vision that lists 235 projects with an estimated total cost of US$30 billion. Bangladesh has 2,877 km of railway lines and hopes to add another 375 km soon. The Master Plan provides for connecting Dhaka with major industrial and urban areas of the country.[42] It also includes projects for updating existing lines and building bridges. As part of the 172-km Dhaka-Jessore railway line, Bangladesh Railway will build the country's longest railway bridge. Meanwhile, Afghanistan plans to develop around 5,000 km of railway lines in the country by 2030.

BOX 3.2 IMPROVING RAILWAY FREIGHT TRANSPORT IN INDIA[41]

Indian Railways plans to undertake numerous measures to increase railway freight as indicated in its Business Plan for 2017-2018. These measures include:

- Long-term tariff contracts with selected freight customers to provide minimum guaranteed traffic;

- End-to-end integrated transport solutions for selected commodities through partnership with logistics players;

- Setting up of private freight sidings/freight terminal;

- The introduction of road-rail transport for efficient container movements at terminals;

- Double stacking of small-size containers;

- The introduction of the roll-on roll-off (RORO) concept in the National Capital Region, i.e. trucks getting loaded onto trains to travel longer distances.

In South-East Asia, efforts are still under way after many years to put the Singapore-Kunming Railway Link (SKRL) into operation. A special working group, with Malaysia as permanent chair, has been constituted to monitor the progress of construction of missing links along the agreed routes. An implementation framework for seamless operations of SKRL is also being prepared. Countries in South-East Asia have their railway network predominantly running on metre gauge; however, there are still divergent technical standards and operational practices among countries, which pose challenges for international railway transport. For many countries in South-East Asia, such as Cambodia, Myanmar, and Thailand, the strengthening of railway transport is high on the agenda of the respective Governments. Railway investment remains a top priority in Thailand as high transport costs continue to pose a risk to economic growth. Rail has an approximate 2 per cent modal share in the freight market in Thailand, with cement accounting for the major share in railway freight. It is proposed to increase this to 5 per cent by 2022.[43]

In Malaysia, container rail services connecting major ports have been improving. KTMB MMC Cargo (KTM Malaysia Railway Cargo) further strengthened its rail feeder services by extending its connectivity from Port Klang to Johor Port and the Port of Tanjung Pelepas for domestic and trans-shipment containers. KTMB MMC Cargo's 100-container freight train successfully embarked on a landmark journey from Port Klang to Johor Port recently. The newly extended route will boost feeder services, complementing the regular and fixed schedule of Rail Inter-Terminal Transfer (ITT) Services between the Port of Tanjung Pelepas and Johor Port.[44]

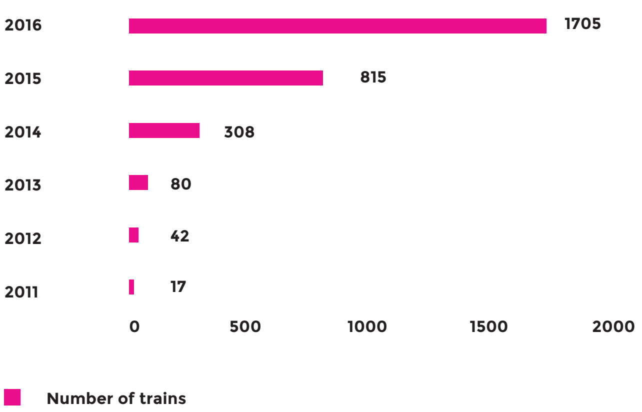
The countries of the Central Asian Regional Economic Cooperation (CAREC) Programme finalized a Railway Strategy at a ministerial meeting of the CAREC countries held in Pakistan in October 2016 on "Unlocking the Potential of Railways: A Railway Strategy for CAREC (2017-2030)". The strategy calls for railways to become the preferred mode of transport for CAREC countries by making them faster, more accessible and easier to use throughout the CAREC region. It aims to strengthen the railways of each of the countries and increase their share in the overall transport mix, thereby contributing to regional economic development. The strategy focuses on strengthening rail and related multi-modal infrastructure as well as commercializing and reforming railway activities. Implementing the strategy calls for addressing issues related to financing, human resource development and technology; this calls for cooperation among railway operators, Governments and development partners. The strategy provides a blueprint for sound long-term development of railways in CAREC countries.

(c) Increase in freight trains from Asia to Europe

In the past few years, the significant development in international railway transport has been the rapid growth in the volume of rail transport between Asia and Europe. From two regular routes in 2012 there are currently nearly 39 operational routes. Around 2,000 freight trains had crossed between the two continents as of 2016. As per data from Global Times,[45] the number of freight trains between China and Europe increased from 17 in 2011 to 1,705 in 2016. The Figure below illustrates the rise in freight trains annually from 2011 until 2016.

Apart from the Trans-Siberian route, which has been the most efficient in operational terms, other routes through Central Asia are also becoming competitive, in part due to the movement of industrial production to the western parts of China.

FIGURE 3.14 YEAR-WISE GROWTH IN NUMBER OF FREIGHT TRAINS FROM CHINA TO EUROPE



Source: Global Times.cn.[46]

The past two years have seen rail traffic growing at much higher rate along the Central Asia routes. The United Transport and Logistics Company, which handles railway traffic through Kazakhstan, the Russian Federation and Belarus, transported 47,400 containers in 2015; that volume more than doubled to 100,000 TEUs in 2016. The company is targeting a 40 per cent increase in 2017.[46]

To exploit the transit potential between Asia and Europe, most countries in Central Asia and those adjoining it are making efforts to improve railway transport, and numerous projects are underway to provide connectivity between Asia and Europe through Central Asia and the South Caucasus. However, challenges persist, many related to the complexity of formalities and procedures. For example, in Uzbekistan the transit time by the 882-km Keles-Galaba (north-south crossing) rail route connecting Kazakhstan, the Russian Federation, China and Mongolia with Afghanistan is four to five days. On the 1,735-km rail route Karakalpakstan-Galaba (east-west crossing) connecting Kazakhstan, the Russian Federation, Ukraine and Belarus with Afghanistan, the transit time is 9-10 days. On the 1,735-km rail route Karakalpakstan-Galaba (east-west crossing) connecting Kazakhstan, the Russian Federation, Ukraine and Belarus with Afghanistan, the transit time is 9-10 days. On the 1,728-km Karakalpakstan-Kudukli (east-west crossing rail route connecting Kazakhstan, the Russian Federation, Ukraine and Belarus with Tajikistan the transit time is also 9-10 days.

The Islamic Republic of Iran plans to increase its railway from the current 11,000 km to 25,000 km by 2025. Afghanistan has established a railway authority under the Ministry of Public Works to oversee railway development in the country, and plans to lay 1,674 km of railway by 2020 in order to enhance its railway transport connectivity. Linking a railway transport corridor between Asia and Europe is also a key priority for Turkmenistan. In 2015, the Turkmenistan railway handled 22 million mt of freight, of which 67 per cent was transit traffic.

Another railway link of significance for Eurasian railway connectivity is the Baku-Tbilisi-Kars (BTK) railway connection that will connect Baku in Azerbaijan to Tbilisi in Georgia and Kars in Turkey. The 827-km route is expected to open in 2017 and will provide an additional railway transport connection between Asia and Europe via the Caspian Sea. The line from Baku to Akhalkalaki in Georgia is on large gauge (1,520 mm), and from there to Kars it is standard gauge (1,465 mm). Therefore, a trans-shipment terminal will be constructed at Akhalkalaki in Georgia.

The growing networks and frequency of services trigger higher volumes. For example, Deutsche Bahn carried more than 40,000 TEUs between China and Germany in 2016; it is expecting this figure to grow to 100,000 TEUs by 2020. Similarly, in the Russian Federation, RZD Logistics' 2016 results reveal that a subsidiary reported Chinese-Europe transit trains carried 73,000 TEUs on the Russian network in 2016.[47]

Eight trans-Eurasian freight trains of China Railway (CR) Express left eight Chinese cities simultaneously on 8 June 2016, heading to destinations across Europe, as a reiteration of the commitment by the Government of China to develop railways as an alternative, environmentally- friendly mode of transport. One of the destinations was London, and the journey from Yiwu, China, crossing eight countries, took only 18 days, or around half the time required by the sea voyage and half the cost of the equivalent air freight journey.[48] The trains reach Europe using either the southern branch of the Trans-Siberian Railway from northern China, or by transiting through western China and Kazakhstan and joining the Trans-Siberian at Yekaterinburg.

One of the most illustrative examples of responses to increased demand is the construction of the Khorgos Gateway, a logistics and industrial hub on the Kazakhstan-Chinese border that is planned to cover 5,470 ha. This includes the 129.8 ha Khorgos Gateway Inland Container Dock, a gauge-changing station for the trans-Eurasian railway with a capacity for six trains at one time and which can process 580,000 TEUs annually. Also, transit countries such as Mongolia are taking measures to support the development of China-Europe freight train routes. A total of 167 China-Europe freight trains travelled through Mongolia in 2016; the total number is expected to reach 400 in 2017. The Mongolian authorities have vowed to help shorten the transit time of China-Europe freight trains and provide faster customs clearance services.[49]

Some of the specific train routes that have been operated during the past two years include a direct container train between China and the Islamic Republic of Iran, which first arrived in Tehran in early 2016 — a distance of 10,399 km from Yiwu in 14 days. The train passed through China-Kazakhstan-Turkmenistan along the newly constructed 925-km Uzen-Gorgan route between Kazakhstan, which transits Turkmenistan, and the Islamic Republic of Iran.

The first freight train from China to Afghanistan reached Hairatan, near the border with Uzbekistan, in September 2016. The train started from Nantong in China with 84 containers and covered the distance of 3,000 km in 14 days. Under China's Belt and Road Initiative, two trains a month have been scheduled to run via Alatau, Kazakhstan and Uzbekistan. Another China-Afghanistan train began to run in August 2016 linking Yiwu, China with Mazar-i-Sharif, Afghanistan. The train was operated by InterRail, an international rail freight provider and train operator between China and Europe. The company conducted its first intermodal rail freight tests in 2012 and began running regular block train services in 2014. From its hub in Yiwu, and working in close cooperation with China Railway subsidiaries CRCT and CRIMT, InterRail now serves Duisburg and Madrid twice-weekly, and has instituted a return Madrid-Duisburg-Yiwu service. It also recently conducted a test service to Riga in Latvia.

November 2016 also marked the opening of the second railway connection between Turkmenistan and Afghanistan. The train service along the 88-km route between Atamyrat in Turkmenistan and Aqina in Afghanistan connects Afghanistan to the railway network of Turkmenistan, and further across the Caspian Sea to Europe.

The volume of freight transported in 2015 along the Trans-Siberian Railway was 113 million mt, around 4 per cent more than 2014. The number of containers transported in 2015 totalled 504,000 TEUs, which was 57 per cent more than was transported in 2011.[50]

The Government of the Republic of Korea cooperates with the Governments of China and Kazakhstan in operating a block train that began transporting Korean cargo to Europe from July 2017. Cargo from the ports of Incheon and Busan will be consolidated at the port of Qingdao, China, then transported to Chengdu, China by the newly introduced Trans China Railways (TCR) service. From Chengdu, a full or partly-chartered block train will further carry the Korean cargo using the Siberian Transit Railway (TSR) route through Kazakhstan's Dostyk, to Poland, without interruption. The service will be operated three times a week and is expected to take about 18-23 days from Republic of Korea to Poland. However, the success of this new block train depends on lowering the transport cost, which currently appears to be 40 per cent higher than sea transportation.

(d) Border crossings along the Trans-Asian Railway Network

The reliability and predictability of freight train services depend to a large extent on the efficiency at border crossings. The main railway corridors along the Trans-Asian Railway Network and the important border crossings are shown in table 3.5.

TABLE 3.5 MAIN RAILWAY TRANSPORT CORRIDORS AND THEIR BORDER CROSSINGS

Source: ESCAP Intergovernmental Agreement on the Trans-Asian Railway Network.

CORRIDOR	NUMBER OF CROSSINGS	NAME OF BORDER CROSSING
1. Trans-Siberian corridor (across the Russian Federation)	None	
(a) Connection with China	1	Manzhouli (China)-Zabaykalsk (Russian Federation)
(b) Connection with China and Mongolia	2	Erenhot (China)-Zamyn Uud (Mongolia) Sukhbaatar (Mongolia)-Naushki (Russian Federation)
(c) Connection with China and Kazakhstan	1(+1)	Alashankou (China)-Dostyk (Kazakhstan) plus one (or more) border crossings between Kazakhstan and the Russian Federation (with limited border control under Eurasia CU rules).
2. Trans-Asia-Europe corridor		
(a) China, Kazakhstan, Uzbekistan, Turkmenistan, Islamic Republic of Iran, Turkey	5	Alashankou (China)-Dostyk (Kazakhstan) Sary-Agach (Kazakhstan)-Keles (Uzbekistan) Khodzhadavlet (Uzbekistan)-Turkmenabad (Turkmenistan) Sarakhs (Turkmenistan)-Sarakhs (Islamic Republic of Iran) Razi (Islamic Republic of Iran)-Kapikoy (Turkey)
(b) China, Kazakhstan, Uzbekistan, Turkmenistan/Azerbaijan, Georgia	4 plus 4 ports	Alashankou (China)-Dostyk (Kazakhstan) Sary-Agach (Kazakhstan)-Keles (Uzbekistan) Khodzhadavlet (Uzbekistan)-Turkmenabad (Turkmenistan) plus Turkmenbashi (Port) (Turkmenistan) plus Baku (Port) Azerbaijan Beyouk Kesik (Azerbaijan) Gardabani (Georgia) plus Poti or Batumi (Port) (Georgia) plus Europe Bleak Sea (Port)
3. Singapore-Kunming, China Rail Link		
Singapore, Malaysia, Thailand	2	Woodlands (Singapore)-Johor Bahru (Malaysia) Padang Besar (Malaysia)-Padang Besar (Thailand)
4. China-Viet Nam	1	Hekou (China)-Lao Cai (Viet Nam) or Pingxiang (China)-Dong Dang (Viet Nam)
5. India-Nepal	1	Raxaul (India)-Birgunj (Nepal)

TABLE 3.6 BREAK-OF-GAUGE BORDER CROSSINGS ON THE TRANS-ASIAN RAILWAY NETWORK

Source: ESCAP Intergovernmental Agreement on the Trans-Asian Railway Network.

BREAK OF GAUGE (MM)	BORDER CROSSINGS
1,435-1,000	Hekou (China)-Lao Cai (Viet Nam) Pingxiang (China)-Dong Dang (Viet Nam)
1,435-1,520	Alashankou (China)-Dostyk (Kazakhstan) Erenhot (China)-Zamyn Uud (Mongolia) Manzhouli (China)-Zabaykalsk (Russian Federation) Suifenhe (China)-Grodekovo (Russian Federation)
	Astara (Islamic Republic of Iran)-Astara (Azerbaijan) Jolfa (Islamic Republic of Iran)-Djulfa (Azerbaijan)
	Sarakhs (Islamic Republic of Iran)-Saraks (Turkmenistan) Incheboroun (Islamic Republic of Iran)-Gudriolum Turkmenistan
	Dogukapi (Turkey)-Akhuryan (Armenia)
1,435 - 1,676	Mirjeveh (Islamic Republic of Iran)-(Koh-i-Taftan) Pakistan

The need to deal with a gauge difference is one of the main distinctive characteristics of several border crossings along the Trans-Asian Railway Network. The border crossings, which are main break-of-gauge points along the network, are listed in table 3.6. The capacity to support efficient break-of-gauge activities, such as reloading facilities and equipment including bogie exchange facilities, is critical for the efficiency of border crossings that have to deal with gauge changes.

The capacity to handle traffic efficiently depends on the facilities available at the receiving and dispatching yards of the border-crossing stations as well as the capability for dealing with specific types of cargo, e.g., containerized, bulk and heavy loads depend on infrastructure and equipment available at the border crossings.

Another important characteristic of border crossings is their location. If the border crossing is located at the intersection of rail and road corridors it could provide capacities for reconfiguring of a train and marshalling operations (rail yards, side lines, equipment and systems) as well as capacities for intermodal road-to-rail and rail-to-road linkages. The number of border crossings along transport routes, related delays and uncertainties of waiting time experienced at the railway border crossings are also very important factors for the attractiveness of rail corridors.

The Trans-Siberian corridor from the Far East seaports through the Russian Federation offers links between Asia and Europe over longer distances, but without any land border crossings in Asia. The Trans-Siberian corridor connections to and through China, Mongolia and Kazakhstan as well as the Trans-Asia-Europe corridor offer different options for connecting Asia and Europe — however, with one or more border crossings.

On other international rail corridors in Asia there is usually one or two border crossings. Border crossings dealing with heavy traffic and large volumes of goods need to have streamlined procedures in order to reduce delays associated with the completion of regulatory, technical and operational controls as well as commercial requirements.

Efficient operations of container trains along international railway corridors involve coordination among numerous stakeholders. In this regard, the railways of the Russian Federation, Kazakhstan and Belorussia have formed a joint stock company, the United Transportation and Logistics Company, to increase the railway transit traffic (box 3.3).

BOX 3.3 UNITED TRANSPORTATION AND LOGISTICS COMPANY[51]

To increase the volume of container transit traffic along the railway transport corridor between Europe and Asia, JSC Russian Railways, the National Union Belarusian Railway and JSC National Company Kazakhstan Temir Zholy have set up a joint stock company called the United Transportation and Logistics Company (UTLC). The company provides the following services along the Dostyk/Altynkol/Brest route:

- Payment of freight charges;
- Delivery of rolling stock;
- Operations at terminals at initial and final points of the route;
- Transit customs declarations;
- Cargo tracking;
- Information support for transportation.

The national railway operators of the Russian Federation, Kazakhstan and Belarus signed the agreement on setting up the company in June 2013. The public joint-stock company UTLC was registered by the universal state registry of corporations in Moscow in November 2014. UTLC facilitates transportation of containers of cargo in the single economic space of the three countries, including in transit between Europe and Asia.

2. ESCAP initiatives to support international railway transport

The entry into force of the Intergovernmental Agreement on Trans-Asian Railway network in 2009 demonstrated the willingness of countries in the region to work together on coordinated development of railway transport. ESCAP member States and their development partners have been making sustained efforts to bridge the missing links on the network. Simultaneously, there is a need to strengthen interoperability in all dimensions (legal, technical and operational) in order to promote seamless movement of freight trains along the Trans-Asian Railway network and beyond.

To carry forward the momentum generated by the entry into force of the intergovernmental agreement, the member States adopted Resolution 71/7 on the Adoption of the Regional Cooperation Framework for Facilitation of International Railway Transport[52] during the seventy-first session of ESCAP held in Bangkok in 2015. The Framework identifies four fundamental issues and 11 areas for cooperation among members for the facilitation of international railway transport.

The fundamental issues identified are: (a) standards for railway infrastructure, facilities and equipment; (b) break-of-gauge; (c) different legal regimes for railway transport contracts; and (d) coordination of regulatory controls and inspections at border interchange stations.

The 11 areas for cooperation indicated in the Framework are: (a) participation in international railway organizations; (b) formulation of subregional and bilateral agreements on the facilitation of railway transport; (c) cooperation to standardize cross-border railway operations; (d) use of advance passenger/cargo information system(s); (e) arrangements for the exchange of wagons; (f) use of new technologies in train operations as well as in container tracking; (g) developing human resources for cross-border railway operations; (h) establishment of logistics centres/dry ports and maintenance hubs at or near border interchange stations, and particularly along railway freight corridors; (i) simplification of the intermodal interface between railways, maritime, air and road transport; (j) promotion of the corridor approach in the facilitation of international railway transport; and (k) working towards paperless railway freight transport.

In order to support members and associate members in implementing the Framework, the ESCAP Secretariat is undertaking a project on the harmonization of rules and regulations for the facilitation of international railway transport. The project aims to develop: (a) commonly agreed technical standards and harmonized operational procedures for efficient international railway transport; and (b) a model/manual of railway border crossing practices to reduce the time for regulatory controls of international railway transport operations.

Historically, international railway transport is based on two legal arrangements, one framed by OSJD and the other by the Intergovernmental Organization for International carriage by Rail (OTIF). OSJD developed the SMGS consignment note while OTIF developed the CIM consignment note for formalizing contractual requirements between railways and its customers. Due to the two different legal arrangements, freight trains along the Eurasian railway corridors incurred long delays at border crossings where there was a change in the legal regime. To overcome this challenge, a common consignment was developed to promote practical implementation of legal interoperability along the Eurasian railway transport corridors.

However, the situation regarding technical and operational interoperability is not clear. There appears to be a divergence in the various technical standards and operational procedures among countries that challenges international railway transport in the region and beyond. Further, to help modal shift and make railways attractive to shippers on a regular basis, it is critically important to increase the reliability and predictability of freight train services. To this end, railway border crossing procedures need to be streamlined to reduce administrative burdens and delays.

Therefore, ESCAP is also undertaking a study on railway border crossings to enhance the understanding of the processes involved, with a view to suggesting streamlining of procedures. This could help railway authorities to reduce border crossing delays and increase reliability of train services.

The study groups railway border crossing processes under the following heading: (a) border-crossing procedures related to railway freight traffic, including those related to a break of gauge, change of locomotive and crew, transfer of wagons, railway technical inspections, and the transfer of goods; (b) documentary requirements for railway border crossings such as wagon lists and consignment notes; (c) the use of electronic information systems for the exchange of information between railways and customs; and (d) processes related to the completion of customs and other government agency formalities that include pre-arrival intimation, mutual recognition of control measures, risk-based inspections, the use of new technologies, and sharing of information.

D. Maritime transport

This section analyses intercountry, intra-subregional and regional maritime connectivity and inter-island shipping in and between Small Island Developing States. ESCAP member and associate member States have made substantial investments in port infrastructure. However, in some countries, investment and facilitation efforts have been confined to ports, with hinterland infrastructure and operational connectivity remaining weak. Increasing congestion on road networks and rail infrastructure indicate coastal shipping is becoming a more attractive, viable and sustainable alternative, which can complement land transport. This section also takes stock of initiatives in developing coastal shipping as an alternative to land transport modes for long distance transportation of bulk cargoes at lower cost. The main points covered in this section include:

(a) Competition and patterns of maritime transport;

(b) Sustainability, safety and security in maritime transport;

(c) Maritime connectivity; the special situation of Small Island Developing States;

(d) Facilitation of maritime transport (streamlined import/export regulations to facilitate efficient clearance of cargo);

(e) The use of new technologies (e-port logistics systems, cargo tracing and tracking).

1. Review of world and Asia-Pacific region maritime transport

(a) Seaborne trade volume and patterns

Recently, the environment surrounding the shipping industry has changed significantly due to mergers and acquisitions between global shipping companies, the expansion of the Panama Canal, reorganization of shipping alliances, continued oversupply of ships, fluctuations in international oil prices, intensified competition among shipping companies and strengthened marine environmental regulations, among others.

The global shipping economy is rapidly changing. The Trans-Pacific Partnership (PPT), has been broken down by the strengthening of protectionism, while bilateral and multilateral FTAs are expanding and the phenomenon of reshoring that brings overseas production plants back to their home country has emerged.

In particular, Europe, which is one of the drivers of the global economy, is expected to face uncertainties due to Brexit and possible protectionism. China appears to have reached the end of the heyday of rapid annual 8-9 per cent economic growth and be in a pace-making stage aiming at economic growth of 6-7 per cent annually.

The global marine transportation of containers has increased by just 1.3 per cent from 182.2MTEU in 2014 to 184.6MTEU in 2015. The details for the main routes in 2015 are: (a) the east-west route accounted for 41.5 per cent of the total trade volume, (76.7 MTEU); and (b) the north-south route accounted for 16.6 per cent of the total (30.7 MTEU). Intraregional routes accounted for 41.9 per cent (77.3 MTEU). In the case of the east-west route, the eastbound cargo was 36.9 MTEU and the westbound cargo rose slightly to 39.8 MTEU. In the case of the north-south route, the southbound cargo was dominant at 18.0 MTEU, while northbound cargo was 12.6 MTEU.

In the Asian region, both the east-west route and north-south routes, carry a much higher share of export cargo to Europe and North America. This imbalance in import and export cargos occurs on most of the trunk routes. On the North American route, the export cargo from the Asian regions was 2.5 times higher at 17.6 MTEU while import cargo was 7 MTEU. In the case of the East Asia-Europe route, the export cargo was 14.5 MTEU, 2.1 times higher than imported cargo of 6.7 MTEU.

This imbalance in import and export cargo due to trade structures is undesirable for shipping companies and efficient re-positioning of the empty containers is a challenge.

(b) Intraregional trade volume and its pattern

One of the recently emerging characteristics of international container trade is the increase in intraregional trade, which has already exceeded that of east-west and north-south trade. The ESCAP region accounts for 81.1 per cent of the total intraregional trade (62.7 MTEU). Within the ESCAP region, the trade volume of Asia is 98.2 per cent (61.67 MTEU). For South Asia it is 0.57 MTEU and for Australasia it is 0.637 MTEU .

FIGURE 3.15 EAST-WEST AND NORTH-SOUTH CONTAINERIZED SEABORNE TRADE VOLUME, 2015

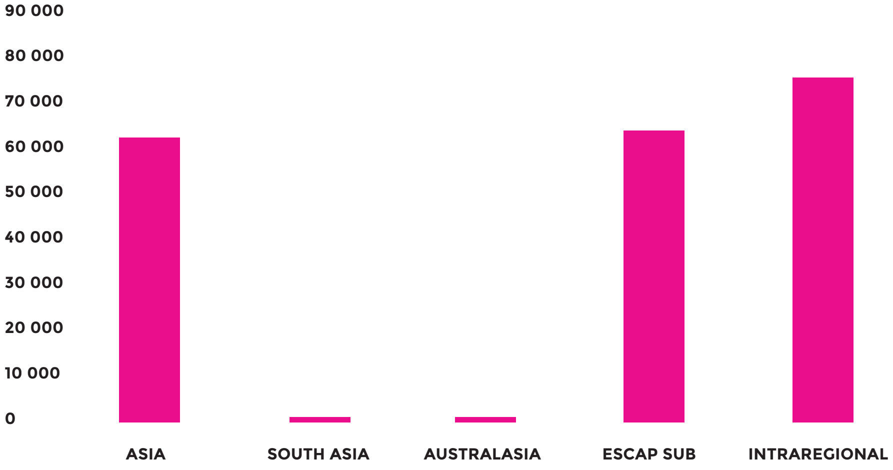
Source: Data from Drewry, Container Forecast and Annual Review, 2016/2017.
Unit: Million TEU.

FIGURE 3.16 INTRAREGIONAL CONTAINERIZED SEABORNE TRADE VOLUME, 2015

Source: Data from Drewry, Container Forecast and Annual Review, 2016/2017.
Unit: Million TEU.

FIGURE 3.17 INTRAREGIONAL CONTAINER TRADE IN 2016 ('000 TEU)

Source: Drewry, Container Forecast and Annual Review. 2016/2017. Unit: '000 TEU.



2. Shipping service demand and supply

(b) Growth in ship size

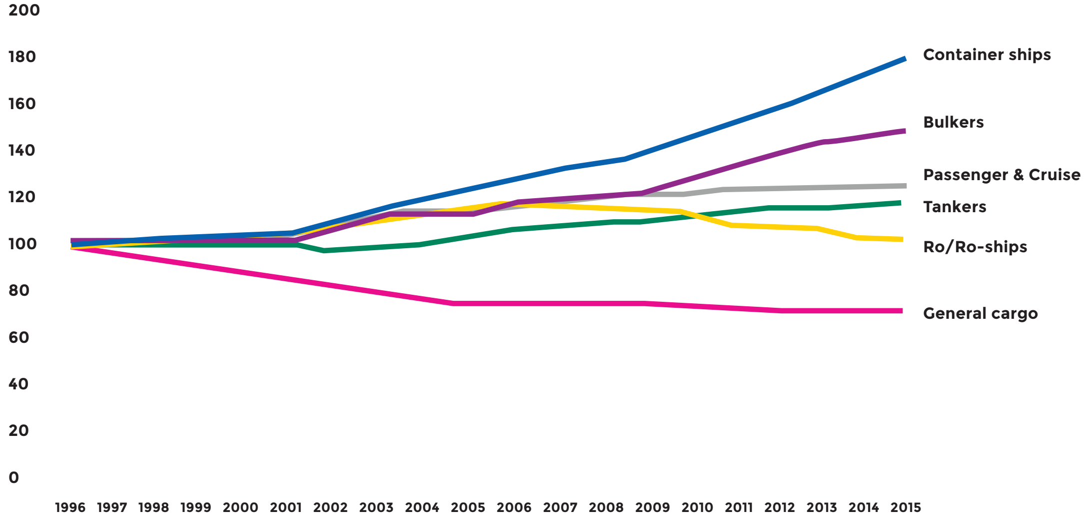
The global economy and demand for shipping capacity are going through a period of modest growth. On the other hand, ships are getting bigger and the continuous input of new vessels is resulting in a continuous oversupply of tonnage. Most shipping market experts are forecasting that the current situation is unlikely to improve within the next two to three years. In the container sector, the upsizing of container ships, led by European shipping companies such as Maersk, vessels of more than 18,000 TEU have entered the market on a large scale, resulting in continuous oversupply of capacity.

It is not easy to expect substantial demand-side growth, since the multiplier effect of commodity exports to GDP is lower than in the 1990s in particular. The multiplier effect of container trade volume to GDP is decreasing. The export multiplier for GDP products dropped from 2.2 in the 1990s to 1.56 in the 2000s, and to 1.07 during 2011-2015. Therefore, it is not possible to expect any increase in container trade volume to substantially exceed GDP growth in the future.

As shown in figure 3.18, the size of container ships increased 90 per cent, bulk carriers increased 55 per cent and tankers increased 22 per cent between 1996 and 2015. Fortunately, there have only been five new orders for ships of 10,000 TEU size since 2016. This is the result of shipping companies that had secured cost competitiveness through ordering large-sized vessels not placing orders for new vessels. During the next few years, orders for superlarge-sized vessels are unlikely to be prevalent, and the conditions for supply and demand are unlikely to deteriorate further.

There is a cautious view that the oversupply of tonnage will be somewhat resolved in the coming year as increases in freight volume exceed fleet growth rate. According to market forecasts, cargo volume should increase 2.9 per cent next year while fleet growth rate will only be 1.7 per cent. Shipbuilding orders declined sharply by 30 per cent in 2016, reaching 12,341,530 CGt.

FIGURE 3.18 TREND IN THE GROWTH OF SHIP SIZE, 1996-2015



Source: OECD/ITF, Olaf Merk, "Making size count — economics of the mega-vessel", 14 October. 2015.

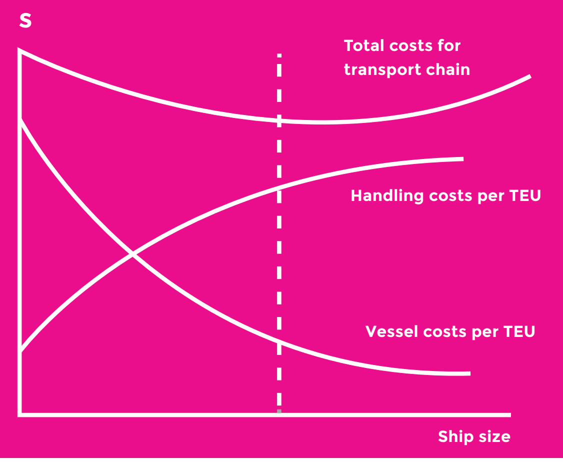
BOX 3.4 ECONOMIES OF SCALE IN SHIP SIZE

The upsizing of container vessels is a strategy for shipping companies to reduce the cost per unit and to secure competitiveness of freight rates in the shipping market:

(a) Compared to 5,000 TEU vessels, 20,000 TEU vessels are four times more cost-effective per unit; and

(b) Since the global financial crisis, major shipping companies such as Maersk have reduced costs and secured profits through the deployment of superlarge-sized vessels.

Reduced costs have been realized through economies of scale, slow steaming, fuel and crew cost savings through superlarge-sized ships.



Source: OECD/ITF, Olaf Merk, "Making size count—economics of the mega-vessel", 14 October. 2015.

The global maritime market is undergoing further changes due to the expansion of the Panama Canal in June 2016 to allow the passage of 14,000 TEU vessels. As a result, the Asia-North American East Coast route, which was mainly serviced by 5,000 TEU Panamax class vessels, is now serviced by ships almost three times in size, up to 10,000~13,000 TEU. Therefore, shipping companies operating on major ocean routes have begun to exclude Panamax class vessels that are less efficient.

Serial reassignment of some of the vessels, called the cascading effect, to the intraregional shipping market in Asia has seen relatively stable growth and stability. The mass introduction of Panamax vessels to the small vessel-dominated intraregional shipping market in Asia will bring the market to extreme competition, and may lead to further declines in profitability.

(b) Changes in shipping services

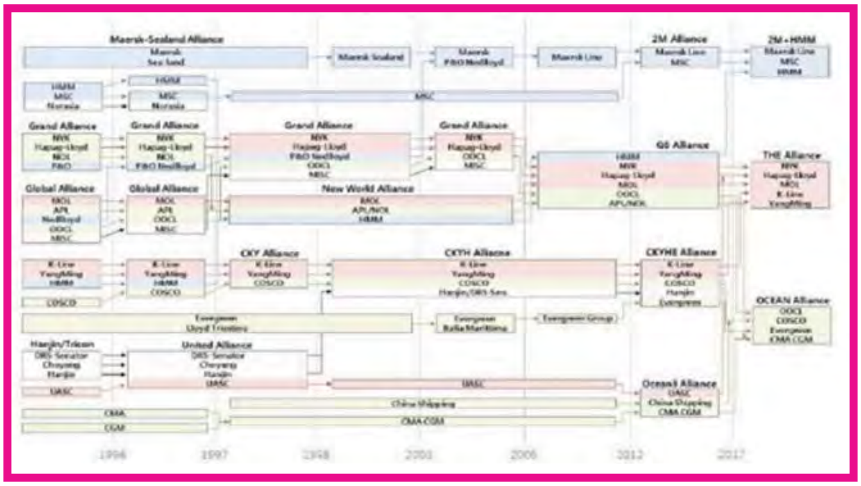
A new shipping alliance system is negotiated in the global container shipping industry every five years. Most recently, the global shipping market was reorganized into three shipping alliances, largely due to the economies of scale and the rise of the shipping industry of China. For price competitiveness, shipping companies have grown in size through mergers and acquisitions as well as the deployment of superlarge-sized vessels. The strategy is to lower freight rates by carrying more cargo at a time. On 1 April 2016, Hyundai Merchant Marine joined a "strategic cooperation partnership" called 2M, the world's largest maritime alliance that includes Maersk.

China has grown into a leading force in the global shipping market by merging COSCO and CSCL, its first and second shipping companies, in March last year. Following this action, China formed the 'Ocean Alliance' with France's CMA-CGM, the world's third-largest shipping company.

Within the shipping industry, a recession began in 2011, resulting in extreme competition and shipping freight rates plummeted to one-third of 2010 levels due to oversupply. In the aftermath of this, Hanjin Shipping, the Republic of Korea's number one carrier and seventh largest shipping company in the world, went bankrupt.

FIGURE 3.19 TREND IN THE RESTRUCTURING OF GLOBAL SHIPPING ALLIANCES

Source: Korea Maritime Institute, Monthly Trend Analysis, April. 2017.



As shown by figure 3.19, the global shipping market has been repeating the process of meeting and parting every few years, and has grown in size through mergers and acquisitions that have now been organized into just three alliances — 2M + HMM, THE Alliance and OCEAN Alliance.

Through the reorganization of the alliances, it is expected that service capability/capacity will increase 5.4 per cent on the Asia-Europe route, 9.4 per cent on the Asia-Mediterranean route, 2.7 per cent on the Asia-North America West Coast route and 19 per cent in the Asia-North America East Coast route that was additionally affected by expansion of the Panama Canal. The number of services increased from 85 to 97, due to alliance reorganization increasing efficiency of the fleet plus the increased sizes of the alliances.

These three alliance fleets account for 75 per cent of the total container traffic and are likely to be able to negotiate more favourable freight rates and terminal charges, based on their enhanced market dominance.

(c) The container shipping fleet

As of 1 July 2016, the world container ship fleet comprised 5,219 vessels ranging in size from <500 TEU to 18,000-plus TEU (table 3.7).

TABLE 3.7 WORLD CONTAINERSHIP FLEET BY SIZE RANGE, 1 JULY 2016

Size range (TEU)	Number of vessels	Capacity ('000 TEU)
<500	333	98
500-999	710	535
1 000-1 499	706	821
1 500-1 999	544	932
2 000-2 499	266	618
2 500-2 999	367	985
3 000-3 999	263	908
4 000-4 999	614	2 718
5 000-5 999	324	1 755
6 000-6 999	232	1 519
7 000-7 999	50	365
8 000-9 999	473	4 139
10 000-13 999	221	2 693
14 000-17 999	77	1 138
18 000+	39	727
Total	**5 219**	**19 951**

Source: Drewry, Container Forecast and Annual Review, 2016/2017; October, 2016.

Container shipbuilding orders peaked at 2.1 MTEU in 2015 while in 2016 they amounted to only 0.21 MTEU. Recently, orders for large container vessels have been almost non-existent and only 10 orders have been placed for feeder ships of less than 3,000 TEU capacity.

As of July 2016, the order status of the container fleet was 3.3 MTEU with an average vessel size of 7,997 TEU, which indicates that growth in ship size is the trend. Of these 420 ordered vessels, 189 are larger than 8,000 TEU. More than 70 vessels of over 18,000 TEU are expected to be delivered by mid-2019, of which the first 20 are expected to be delivered in 2017.

Ships of more than 8,000 TEU accounted for 43.6 per cent of the entire container fleet, and the average size of the container fleet reached 3,823 TEU by 2016, which is 2.5 times larger than the 1,539 TEU average in 1996 and 1.6 times larger than the 2,377 TEU in 2006.

The average speed of the entire fleet was analysed as 21.1 NM, and the average age was 11.3 years, which is relatively low compared to other ship types.

The volume of scrapped ships in 2016 was the third biggest in history and the volume of scrapped container ships was the largest ever. A total of 195 container ships (8.8 million DWT, 0.7 million TEU) were scrapped, which is the biggest figure since statistics, based on DWT and TEU standards, began in 1956. Of those ships scrapped, vessels of 3,000~7,999 TEU capacity represented 6.5 million DWT (106 ships), or 74 per cent of the total container ships retired.

Within this category, the retirement of vessels of 4,000~5,000 TEU has increased sharply as a result of the Panama Canal expansion. It is expected that, in 2017, 6.2 million DWT of container ships in the 3,000~7,999 TEU class will be scrapped, while the total number of container ships scrapped is expected to reach 8.3 million DWT.

3. Recent issues related to maritime transport in Asia-Pacific

(a) Mergers and acquisitions in the shipping industry

Major issues in the shipping industry in recent years have been the restructuring of the global shipping industry which was reorganized into a top three shipping alliances that commenced service provision in April 2017 and the mergers and acquisition(M&A) between major global shipping companies that has been active for the past two years.

In December 2016, the world's number one shipping company, Maersk, acquired Hamburg Sud. In December 2015, CMA-CGM acquired NOL. In 2017, Cosco and CSCL merged into one company.

In July 2017, a joint venture was established that integrates the container operating divisions of three Japanese container companies (NYK, MOL and K-Line). Also in 2017, Cosco acquired OOCL, a shipping company of Hong Kong SAR.

Hapag-Lloyd, the largest container shipping company in Germany merged with UASC, a shipping company of the UAE, to represent 7.4 per cent of world holdings with 225 ships. With the completion of these mergers and acquisitions the share of the top five shipping companies (Maersk, MSC, CMA-CGM, Cosco, and Hapag-Lloyd) has increased to 54.9 per cent, from 47 per cent in September 2015.

When the shipbuilding industry completes the delivery of container vessels that have already been ordered, and because orders for large ships have not been made since 2016, it is likely freight rates will rise in the coming years to the benefit of large shipping companies. In this changing paradigm the shipping industry is shifting from the competition to increase sales and ship size to focus on profitability.

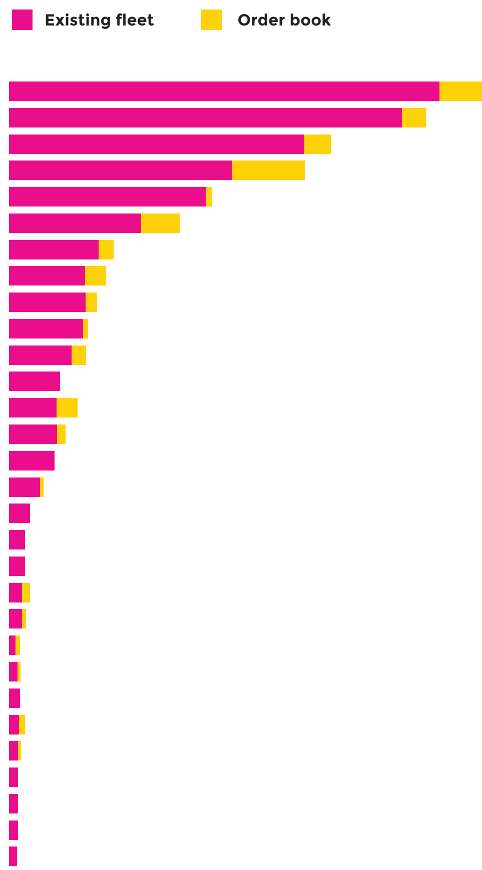
(b) Strengthening of environmental regulations and their impact

Environmental regulations, such as restrictions on greenhouse gas emissions and mandatory ballast water treatment systems, are becoming a challenge for shipping companies. Although the Convention for the Ballast Water, which was originally scheduled to be applied from September of 2017, was postponed to 2020, the international conventions for the protection of the marine environment and sustainable development will continue to be strengthened.

FIGURE 3.20 CONTAINER FLEET, BY OPERATOR

Source: https://www.alphaliner.com/top100/.

Operator	Teu	share
1 . AMP-Maersk	3,349,062	16.1%
2. Mediterranean Shg Co	3,060,359	14.7%
3. CMA CGM Group	2,300,043	11.0%
4. COSCO Shiping Co Ltd	1,735,977	8.3%
5. Hapag-Lloyd	1,527,876	7.3%
6. Evergreen Line	1,024,118	4.9%
7. OOCL	689,987	3.3%
8. NYK Line	592,759	2.8%
9. Yang Ming Marine Transport Crop	580,849	2.8%
10. Hamburg Sud Group	565,288	2.7%
11. MOL	490,929	2.4%
12. Hyundai M.M	371,705	1.8%
13. PIL (Pacific Int. Line)	371,215	1.8%
14. K Line	358,498	1.7%
15. Zim	346,945	1.7%
16. Wan Hai Lines	228,705	1.1%
17. X-press Feeders Group	143,658	0.7%
18. KMTC	118,509	0.6%
19. SITC	103,310	0.5%
20. IRISL Group	97,671	0.5%
21. Zhonggu Logistics Corp.	92,544	0.4%
22. Arkas Line / EMES	71,331	0.3%
23. Sinotrans	69,407	0.3%
24. SM Line Corp	68,083	0.3%
25. Quanzhou An Sheng Shg Co	67,073	0.3%
26. TS Lines	64,724	0.3%
27. UniFeeder	58,652	0.3%
28. Simatech	58,495	0.3%
29. Grimaldi (Napoli)	50,622	0.2%
30. Transworld Group	50,117	0.2%



According to such measures, the sulphur content (Sox) of ship fuel should be reduced from 3.5 per cent to 0.5 per cent. These are the most important measures to be brought into force since tankers were required to change from single hull to double hulls 20 years ago.

Larger vessels mainly use the "Bunker C oil". This oil has the lowest quality among petroleum products from crude oil. In Europe, which has many port cities, air pollution due to ship exhaust gas is serious in coastal ports as well as inland cities due to frequent entry of ships. Since 2010, the International Maritime Organization (IMO) has regulated the content of sulphur oxides in the fuel of ships passing through the ECA (Baltic, Arctic, North America and the Caribbean) to 1.0 per cent or less, and to 0.1 per cent from 2015. The regions outside the ECA were regulated below 3.5 per cent from 2012. At the IMO General Assembly held on 28 October 2016 it was decided to reduce the content of sulphur oxides in the fuel of the ships to 0.5 per cent from 2020.

In order to meet the IMO requirements, ships must use the low sulphur oil (marine gas oil) and install scrubbers. The problem is cost. The low sulphur oil is 50 per cent more expensive than Bunker C oil and it costs about US$5 million to install scrubber technology. In addition, scrubbers have the disadvantage of consuming more fuel as they degrade the performance of existing engines. In the case of old vessels, experts claim it is more economical in the long term to replace them with a new vessel powered by LNG, rather than replacing the existing fuel with the low sulphur flow or installing a scrubber.

Ballast water (seawater) is used to maintain stability of a ship. Once cargo is loaded on ships, the ballast is discharged. In 2004, IMO created the Ballast Water Management Convention) to prevent marine ecosystems being polluted or disturbed by ballast water. More than 30 countries have ratified the Convention, which prevents ships from disposing ballast water that has not been processed through a Ballast Water Management System.

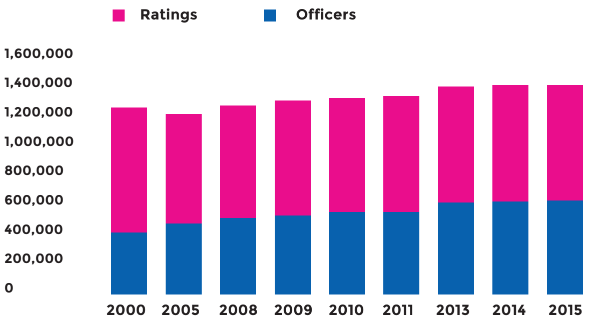
The ballast water treatment system will be installed in newly constructed ships during the construction process. In the case of ships currently in operation it should be installed during one of the regular inspections carried out every five years. On average, it is estimated it costs US$ 1 million to US$ 2 million to install, and up to US$ 5 million for bigger ships.

The average life of a ship is around 25 years, but this period is getting shorter, due in particular to new regulations. In the case of vessels with a remaining life span of less than five years, it is expected the disposal rate will be accelerated because the cost of installing additional scrubbers or ballast water treatment equipment is higher than the revenue earned from continued vessel operation. Additionally, ships older than 15 years must undergo an interim periodic inspection at 18 years and 20 years at a cost of about US$7 million for the two inspections plus the additional cost of installing scrubbers and a ballast water treatment system. Shipping companies may find it increasingly more economical to replace 15-year-old vessels with new ships.

(c) Shortage of qualified seafarers

There is a shortage of maritime officers that is particularly acute in developed countries. In some developing countries, the shortage also applies to naval ratings.

FIGURE 3.21 WORLD SEAFARER NUMBERS



Source: Drewry, Maritime research.

At the end of 2015, the number of officers was approximately 615,000, and 15,000 more qualified officers were needed. According to recent estimates, the trend will continue with an demand for an additional 42,500 officers by 2019.

The main reason for the shortage of officers is the loss of attractiveness in the profession, notably for young people, because of the long periods of separation from family and social life, poor working conditions and a narrowing wage gap compared with jobs on land.

Ageing crews is another challenge for shipping companies, which as a result are obliged to find solutions to the problem faced in manning vessels in many developed countries. The current solution is to hire crew from developing countries to supplement scarce national resources.

(d) Maritime safety

The shortage of qualified crew members is also associated with the frequent occurrence of maritime accidents in the Asia-Pacific region. More than 80 per cent of maritime accidents analysed have identified human error as the main cause of accidents, and globally some 60 per cent of collisions and groundings are caused by direct human error.[54]

More maritime accidents occur in the Asia-Pacific region than in Europe and North America. Their increased frequency may be caused by heavy maritime traffic in the region, ships that are old or non-complying with the regulations of the International Maritime Organization (IMO) or inadequately-skilled crew.

Asia and the Pacific, as one of the core drivers of the global economy, is dependent on shipping for the majority of its trade. Any safety-related incident in the region, including pollution, may have a massive impact on coastal and archipelagic countries with long-lasting consequences for sustainability.

To help address some of these problems IMO is taking several initiatives to harness new technological applications in order to enhance the navigation safety of ships while simultaneously reducing the burden on navigation officers.

The new e-Navigation system, under implementation and led by IMO, has identified specific user needs and potential solutions. The core objectives of the e-Navigation concept are to:

(a) Facilitate safe and secure navigation of vessels with regard to hydrographic, meteorological and navigational information and risks;

(b) Facilitate vessel traffic observation and management from shore/coastal facilities, where appropriate;

(c) Facilitate communications, including data exchange, among ship-to-ship, ship-to-shore, shore-to-ship, shore-to-shore and other users;

(d) Provide opportunities for improving the efficiency of transport and logistics;

(e) Support the effective operation of contingency responses, and search and rescue services;

(f) Demonstrate defined levels of accuracy, integrity and continuity that are appropriate to a safety-critical system;

(g) Integrate and present information on board and ashore through a human-machine interface that maximizes navigational safety benefits and minimizes any risks of confusion or misinterpretation on the part of the user;

(h) Integrate and present information onboard and ashore to manage the workload of users, while also motivating and engaging users, and supporting decision-making;

(i) Incorporate training and familiarization requirements for users throughout the development and implementation process;

(j) Facilitate global coverage, consistent standards and arrangements, and mutual compatibility and interoperability of equipment, systems, symbology and operational procedures in order to avoid potential conflicts between users;

(k) Support scalability to facilitate use by all potential maritime users.[54]

Overall, e-Navigation is defined by the IMO as "the harmonized collection, integration, exchange, presentation and analysis of marine information on board and ashore by electronic means to enhance berth-to-berth navigation and related services for safety and security at sea and protection of the marine environment."[55]

The e-Navigation Strategy Implementation Plan (SIP), which was approved in November 2014, identified five prioritized e-navigation solutions:

(a) Improved, harmonized and user-friendly bridge design;

(b) Providing the means for standardized and automated reporting;

(c) Improved reliability, resilience and integrity of bridge equipment and navigation information;

(d) Integration and presentation of available information in graphical displays received via communication equipment;

(e) Improved communication of the VTS Service Portfolio (not limited to VTS stations).

These solutions, when completed during 2015-2019, are expected to provide the industry with harmonized information in order to start designing products and services to meet the e-Navigation solutions.

4. Strengthening maritime connectivity

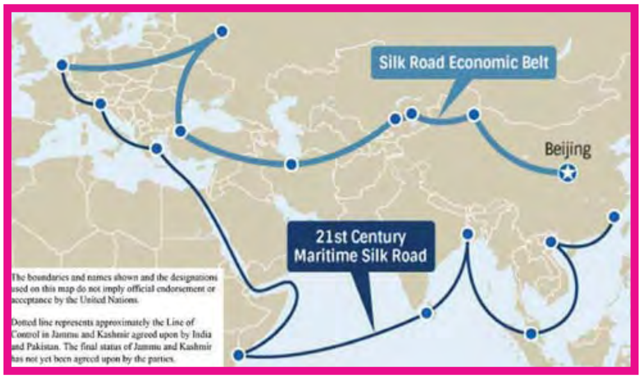
Strengthening economic cooperation between countries and regions inevitably drives demand for transport and logistics services. The development of faster, more efficient and cost-effective transport routes, and the building of integrated intermodal transport systems, are urgent and important challenges. For this reason, many member countries are actively promoting policies to strengthen inter- and intraregional transport connectivity. In addition, member countries are strengthening networking with emerging and transit countries as well as promoting service routes in collaboration with neighbouring countries and through subregional cooperation. Strengthening maritime connectivity has not been limited to linking ports, but encompasses extension inland to logistics centres and industrial hubs.

A major development that focuses on connectivity and cooperation in the Asia-Pacific region is China's Belt and Road Initiative. It promotes the development and operation of six corridors and proposes substantial investment programmes during the coming years

In addition to China, many ESCAP member countries —including India, the Islamic Republic of Iran, Japan, the Republic of Korea and the Russian Federation —are making great efforts to build efficient transport networks, expand logistics infrastructure and strengthen connectivity.

In the Pacific subregion, maritime transport is essential for national and regional economic development; however, it faces major problems due to the lack of capital, small-scale economies, lack of qualified and skilled human resources, the lack of cooperation between regions and countries, and suboptimal use of their main resource, the ocean. In order to ensure economic benefits for people and industries in the region, transport services must be reliable and predictable as well as economically, environmentally and socially acceptable and affordable.

FIGURE 3.22. CHINA'S BELT AND ROAD INITIATIVE



Source: https://asia.nikkei.com/Politics-Economy/International-Relations/One-Belt-One-Road-initiative-gathers-steam

BOX 3.5. SAGARMALA PROJECT

The Sagar Mala project is a strategic and customer-oriented initiative of the Government of India to modernize India's ports and thereby contribute to India's growth. It proposes transforming existing ports into modern world-class facilities and integrating them with industrial clusters and hinterlands through road, rail, inland and coastal waterway connections, resulting in ports becoming drivers of economic activity.

Six mega-ports are planned within the Sagarmala Project, i.e., West Bengal, Tamil Nadu, Maharastra, Sagar Island, Wadhwan and Colachel.

Source: http://www.insightsonindia.com/2015/10/05/insights-daily-current-events-05-october-2015/sagar-mala-project/.

In general, inter-island shipping services in the region face high costs with low profitability due to substantial trade imbalances, which are difficult to overcome. Due to low revenues generated by these services, the maritime industry in the Pacific subregion faces a vicious circle in which service levels are reduced. Low productivity of state-owned shipping companies, different licensing policies by countries, government-subsidized shipping services and weak development of various sub-industries are also obstacles to the development of maritime transport services in the Pacific subregion.

5. A case for coastal shipping

Transporting a metric ton of cargo for 1 km by coastal shipping costs about 5 per cent of the cost incurred by road, and carbon dioxide emissions are about 17 per cent. Coastal shipping has great advantages for long-haul, bulk cargo transportation, and as an environmentally-friendly means of transport it can contribute to achieving the Sustainable Development Goals.

In the Republic of Korea, coastal shipping is contributing significantly to the national economy. Cargo transported by coastal ships represents 20.7 per cent of total domestic cargo volume, and accounts for most of the strategic material transported, including petroleum, cement and iron ore (oil accounts for approximately 90 per cent of the volume). As of 2015, Korean coastal shipping handled 123 million mt (arrival basis). Passenger coastal ships connect 470 remote islands to the peninsular. The number of passengers increased from 9.7 million in 2000 to 15.38 million in 2015, and is expected to increase to 18 million in 2020. While the number of passengers on subsidized routes decreased, due to the opening of new suspension bridges and a decrease in island populations, the total number of passengers is increasing due to domestic and international tourism as faster and safer ships are introduced.

E. Air transport

Aviation today has become an essential component of global society. It is a crucial driver of economic, social and cultural development worldwide, supporting approximately 67 million jobs globally and generating more than US$2.7 trillion in economic activity. It continues to transform lives and societies by connecting the world, allowing access to new technologies and opening global markets. Air transport has continued to grow and is projected to carry over 6 billion passengers a year on more than 60 million flights in just 15 years' time.

Asia and the Pacific is one of the regions currently experiencing high air transport growth rates, i.e., 10.2 per cent in terms of revenue-passenger-kilometre (RPK). The region's air transport industry supports 30.9 million jobs and contributes US$632 billion of gross domestic product (GDP). Asia-Pacific carriers have a 33 per cent market share of global passenger traffic and 39 per cent of global cargo traffic. The growth of this market is projected to continue.

1. Regulatory framework

The continuous growth in air traffic, emergence of strong carriers and enhanced air connectivity globally have been made possible by changes in economic policy and regulatory approaches. Modern aviation is built on the basis of the Convention on International Civil Aviation (Chicago Convention) of 1944, which sets out the regulatory framework for civil aviation development among States. In the past seven decades, the operation of international air services have been managed mostly by a website containing some 4,000 bilateral Air Services Agreements (ASAs) signed between States, which regulate air carriers' destinations, routes, capacity and frequency, fares and rates, and other operational matters.

In response to the growing call by the air transport industry to reduce regulatory barriers, countries began to negotiate, bilaterally or multilaterally, more liberal agreements in the early 1990s to allow the industry to do business in a more favourable operating environment and to expand into new markets.

Liberalized or "open skies" policies adopted by countries and regions as well as the policy guidance produced by ICAO for liberalization have greatly facilitated the growth of international air transport services in the past two decades. Building on these achievements, ICAO is working with countries and aviation stakeholders to improve the global regulatory framework, including developing international agreements for air transport liberalization.

2. Policies and regulations that may affect the sector

(a) ICAO Policies

(i)International Agreement on the Liberalization of Market Access, Air Cargo and Air Carrier's Ownership and Control

ICAO is currently developing international agreements for the Liberalization of Market Access, Air Cargo, and Air Carrier's Ownership and Control. This project represents a major step by the aviation community to modernize the current regulatory system, which has been dominated by bilateral air services agreements. Agreements on market access and air cargo, expected to be finalized by 2019, are intended for countries to reduce restrictions in exchanging commercial rights and in operating their air services on a multilateral basis. Such agreements would allow them to join on a "willing and ready" basis.

The Agreement on Liberalization of Air Carrier Ownership and Control is intended to reduce barriers to access by airlines to international capital markets, to enable them to acquire the necessary investment for fleet modernization and improvement of the management and operation of their business activities.

(ii) Harmonization of consumer protection regulations

The protection of air passenger rights has gained greater importance with the continuing liberalization of air transport regulation. Many countries have adopted regulatory measures that address passenger protection issues, including: denied boarding compensation; assistance in the event of flight delays and cancellation; price transparency; and access by disabled passengers. In addition, many airlines have adopted voluntary commitments with regard to certain customer services. However, airlines and passengers are facing challenges caused by the different regimes applied with regard to consumer protection.

In order to address these diverse consumer protection regimes, and to facilitate regulatory and operational convergence and compatibility, ICAO has developed a set of Core Principles on Consumer Protection as guidance for Governments and industry stakeholders. These principles establish an appropriate balance between protection of consumers and industry competitiveness.

It is desirable for countries and airlines all over the world, including Asia and the Pacific, to achieve a more harmonized consumer protection regime on the basis of ICAO's Core Principles on Consumer Protection. This will create a better travelling experience for passengers and ease the operational burden on airlines.

(iii) Convergence in competition policies and rules

Liberalization of air transport has made the aviation operating environment more market driven. In order to ensure a sound and orderly operating environment with fair and equal opportunity, many nations have developed competition policies and laws. These national or regional competition policies and laws are meant to address and prevent anti-competitive behaviour including: abuse of dominant market positions; capacity dumping and predatory pricing; collusive behaviours such as price-fixing; consolidation through mergers and acquisitions; and possible market distortion caused by government aid and subsidies. However, due to the differences in situations and legal regimes, competition policies and rules applied to international air transport vary from country to country, and cover a wide range of issues. The lack of convergence in competition regimes could impede the orderly and sustainable development of the industry. In an effort to increase transparency as well as promote harmonized and compatible regulatory approaches, ICAO has compiled a compendium of competition policies and practices, and provided other tools including exchange forums to facilitate convergence on competition policies and rules.

(iv)Universal adherence to international air law instruments, including the Montréal Convention of 1999 and the Cape Town Convention and Aircraft Protocol of 2001

A large number of international air law instruments have been adopted under the auspices of ICAO over the years, such as the Convention for the Unification of Certain Rules for International Carriage by Air, adopted in Montreal on 28 May 1999 (Montreal Convention of 1999). The Convention modernizes and consolidates the international legal regime that was established pursuant to the Warsaw Convention of 1929 and its various amending instruments, and provides within a consolidated and uniform framework the rules related to the international carriage of passengers, baggage and cargo performed by aircraft for remuneration .

The Montreal Convention of 1999 entered into force on 4 November 2003 and has now been ratified by 125 States. In the Asia-Pacific region, 17 of 38 States have ratified the treaty. Universal adherence to the Convention would provide significant benefits to the travelling and shipping public as well as greater certainty to the airline industry about what rules govern their liability.

The Convention on International Interests in Mobile Equipment (Cape Town Convention) and the Protocol to the Convention on International Interests in Mobile Equipment on Matters specific to Aircraft Equipment (Aircraft Protocol) were both adopted in Cape Town on 16 November 2001 under the auspices of ICAO and the International Institute for the Unification of Private Law. This international treaty sets up a legal framework to facilitate cross-border and asset-based financing of aircraft by improving predictability as to the enforceability of security, title reservation and leasing rights in aircraft, thereby protecting lenders and lessors as well as allowing borrowers to gain better access to credit at lower costs. The Convention and Protocol entered into force on 1 March 2006 and has been ratified by 68 States. In the Asia-Pacific region, 15 of 38 States have ratified the treaty. Wider adherence to the Cape Town Convention and Aircraft Protocol by countries in the Asia-Pacific region would facilitate their ability to gain better access to new fleets, create new airlines and open new air links.

(v) E-commerce

Recent years have seen a rapid growth in e-commerce activity. The share of scheduled international mail kilometres (MTKs) grew from 16 per cent to 74 per cent between 2010 and 2015, and is projected to grow to 91 per cent by 2025. In 2015, around 87 per cent (392 million) of Business-to-Consumer (B2C) e-commerce parcels were carried by air. It is expected that, by 2020, 50 billion electronic devices will be connected to the Internet as opposed to 15 billion today.

China now ranks top for e-commerce in terms of B2C parcel count, with 226 million outbound and 33 million inbound parcels in 2015. In 2013, the Alibaba Group launched the Cainiao Network, aspiring to become a global logistics leader. It is a proprietary logistics information platform that links together a network of logistics providers, warehouses and distribution centres. A total of 70 per cent of parcels in China now run on Cainiao's network, which processes 600 million pieces of shipping information per day among 128 warehouses, 40,000 service locations and 1.7 million delivery workers.

ICAO is following e-commerce developments closely. In addition to working with partner organizations to promote more cost-effective, efficient and reliable e-freight solutions such as e-air waybills for international cargo transportation. ICAO also joined forces with major stakeholders through ETrade for All, an initiative aimed at improving the ability of developing countries to use and benefit from e-commerce by scaling up collaboration in the field of e-commerce globally. Launched by the United Nations Conference on Trade and Development, ETrade for All includes as founding partners the International Telecommunications Union, the Universal Postal Union, the World Bank, the World Customs Organization and the World Trade Organization.

3. National regulations and policies

(a) Adopted liberalization policies

The Asia-Pacific region has become one of the biggest air transport markets in the world. Routes, frequencies, seat capacities and the number of destinations have increased significantly in recent years. One of the factors responsible for this growth is the liberalization policies adopted by countries in the region.

Experience has shown liberalization or open-market policies can bring tremendous benefits to the development of air transport and national economies. While some countries in the region have applied open skies policies, many others are taking a progressive liberalization approach. National policies in air transport regulation will continue to have a direct impact on the future growth of aviation in the region. The more that countries embrace open skies policies, the more open the markets will become, enhancing opportunities and benefits for the industry and travelling public.

(b) The impact of regional economic integration schemes and air transport liberalization programmes

Together with the trend of regional economic integration, countries in many regions have adopted regional air transport liberalization programmes; some have already achieved success with positive impacts on economic development and growth of the air transport industry. Countries in the Asia-Pacific region are no exception, having concluded a number of agreements, commitments and/or programmes for liberalization of regional air transport services. These include the Association of Southeast Asian Nations Multilateral Agreement on Air Services (MAAS) (2009), the ASEAN Multilateral Agreement on the Full Liberalization of Air Freight Services (2009) and the ASEAN Multilateral Agreement on the Full Liberalization of Passenger Air Services (MAFLPAS) (2011).

The establishment of the ASEAN Single Aviation Market is aimed at liberalizing air travel between member States, and supersedes existing unilateral, bilateral and multilateral air services agreements which are inconsistent with its provisions. This will benefit ASEAN airlines by boosting the growth of air travel as well as tourism, trade, investment and other service industries in the region.

In the Pacific subregion, members of the Pacific Island Forum (2007) signed the Pacific Island Air Services Agreement to gradually integrate and liberalize air transport services.

The success of these regional integration and liberalization policies and programmes will have a positive impact on the future of air transport and economic development in Asia and the Pacific.

(c) Financing of aviation infrastructure to meet the needs of growing traffic

Infrastructure plays a critical role in improving connectivity and promoting sustainable growth among Asia-Pacific economies. The growing air traffic in the region has made development of infrastructure necessary in order to cater for today's traffic and future capacity requirements. There is concern that aviation infrastructure in the region is not keeping pace with growth, which could put some potential future economic benefits of aviation at risk.

Currently, 35 per cent of global airport investments are concentrated in Asia, which has more than 540 infrastructure projects in progress or planned with a value at US$191 billion. According to the Civil Aviation Administration of China, China plans to build 66 new airports during the next five years, including in major cities such as Beijing, Chengdu, Qingdao, Xiamen and Dalian.
Based on aviation growth and population prospects, foreign investors are turning their attention to Asia-Pacific

economies. Strategic and financial investors as well as financial institutions such as the Asian Development Bank, the European Bank for Reconstruction and Development, and the World Bank are especially interested in foreign direct investment (FDI) that supports the development and expansion of the region's airports. The Belt and Road Initiative launched by the Government of China has been welcomed by many countries as it helps infrastructure development by opening up both outbound and inbound FDI.

To attract increased FDI, the regulatory environment needs to be strengthened to provide investors with certainty and transparency. This would also have an impact on the future of air transport in the region.

(d) Placing aviation in the heart of national development

Air transport has become a catalyst for economic development and a vital engine of global socio-economic growth. Many economies now include aviation in their national development plans, and position aviation as a strategic priority for the development of the country.

Countries such as Australia and Singapore have placed significant importance on aviation as an economic driver. This is reflected in how they have shaped their respective aviation policies and built up national carriers. More economies in the region, such as China, India, Indonesia and Viet Nam, have now also made aviation a strategic priority for development of their economies.

At the regional level, adoption and implementation of the ASEAN single aviation market will have a positive impact, not only on the region's air transport but also on trade and tourism development, thereby contributing to future aviation and economic development.

The air transport industry in Asia and the Pacific will continue to grow. Traffic has been projected to double in the region together with the GDP growth — making the region one of the most important aviation markets in the future. The sector's development will be affected, as in the past, by policies made by ICAO at the global level as well as the regulations and policies of the economies in the region.

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Urban transport

A. Introduction

The Asia-Pacific region has witnessed rapid population growth and urbanization. In 2016, 48.7 per cent of the region's 4.3 billion population lived in urban areas. According to recent projections, more than half of the region's population will be urban residents by 2018,[1] and by 2050[2] the total regional urban population will reach 3.2 billion The fleet of motor vehicles is also growing steadily in the region's cities. This rapid growth and increased urbanization will continue to stress urban transport systems and infrastructure leading to congestion, accidents and more consumption of fossil fuels, and correspondingly will raise greenhouse gas (GHG) emissions. Quality of life issues such as loss of productivity and health will also suffer as a follow-on impact.

Given the increasing demand for urban mobility, due to rapid urbanization and rural-urban migration, Asian countries and cities need to initiate integrated policies and invest in improved urban public transport systems and services. Further, the 2030 Sustainable Development Agenda's[3] 17 Sustainable Development Goals (SDGs) — specifically Goal 11 on sustainable cities and communities — and the New Urban Agenda[4] adopted at the Habitat III summit provide new impetus to addressing the urban transport challenges.

This chapter presents a status and analysis of urbanization and motorization trends, policies, projects and examples in the region together with its impacts on planning, development and operation of different forms of urban transport systems. It also suggests policies for enhancing sustainable mobility in urban areas and emerging cities in the Asia-Pacific region, and makes a strong case for multimodal transport integration.

B. Urbanization and motorization in the region

The Asia-Pacific region is home to more than half the global urban population. Indeed, urban populations are expected to soon exceed rural populations (figure 4.1). Ninety per cent of the world's urban expansion is in developing countries. As of 2017, 23 of the world's 37 megacities are in Asia, of which eight of the top 10 megacities are in Asia, including the top three. However, nearly half of urban dwellers live in emerging cities with populations of less than half a million. Thus, secondary and emerging cities are growing as economic centres and pose challenges as well as provide opportunities to plan and develop sustainable urban transportation systems.

In addition, as a result of economic prosperity, the motorization rate in countries and cities continues to grow. One main characteristic of motorization in the region's cities is the growing number of private vehicles. Asian motorization rates between 2005 and 2014 increased by 123 per cent (excluding Japan and the Republic of Korea) compared with between 4 per cent in North America, 7 per cent in Europe, 31 per cent in Africa and 59 per cent in South America.[5] Figure 4.2 shows the number of vehicles per 1,000 population in selected Asian countries for 2013 and 2014. Developed countries such as Australia, Japan, New Zealand and the Republic of Korea have a high share of vehicles per 1,000 population, ranging from 406 to 778. Bangladesh, India, Pakistan, the Philippines and Viet Nam have a low vehicle share per 1,000 population, ranging from five to 22. Further, motorcycles constitute a major share of the vehicle population in cities in South Asia and South-East Asia. India, Indonesia, Thailand and Viet Nam have very high numbers of motorcycles.


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FIGURE 4.1. PROJECTED URBAN AND RURAL POPULATIONS, ASIA AND THE PACIFIC, 1960-2050

Sources: World Bank and Statistical Yearbook for Asia and the Pacific, 2015.

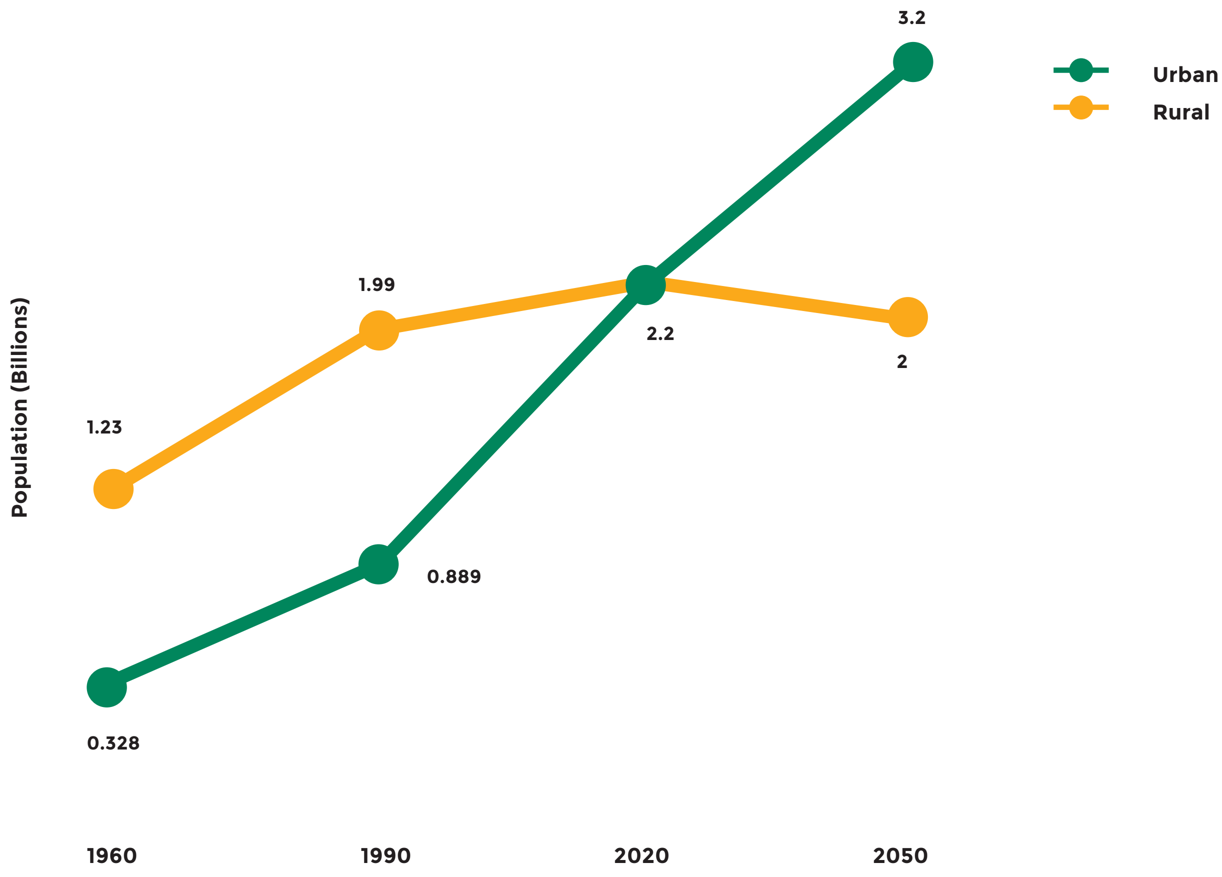
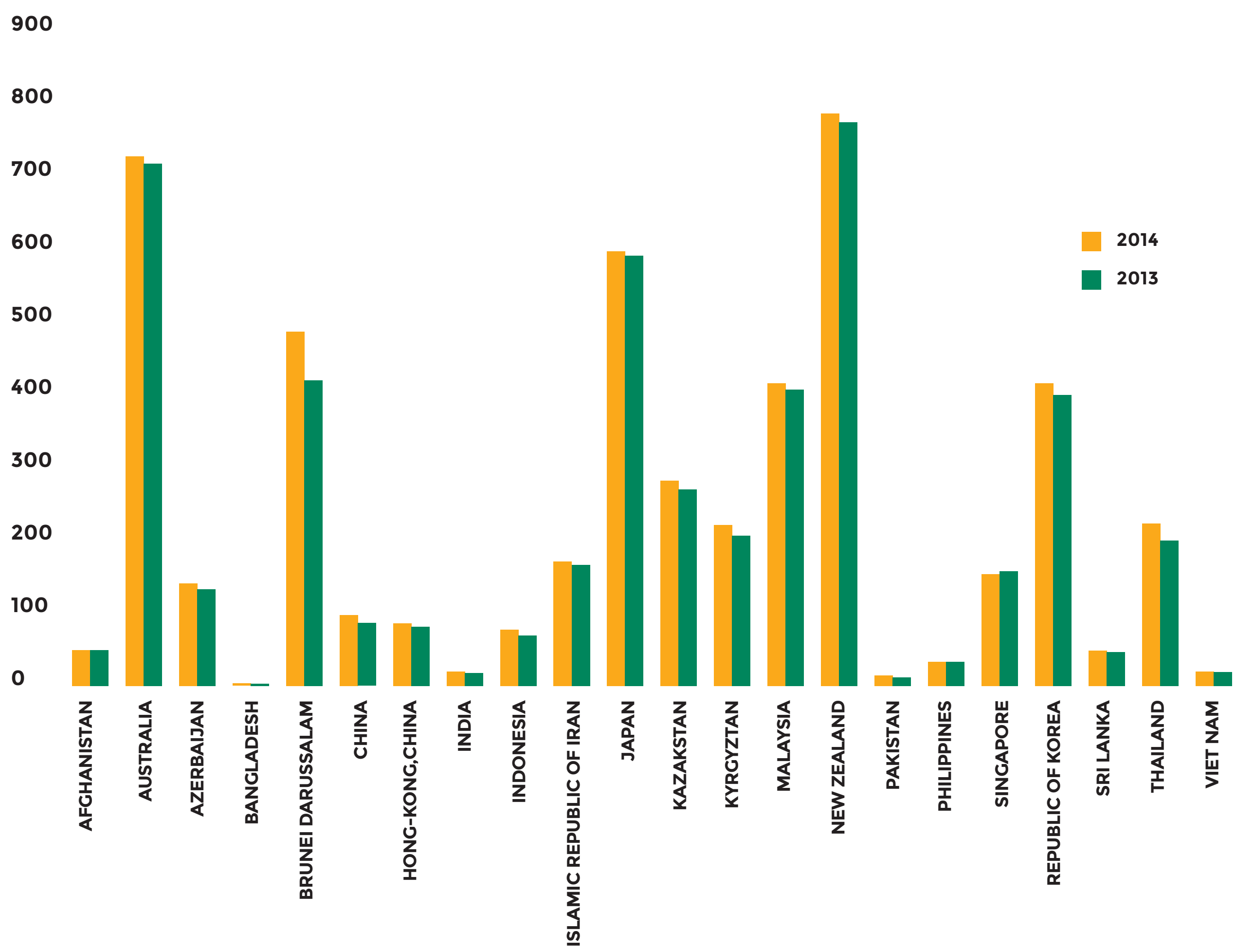


Figure 4.3 shows the growth of motorization in selected Asian countries between 2013 and 2014. Most Asian countries showed such growth with the exception of Singapore and Afghanistan. Growth was between 10-14 per cent in Brunei Darussalam, China, India and Thailand, while the growth was a low 1-2 per cent in Bangladesh, Japan, Malaysia and the Philippines. Growth was 3-7 per cent in many developing countries. Such numbers show vehicle ownership is continuing to increase in Asia, and most countries may need to implement more stringent vehicle control measures such vehicle and road taxes if they are to manage city congestion and pollution.

The increasing trend of urban growth as a result of rural-urban migration in the search for economic opportunities, together with the accompanying motor vehicle fleet growth in cities, is posing challenges to urban planning and provision of urban mobility. The demand for urban public transport is increasing; urban roads are becoming more congested, leading to slower vehicle speeds as well as increased fossil fuel consumption and vehicle emissions.

Figure 4.4 illustrates the congestion levels in major cities, measured by calculating the percentage change in travel time between smooth traffic and congested traffic for travel from point A to B. Unsurprisingly, Bangkok, Jakarta and Chongqing experienced the worst traffic jams. Cities such as Beijing, Istanbul, Shanghai and Tianjin are experiencing between 40-49 per cent increases in travel time, while Ankara, Singapore and Hong Kong, China have 30-39 per cent congestion.

FIGURE 4.2. TOTAL NUMBER OF VEHICLES PER 1,000 PEOPLE IN SELECTED COUNTRIES



Source: www.oica.net/category/vehicles-in-use/.

Cities account for more than two-thirds of energy use and GHG emissions. Congestion, air pollution and road crashes have an estimated 5-10 per cent negative impact on the gross domestic product (GDP) of a country. Another important problem facing Asian cities is the prospect of an ageing population, which in turn adds challenges to urban and transport planning and demands for more urban space, barrier-free public transport and pedestrian facilities. New concepts of planning and designing livable cities are emerging that encourage sustainable and active mobility and accessibility, and which provide more vibrant public spaces.

Many of the region's megacities have attracted much attention from national Governments and city authorities as well as development partners in addressing urban mobility problems. Cities such as Hong Kong, China as well as Seoul, Shanghai, Singapore and Tokyo have already developed urban public transportation systems while Bangkok, Delhi, Dhaka, and Mumbai are at various stages in the development of urban public transportation systems. Emerging secondary and medium-sized cities offer opportunities to plan and develop integrated sustainable urban public transport systems as land and space to plan such systems can easily be acquired. Many large Asian cities are located on, or close to coastal areas and are vulnerable to the impacts of climate change.[6] These cities also pose additional challenges to develop resilient urban transport systems.

FIGURE 4.3. GROWTH OF MOTORIZATION IN SELECTED COUNTRIES

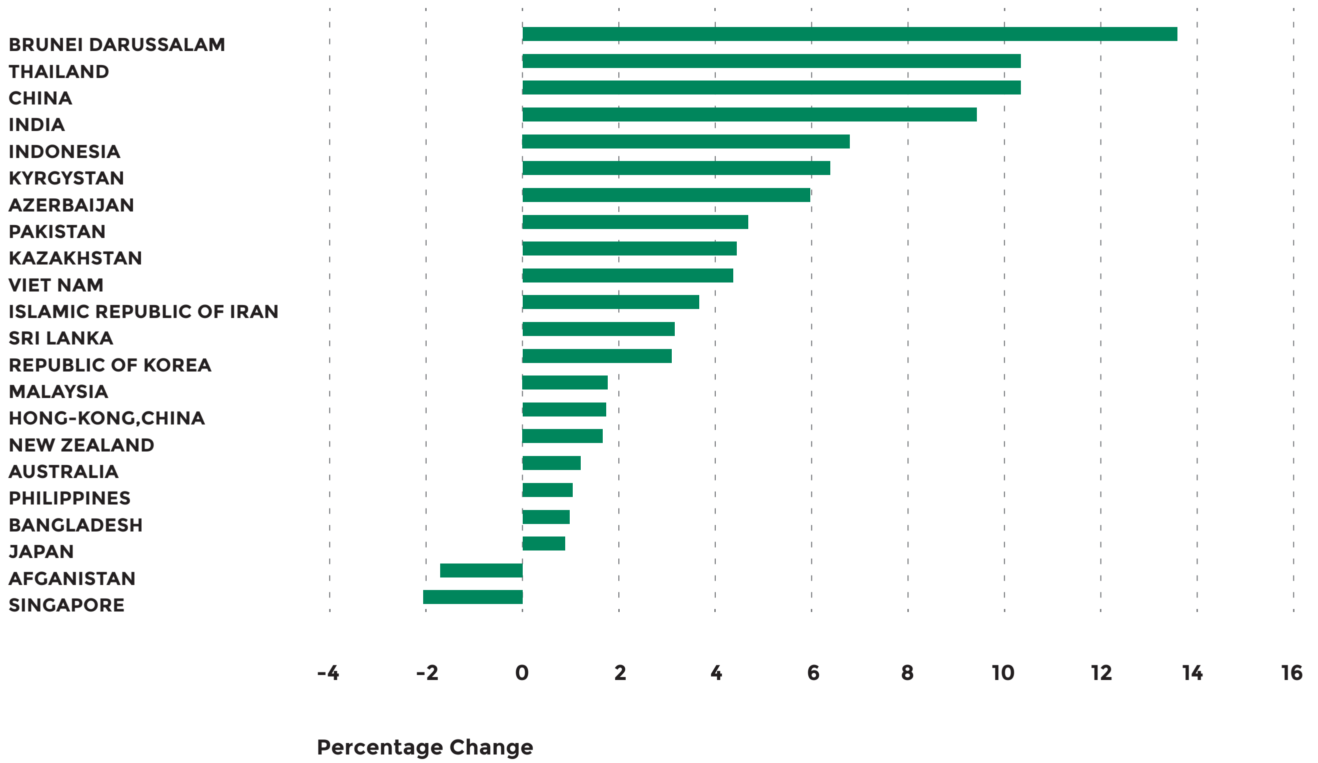
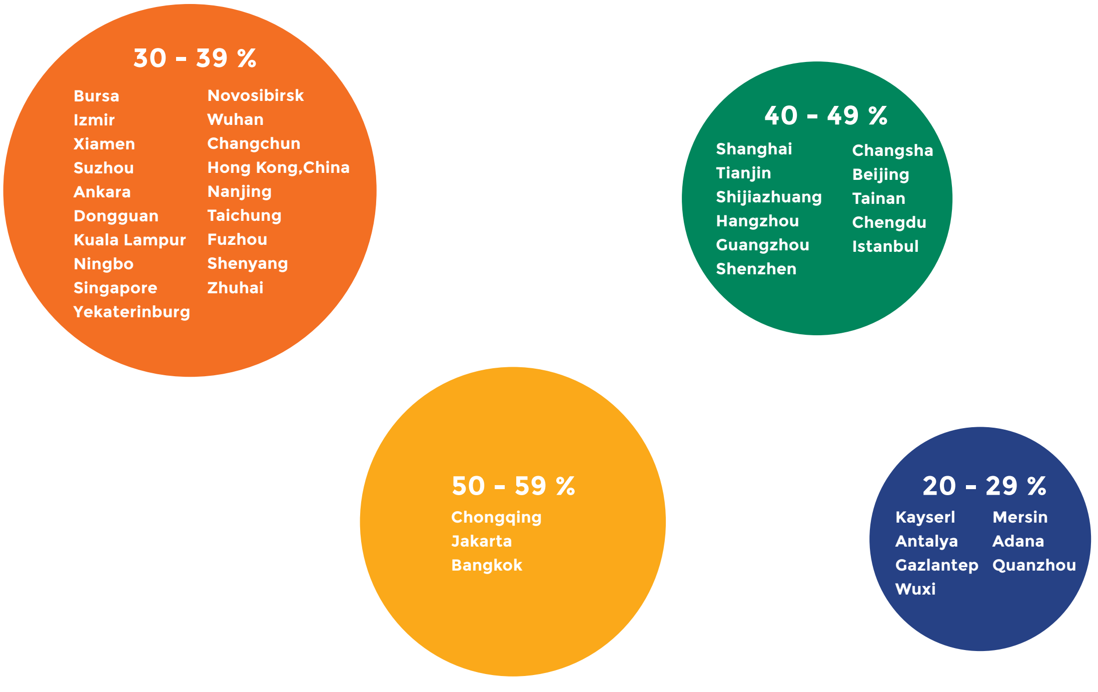


FIGURE 4.4. TRAFFIC CONGESTION IN MAJOR CITIES IN ASIA

Source: Tomtom Traffic Index, 2016.



The region's cities should therefore consider planning and development for sustainable urban mobility, based on various public transport modes and their integration. Countries and cities with high growth of their vehicle fleets should also consider policies to stem the growth of private vehicles.

C. Urban public transport systems

Urban public transport systems should provide safe, secure, reliable, frequent, convenient, affordable and comfortable services for urban residents. Popular forms of urban public transport prevalent in the region's cities include buses, bus rapid transit, light rail transit, mass rapid transit, subways, metro, elevated rail, trams, taxis, urban railways, boats and ferries. Paratransit in the form of vans, mini-vans, tempos, electric-three wheelers, motorcycle taxis, minibuses, customized public pick-ups (e.g., Thailand's Songtao and the Philippines' Jeepneys) serve large populations in inner cities.

FIGURE 4.5. JEEPNEYS ARE A POPULAR FORM OF PARATRANSIT IN MANILA

Source: Madan B. Regmi.

Asian cities are improving their public transportation systems. Bus Rapid Transit (BRT) and Mass Rapid Transit (MRT) are very popular forms of public transport being considered by cities. BRT continues to be a popular form of mass transport in Asia.

During 2015-2016 an additional two cities began to operate BRT (one each in China and Malaysia), making it 42 Asian cities with 1,579 km of BRT carrying about 9.3 million passengers per day.[7] BRT systems are preferred to other costlier modes, especially for their ability to improve walking in cities once in place, and the relative ease and low-cost of installation. Table 1 shows some high-capacity BRT systems in Asia. Tehran BRT has the highest capacity of 2 million passengers per day, while the Jakarta BRT system is the longest in the world with 207 km. Many Chinese cities also have high-capacity BRT networks. Some countries, such as India, Pakistan and Thailand, are using CNG buses in their BRT networks to reduce emissions associated with diesel buses.[8]

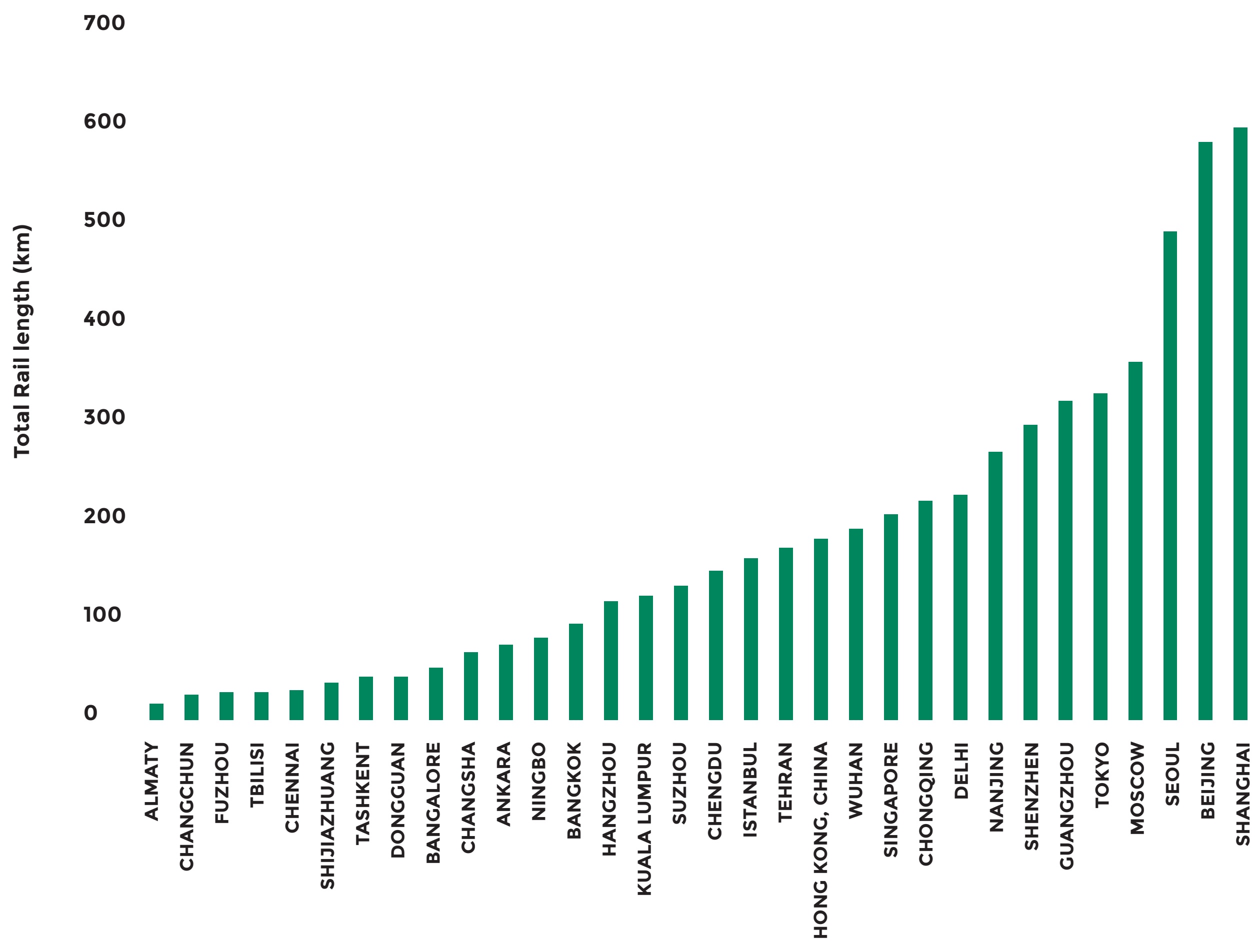
TABLE 4.1, SELECTED BRT SYSTEMS IN ASIA

City	Capacity (passengers per day)	Length (km)
Tehran	2 000 000	130
Guangzhou	850 000	23
Zhengzhou	650 000	31
Seoul	400 000	115
Urumqi	380 000	80
Jakarta	370 000	207
Changzhou	350 000	50
Xiamen	340 000	49
Beijing	305 000	75
Lanzhou	290 000	9
Hangzhou	260 000	55
Jinan	220 000	60
Lahore	180 000	27
Kunming	156 000	47
Isfahan	135 000	17
Ahmedabad	130 000	82
Islamabad	125 000	23

Source: brtdata.org

FIGURE 4.6. RAIL-BASED MASS TRANSIT SYSTEMS IN ASIAN CITIES

Source: compiled from various sources.



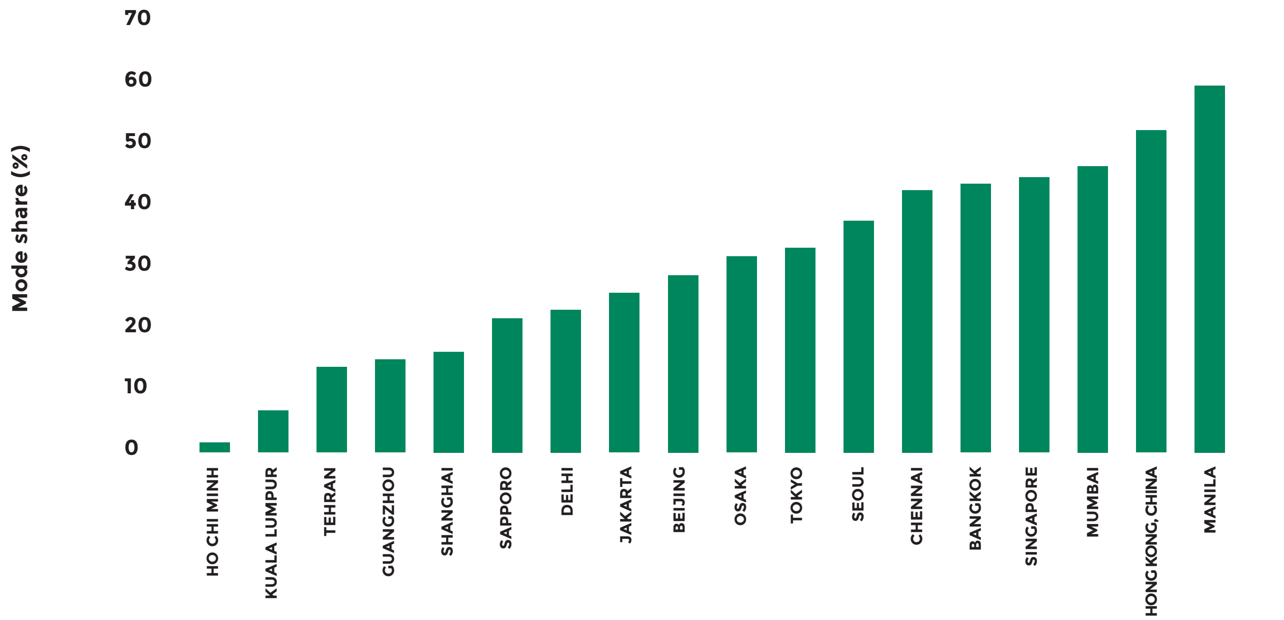
1. Rail-based mass transit systems

The past two years have seen significant growth in urban metro-rail lengths in many major cities across Asia. Figure 4.6 provides the latest updates on rail-based mass transit developments in selected cities. Cities such as Beijing, Seoul and Shanghai have a substantial number of rail-based urban transport networks. The construction of rail-based urban mass transit systems is progressing in many Chinese cities (Baotou, Jinan, Lanzhou, Urumqi and Xiamen), Indian cities (Chandigarh, Gandhinagar, Kanpur, Lucknow, Nagpur and Pune), Iranian cities (Ahvaz, Karai, Kermanshah and Qom) as well as in Bangkok, Dhaka, Hanoi, Jakarta, Ho Chi Minh and Lahore.

Figure 4.7 shows the share of the public transport mode in selected Asian cities and reflects the high share of public transport modes in cities like Manila (59.04 per cent), Hong Kong, China (52.2 per cent), Mumbai (45 per cent) and Singapore (44 per cent). Cities such as Ho Chi Minh (1.6 per cent), Kuala Lumpur (7.2 per cent) and Tehran (12.7 per cent) have a low public transport mode share. Even though cities such as Bangkok, Jakarta and Manila show a high public transport mode share, road traffic congestion is very severe. Cities with a low public transport mode share should work to improve public transport facilities.

FIGURE 4.7. PUBLIC TRANSPORT MODE SHARE IN SELECTED ASIAN CITIES

Source: De Gruyter and others.[9]



Much progress has been made in the public transport mode share across the region, but the optimum balance between public (rail and bus) and private (cars and non-motorized transport) is still unclear. Figure 4.8 presents the operating costs of public transport systems in selected Asian cities. It shows Sapporo in Japan has the highest annual operating cost while cities such as Ho Chi Minh, Shanghai, and Beijing have a low annual operating cost. Figure 4.8 further illustrates the cost-benefit trade-offs of a higher public transport mode share and the capital investments required to achieve it.

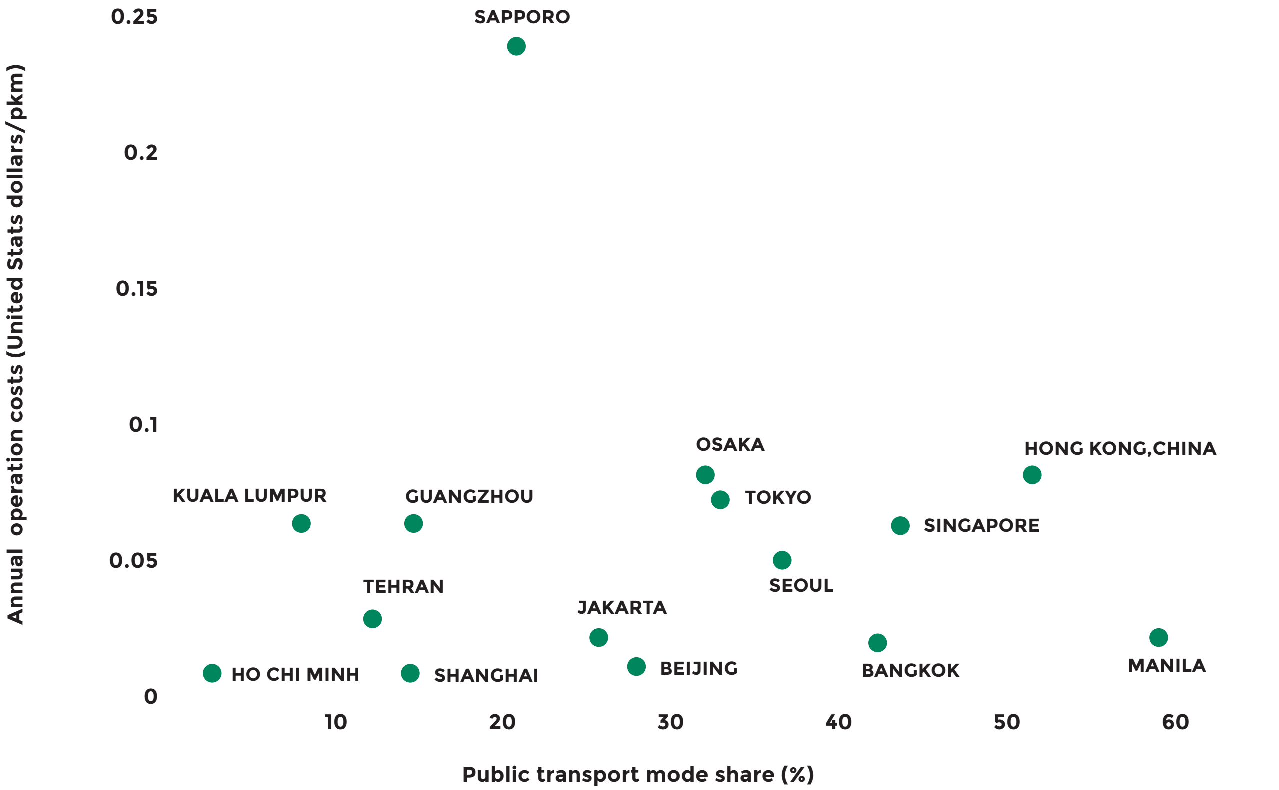
Cities such as Bangkok and Manila have achieved a high mode share with relatively low operating costs. While Hong Kong, China as well as Singapore pay a comparatively high price to maintain a high mode share. Osaka, Tokyo and Seoul have to bear high operating costs to maintain a 32-36 per cent modal share. On the other hand, while at the same operating cost of US$0.06 per passenger kilometre, the mode share appears increasingly variable across cities such as Kuala Lumpur (7 per cent), Guangzhou (14 per cent) and Singapore (44 per cent). This suggests Asian cities that wish to increase their public transport mode share and progressing cities such as Kuala Lumpur and Guangzhou have much opportunity to maximize cost efficiency. The high operating costs, as in the case of Sapporo and Osaka, could continue to be a stumbling block for the adoption of such systems, especially for cities with low GDP. Despite this situation, cities should attempt to find their context-specific balance, drawing inspiration from cities such as Seoul that appear to have struck a good relative balance between operating costs and high mode share.

2. Non-motorized transport

Non-motorized transport (NMT) such as walking and cycling is also gaining popularity in regional cities. Country and city authorities are developing infrastructure for non-motorized transport as part of their integrated public transport plans. Cities are also promoting car-free days and lanes (figure 4.9). Likewise, bicycle use has been growing and many schemes for public bicycle sharing are emerging. China, Japan, India, the Philippines, the Republic of Korea, Singapore and Thailand are in various stages of rolling out or encouraging bicycle sharing. These systems, enabled by mobile phone technology, RFID cards or other payment systems, allow transit users to reduce the time of last-mile trips from the public transport station.

FIGURE 4.8. PUBLIC TRANSPORT MODE SHARE AND OPERATING COSTS

Source: De Gruyter and others.



Private sector bicycle-sharing initiatives, such as Mobike, Ofo and a number of other companies, have appeared on the streets of Beijing, Guangzhou, Shanghai and other cities in China. They provide bicycles that can be unlocked using a mobile telephone app, allowing bikes to be left almost anywhere, and avoiding the expensive and often intrusive bicycle-rack infrastructure needed for systems that use non-mobile telephone-based systems (box 4.1). Mobike, the first of these bicycle share systems, plans to manufacture 5.6 million shared bicycles to be put on China's streets in 2017.[10] In terms of the percentage of total trips by bicycle in urban areas, Beijing (32 per cent) had the highest share of bicycles in 2011, followed by Osaka (25 per cent), Shanghai and Tokyo (20 per cent in 2011 and 2009, respectively), while Delhi and Mumbai had a 12 per cent and 6 per cent share, respectively, in 2011. Hong Kong, China had a 2 per cent share.

BOX 4.1. DOCKLESS BICYCLE-SHARING IN CHINA AND THE REGION

Dockless bicycle-sharing is becoming an increasingly popular non-motorized transport (NMT), infusing technological innovation in increasing the NMT mode share. Global usage of this mode is being spearheaded by the Chinese leaders, Mobike and Ofo. This is a departure from dock-based bicycle sharing where bicycles are rented from purpose-built parking docks. This system allows people to park their bicycles almost wherever they want with no need to return them to a fixed docking point. Users find bicycles nearest to them via GPS and an app, and then unlock the bicycles with their telephone. This mode is being implemented to reduce congestion and promote healthier living by some cities that are experiencing congested sidewalks and broken bicycles that contribute to unsightly littering.

Mobike is currently the domestic and global leader, operating 5 million bicycles in China alone. It is backed by Foxconn and Internet giant Tencent. With government support, both are also operating in Singapore. The fastest adopters of this mode of transport are young users.

Cities need to be aware of the opportunities and benefits offered by this innovation and market as well as the challenges to providing safe infrastructure. Mobike has 6,000 bicycles and records 20,000 rides a day. National regulations are also being rapidly issued for limiting the number of companies providing this service, insuring users and making firms responsible for reckless parking. However, the infrastructure has yet to catch up with the lack of bicycle lanes and existing dock-based cycling agreements. However, this situation is starting to change.

One good example for cities to follow is Singapore, where a continuous 150-km park connector has been designated around the city. This Round Island Route (RIR) links nature, culture, recreational sites, communities and parks, thereby enabling NMT such as cycling, skating and jogging. To facilitate cycling, or to take the place of bicycle lanes, new routes are wider than normal park connectors (six metres instead of four metres) with amenities such as shelters, toilets, lookout points, seating areas, information kiosks, bicycle parking lots and self-help bicycle repair facilities at various nodes.

Source: De Gruyter and others.

3. Eco-taxis and buses

In 2016 and 2017, cities such as Hyderabad, Shenzhen and Singapore implemented initiatives to decrease pollution and reduce their reliance on fossil fuel imports. In 2017, Hyderabad launched India's first electric airport taxi service with charging stations at the airport. In Singapore, Chinese automobile giant BYD teamed up with the Government of Singapore to launch a fleet of green taxis. At the same time, a taxi company in Singapore has invited tendering for 100 electric taxis that will increase its fleet to 130. Simultaneously, Singapore's Land Transport Authority will call tenders to purchase 50 hybrid buses and 60 electric buses.

FIGURE 4.9 PROMOTION OF CARLESS STREETS IN ALABANG CITY, MANILA

Source: Madan B. Regmi.

Part of the forces driving these changes are central Government subsidies. In India, for example, in 2015 the central Government launched the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles in India (FAME) scheme, under which incentives are offered for purchases of electric and hybrid vehicles. The Government is also offering a 4 per cent tax exemption on each vehicle in order to reduce air pollution. Shenzhen also offered tax incentives to taxi drivers to boost usage of electric taxis; the city now has a fleet of more than 800 zero emission electric taxis. Rapid advances in technology have also encouraged take-up rate. As an example, BYD's E6 model electric cab needs 90 minutes to charge and can run 350 km on one charge. Electric rickshaws are also gaining popularity for paratransit in Nepal (figure 4.10). Hanoi has a fleet of electric vehicles available for hire to tour core city area in Hanoi (figure 4.11).

FIGURE 4.10. AN ELECTRIC RICKSHAW IN BUTWAL, NEPAL

Source: Madan B. Regmi.

FIGURE 4.11. A FLEET OF ELECTRIC VEHICLES FOR TOURIST IN HANOI

Source: Madan B. Regmi.

However, the lack of a charging infrastructure and the prolonged charging time required for electric vehicles limit their adoption. Therefore, it is necessary for Governments to simultaneously encourage adoption and boost infrastructure while providing incentives that support, embrace and encourage private investors.

As an example, by 2020 the Government of Singapore aims to roll out a total of 1,000 electric cars, to be supported by 2,000 charging points across residential neighbourhoods, key industrial and commercial areas, and the Central Business District.

4. Spotlight on major cities

Figure 4.12 presents the total length of mass transit systems (rail-based and BRT) per million head of population in major cities. Seoul and Singapore have the greatest length per population, while Bangkok, Delhi, Manila and Mumbai still need to expand the coverage of their mass public transport systems.

Figure 4.13 shows the plot of total mass transit length against the GDP of cities. Singapore and Hong Kong, China, with higher GDP, have a moderate length of mass transit systems of around 200 km. Cities such as Beijing, Seoul and Shanghai with moderate GDP have a high length of mass transit systems of more than 6,000 km. Cities such as Bangkok, Jakarta, Manila and Mumbai, with lower GDP, have a low length of mass transit systems of less than 200 km. Thus, there does not appear to be a direct relationship between city GDP and the length of mass transit systems. However, it does indicate that cities with low GDP and a low mass transit system length need to improve the extent of their public mass transportation systems.

While there have been efforts to improve urban public transport systems, the issue of urban freight consolidation and delivery has not received much policy attention. Megacities in the Islamic world also lack an urban transport in frastructure that facilitates smooth urban freight transport.[12]

FIGURE 4.12. MASS TRANSIT SYSTEM IN SELECTED CITIES

Source: De Gruyter and others.

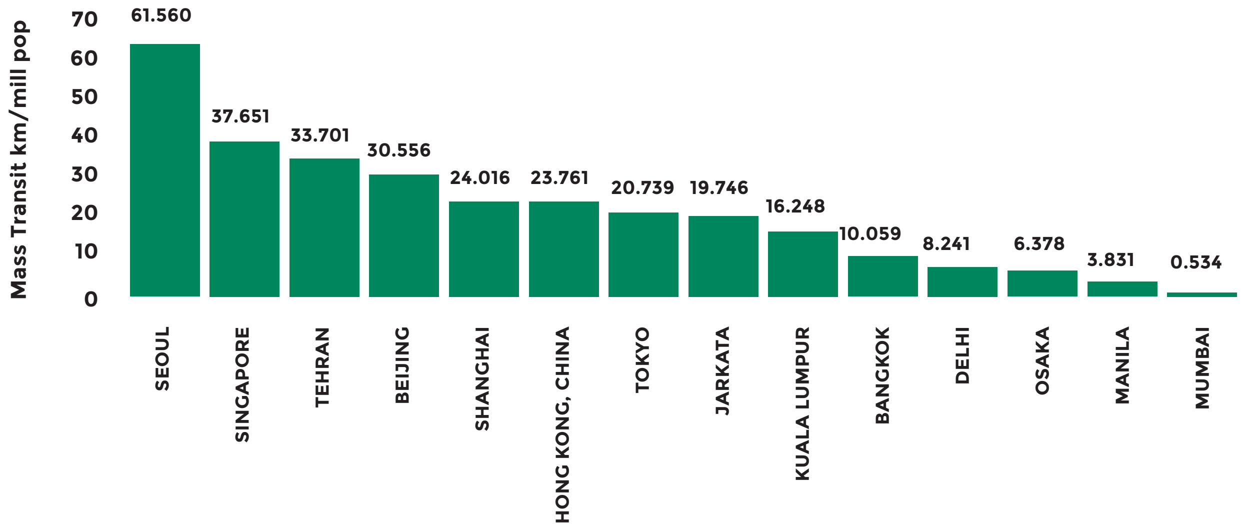
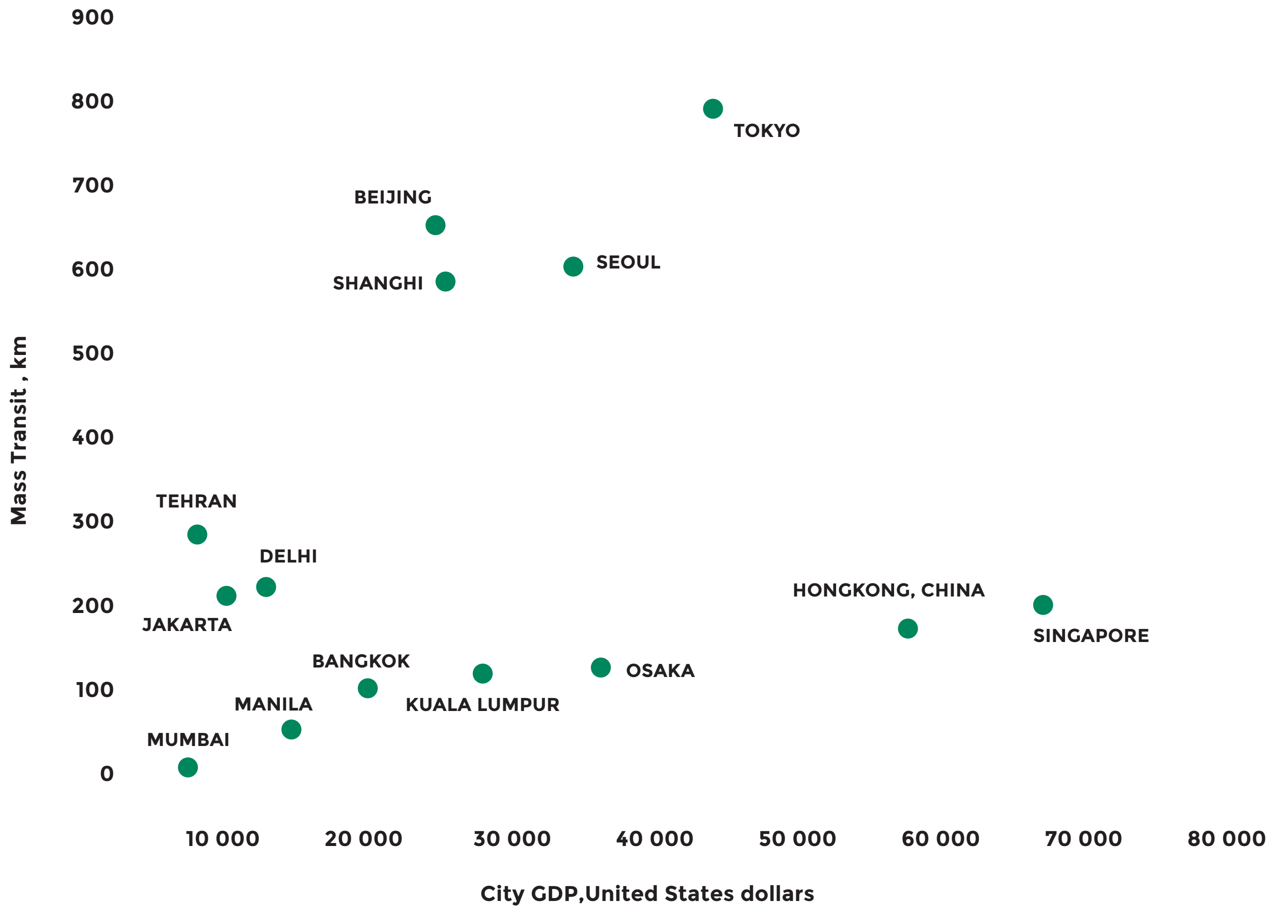


FIGURE 4.13. MASS TRANSIT LENGTH AND CITIES' GDP

Source: De Gruyter and others.



In order to reduce dependency on private transport modes, policies to increase the share of public transport modes and discourage use of private vehicles can be employed. Popular push policies include parking restrictions and pricing, congestion charging, area licensing schemes, electronic road pricing, car sharing, designation of car-free areas and car-free days, and designation of high-occupancy lanes. Pull policies include improvement of the quality and extent of public transportation services. Hong Kong, China as well as Japan, the Republic of Korea and Singapore have developed well-functioning integrated urban transportation systems that are based on attractive public transport and restricted use of private vehicles. As a result of a vehicle quota system being implemented in Singapore, total vehicle population decreased from 974,170 in 2013 to 965,430 in 2016.[13]

Promotion and use of fuel-efficient electric and hybrid vehicles can contribute to lessening problems associated with air pollution and fossil fuel use. Country and city authorities could initiate policies to promote their use through providing tax rebates.

There is much agreement and consensus in urban transport literature about how a city should plan and develop sustainable urban transport systems. Many guidelines,[14] technical standards,[15] case studies[16] and sourcebooks1[7] that focus on a particular aspect of urban transport and mobility are readily available. Countries and cities of the region could focus attention on utilizing these resources for actual application and implementation. A broad coalition of development partners to support regional cities in implementing sustainable urban transport master plans would be a step in the right direction. An example of this approach is the Transformative Urban Mobility Initiative[18] of the German Federal Ministry for Economic Cooperation and Development (BMZ), the objective of which is to enable leaders to plan and implement sustainable mobility concepts. A project on Transforming Urban Transport - The Role of Political Leadership aims to advance knowledge about where political leadership has successfully implemented ground-breaking transportation policies in major cities.[19]

D. Integration of urban transport modes

A good urban transport plan should incorporate various modes of transport. Depending on the need for travel, a journey usually involves more than one mode of transport. The integration of urban transport modes is essential to promoting smooth intermodal transfer. When there are two operators of different transport systems, integrated ticketing makes it more efficient as well as convenient for users, and many cities are now following this approach.[20] The physical interface between modes, infrastructure and facilities at intermodal junctions should allow smooth transfer of passengers and goods from one mode to another. Operational integration and scheduling should facilitate transfer with minimum time wasted between modes.

Integrated intermodal terminals can be developed through a value-capture approach and the participation of the private sector. Such intermodal transfer facilities ensure easy transfer between urban transport modes, including active modes such as walking and cycling. Such intermodal transit stations need to be accessible via walkways, cycle paths and parking facilities for bicycles available nearby.

There are numerous examples of commercially developed intermodal transfer facilities where different urban transport modes and systems —such as subways, public bus, BRT and elevated Light Rail Transit (LRT) — meet at a junction. The adjoining areas and buildings could include commercial facilities for shopping areas, hotels, office complexes, recreational facilities and restaurants. Interchange stations in Hong Kong, China as well as Tokyo and Seoul provide thriving examples of commercial and economic activities at such intermodal transfer terminals developed through value-capture. Kokura intermodal station in Kitakyushu, Japan is an example of an intermodal station that facilitates seamless transfer between high-speed train, monorail, buses and pedestrian walkways together with bicycle parking facilities.[21]

Another approach to promoting intermodal transfers is to develop facilities in suburban areas to ensure intercity and suburban transport modes do not enter central city areas, but where passengers can enjoy a smooth transfer to urban public transport. Greater Jakarta has developed a transport master plan based on this concept. Planning should consider the needs of urban and rural populations.

FIGURE 4.14 KOKURA INTERMODAL STATION IN KITAKYUSHU, JAPAN

Source: winhorse / istockphoto

BOX 4.2. SUSTAINABLE URBAN TRANSPORT INDEX

The Sustainable Urban Transport Index (SUTI) is a framework of 10 indicators for the assessment of urban transport systems and services as well as the state of urban transport performance in a city. Table 4.2 lists the 10 indicators, measurement units and normalization range.

Indicators on different scales are normalized and SUTI is derived by geometric aggregation of the 10 indicators.

The Regional Meeting on Sustainable Urban Transport Index held in Jakarta on 2 and 3 March 2017 finalized SUTI and agreed on its pilot application in four cities – Colombo, Greater Jakarta, Hanoi and Kathmandu. A capacity-building workshop was organized to share the results of the pilot application of SUTI. The Index could be a useful tool for cities to assess the achievement of SDG target 11.2, and make policy measures to improve urban transportation systems and services.

TABLE 4.2 INDICATORS FOR SUTI

Indicators	Measurement units	Weight	Range	
			Min.	Max.
The extent to which transport plans cover public transport, intermodal facilities and infrastructure for active modes	0-16 scale	0.1	0	16
Modal share of active and public transport in commuting	Trips/mode share	0.1	10	90
Convenient access to public transport service	Percentage of population	0.1	20	100
Public transport quality and reliability	Percentage satisfied	0.1	30	95
Traffic fatalities per 100,000 inhabitants	Number of fatalities	0.1	35	0
Affordability — travel costs as part of income	Per cent of income	0.1	35	3.5
Operational costs of the public transport system	Cost recovery ratio	0.1	22	175
Investment in public transportation systems	Percentage of total investment	0.1	0	50
Air quality (pm10)	μg/m3	0.1	150	10
Greenhouse gas emissions from transport	CO2 Eq. tons	0.1	2.75	0
Total		**1.00**		

E. Selected examples of sustainable urban transport policies and projects

1. Delhi Metro

Delhi Metro[22] is a joint venture between the Government of India and the Delhi Government. It provides a good example of what can be done by the public sector. It is the first metro to get carbon credits from the United Nations Framework Convention on Climate Change and has revolutionized metro development. Delhi Metro is now providing advice to other cities in India as well as Dhaka in Bangladesh. It shows how a mammoth, technically complex infrastructure project can be completed before time and within budget by a Government.[23] The first phase of 65 km was completed in April 2006 and it now has a network of 212 km with 160 stations. The third phase of 160 km is under construction. Phase IV includes six corridors with a length of 104 km. When all planned extensions are complete the total network length will be 512 km. It carried an average of 2.6 million passengers per day in 2016 and is under commercial operation. It carried a record 3.37 million passengers on 17 August 2016. It has adopted many innovations in station design and construction to ensure environmental and social sustainability. In 2011, its operation created a reduction of 630,000 metric tons of GHG of CO_2 equivalent and kept 390,000 vehicles off the urban streets of Delhi.

FIGURE 4.15. DELHI METRO

Source: Elena Mirage / shutterstock

2. Integrated Urban Transport Plan for Greater Jakarta

Greater Jakarta has developed an Integrated Urban Transport Plan that includes the construction of BRT, LRT, MRT, urban rail and airport link, and the improvement of bus services, pedestrian walkways and bicycle lanes. TransJakarta, the first BRT system in South-East Asia, is the longest in the world (207 km), has a capacity of 370,000 passengers per day along 12 corridors and through 228 stations.[24] Trans Jabodetabek serves routes from the surrounding cities to the capital city. In order to ease intermodal transfer from residential suburban areas around Jakarta, buses are provided by Jabodetabek Residence Connexion (JR Connexion). In addition, Jabodetabek Airport (JA Connexion) provides bus services from Soekarno-Hatta International Airport to several hotels and malls in Jakarta.

The construction of Jakarta's Mass Rapid Transit (MRT) North-South Line Phase 1, along 16 km from Lebak Bulus Station in South Jakarta to Hotel Indonesia Station in Central Jakarta, began in October 2013. It will have 13 stations — six underground and seven elevated — and is scheduled to be finished in July 2018.[25] A 42.1-km Jabodebek Light Rail Transit (LRT) system from Cibubur to Cawang, East Bekasi to Cawang, and Cawang to Dukuh Atas is under construction, with the first 5.8-km section scheduled to open in time for the 2018 Asian Games.[26] In 2016, the share of public transport in Jakarta was 26 per cent. The Greater Jakarta Transport Authority plans to increase the public transportation share to 40 per cent by 2019, 50 per cent by 2024 and 60 per cent by 2029.

3. Non-motorized transport in Thailand

Thailand has taken policy initiatives to promote the use of bicycles and improve pedestrian facilities. Thailand has 566 km of bicycle lanes across the country, and NMT policies are to be included in the master plans of all major cities. Shared public bicycles, bicycle lanes and parking facilities are available in some areas of Bangkok, including at selected Bangkok Mass Transit System (BTS) stations.

FIGURE 4.16. LIGHT RAIL TRANSIT CONSTRUCTION IN JAKARTA

Source: Greater Jakarta Transport Authority.

FIGURE 4.17. CYCLING AND PEDESTRIAN FACILITY IN A RURAL AREA OF THAILAND

Source: Madan B. Regmi.

The Pun-Pun Bike Share[27] scheme was first launched by the Bangkok Metropolitan Administration (BMA) in October 2012 at two locations in the centre of the city. It is now available at 12 stations. BMA has designated 232 km of bicycle lanes in Bangkok and has upgraded 8 km in the Rattanakosin area with lanes painted green with white bicycle logos and safety bollards. There is a 23.5-km, dedicated cycling track around the airport perimeter as well as a 1.6-km inner track and a cycling park called Sky Lane, which is located in the north-east corner of Bangkok's Suvarnabhumi Airport. Sky Lane facilities specially designed for cyclists, currently include medical clinics, food and beverage outlets as well as other shops, a parking lot and a rest area.[28] Non-motorized transport projects are being implemented in Bangkok with a pilot "bicycle town" to monitor energy consumption and GHG emission reduction. In addition, elevated pedestrian walkways are in operation in core city areas such as Sukhumvit Road, Ploenchit, Rajprasong and Siam Square. These elevated walkways are located below the BTS lines and connect stations with commercial facilities, shopping malls, hotels and office buildings. Cycling and pedestrian facilities are also being constructed in rural areas.

FIGURE 4.18 CITY BICYCLE-SHARING STATION IN JAPAN

Source: tupungato / istockphoto

4. Bicycle-sharing in Japan

Japan has piloted an unattended IC-card (cards that can also be used to conveniently pay fares on various types of public transport) enabled the implementation of a bicycle-sharing system across the country. The project was launched in Toyama City and operates on the basis of a monthly fee or ad hoc usage fee for 30-minute blocks. Japan is encouraging employees of private companies to ride bicycles to work, especially for short trips. To support this endeavour, Japan has made efforts to (a) improve and maintain bicycle lanes, bicycle parking areas and facilities, (b) support community cycling projects and (c) formulate a bicycle network maintenance plan. It has also upgraded transport nodes and public transport facilities to facilitate smooth transfer to and from bicycles. It has revised the "Guidelines for Creating a Safe and Comfortable Bicycle-Use Environment" and supported programmes for bicycle network planning, and maintenance of open spaces for bicycle operation.[29]

F. Policies underpinning sustainable urban mobility

Rapid urbanization has transformed cities in the Asia-Pacific region into production and economic centres, and has contributed to economic and social well-being. Cities account for about 80 per cent of the region's economic output.[30] However, the rising motorization trend, coupled with unplanned urbanization and the lack of integrated public transport systems, in most cities of developing countries has made it difficult for urban residents to meet their mobility needs; this situation is worsened by increasing congestion, emissions and road traffic crashes. City authorities need to address these significant planning issues, and work to improve and expand city and urban transport systems. As such, rigorous action is needed in the area of policy development and implementation, financing and technical innovation.[31]

At the regional level, the ESCAP Commission Resolution on the Implementation of the Ministerial Declaration on Sustainable Transport Connectivity in Asia and the Pacific[32] includes sustainable urban transport as one of the core themes of the Regional Action Programme for Sustainable Transport Connectivity in Asia and the Pacific, phase I (2017-2021).

Cities need to periodically assess their urban transport systems and services, and identify policy, planning and implementation shortcomings, improve quality and extent of services, and pledge to continuously improve the urban transport system. In this context, the Sustainable Urban Transport Index (box 4.2) developed by ESCAP is a useful objective tool for measuring the 10 key systemic, economic, environmental and social indicators incorporating elements of planning, multimodal transport, service quality, user satisfaction, operation, infrastructure, safety, costs and funding.

1. Integrated urban transport plan

Each city should develop an integrated sustainable urban transport master plan that meets the mobility needs of urban residents, based on the use of public transportation systems with future growth and expansion in mind. The plan should incorporate all modes of transport, including active modes such as pedestrian facilities and cycling, while promoting road safety, barrier-free access, inclusiveness and intermodal transfer facilities. It should be developed through a public consultation process, with the support of experts, to ensure citizen-ownership. The master plan should serve as a blueprint for all related projects and programmes, taking into account the expansion of urban areas, changes in demand and travel patterns.

2. Implementation of an urban transport master plan

Once the master plan is developed there must be commitment from all stakeholders to implement the plan through the mobilization of resources, prioritization and development of projects. Many Asian cities have invested in, and developed urban public transport systems through private sector participation. There are examples of metro and suburban railways being developed by the private sector in Hong Kong, China as well as Tokyo that fully integrate land-use and transport planning to maximize value capture. Implementation of urban transport plans also needs a high level of coordination among multiple agencies at all levels of government (national, provincial and urban/local).

3. Urban governance

As a result of devolution and decentralization, cities and urban authorities are receiving more autonomy and authority to plan, make decisions and implement projects. At the same time, these authorities need support in exercising their power, such as developing legal and regulatory frameworks, enhancing institutional coordination, ensuring effective public participation, and making effective and timely evidence-based decisions. There are many examples of city leaderships that have led the transformation of cities and developed exemplary public transport systems, which can be followed to enable world-class sustainable public transport systems. Any delays in decision-making and project implementation translate to increased costs to economies. In order to improve project governance, accountability frameworks, inspection and monitoring guidelines, and quality assurance plans should be devised and strictly followed.

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Rural transport

A. Introduction

Regional transport connectivity is very high on global and regional agendas. While more efforts are being made to improve regional, sub-regional, international and intercity connectivity, rural connectivity, which plays a greater role in contributing to the achievement of Sustainable Development Goals (SDGs), has not received priority attention. Further, as 39 per cent of the rural population in developing Asia and the Pacific are poor[1], rural transport provides a vital link in making a meaningful contribution to the achievement of SDGs . Implementation of rural transport projects will indirectly contribute to the achievement of Goals 1 to 6, 8 to 11 and 13.

Rural areas are home to 51.2 per cent of the Asia-Pacific region's population and most of the world's poor population. More than one in 10 people — some 400 million people (around 10.3 per cent of the region's population) — live in extreme income poverty. Further, more than one in four people in the region's developing countries experience poverty in multiple dimensions.[2] Physical isolation has been a factor in perpetuating the cycle of poverty. Unfortunately, integrating connectivity into the economic growth agenda has not gained momentum. This situation further isolates rural populations from effectively participating in national and global economies, and is depriving them of the benefits of social services.

Rural transport can help create economic opportunities, generate employment and contribute to poverty reduction by connecting farmers to markets and producers to consumers. Furthermore, social, education and health needs are hampered by a lack of access. Many rural areas have yet to be connected to feeder or trunk roads. However, rural roads are often poorly engineered, unpaved and only accessible in the dry season. Once construction is complete, their maintenance is often neglected. Thus, a major challenge in improving rural access is to expand rural road networks, and to upgrade and maintain existing access. Due to the small scale of investments and sometimes lower economic benefits, financing for rural access projects is frequently not forthcoming.

This chapter outlines the role of transport in supporting rural development. It highlights the importance of rural connectivity in reducing poverty, creating employment, and improving access to health and education. It then assesses the progress as well as the challenges of connectivity between rural areas and wider regional transport networks. In order to investigate national efforts, the review includes an analysis of selected rural transport projects in the region. Highlighting the need to improve connectivity of rural roads to wider transport networks, it offers policy suggestions to improve rural transport connectivity.

B. Role of transport in supporting rural development

The majority of the population in the region reside in rural areas. Figure 5.1 shows the ratio of the rural population in selected countries. In Afghanistan, Bangladesh, Bhutan, Cambodia, India, Kyrgyzstan and the Lao People's Democratic Republic more than 60 per cent of the population live in rural areas.

Rural development is the process of improving the opportunities and well-being of rural people,[3] It involves human development, economic opportunities, health, education, recreation, transport, improving agricultural productivity, and the development of small and medium-sized enterprises. Rural transport plays an important role in facilitating and enabling rural development as well as enhancing


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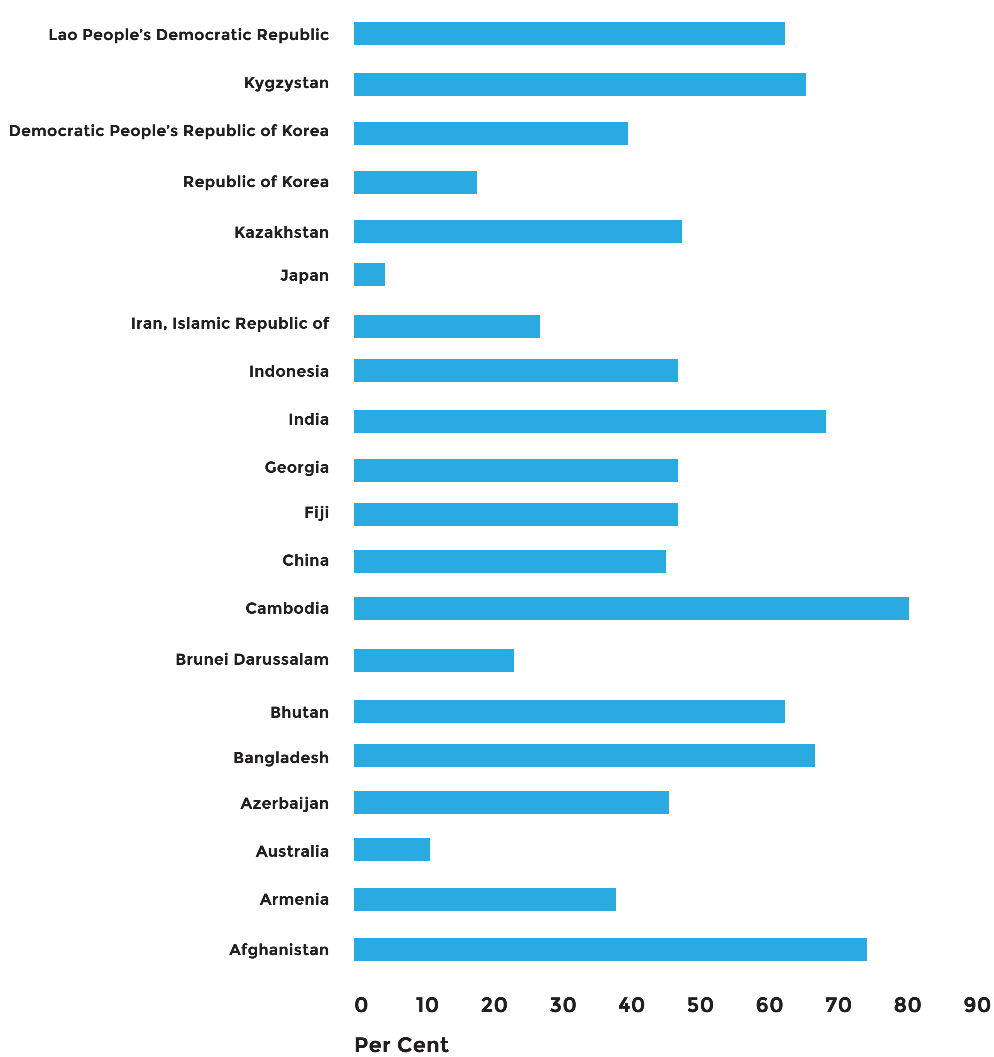
economies of scale and agglomeration, thus expanding opportunities in all multiple development dimensions.[4]

Rural transport is considered a key component of integrated rural development projects. For example, the "build your own village" programme is very popular in Nepal where local authorities receive substantial funds from the central Government. Within this programme, rural road schemes are usually given first priority when selecting projects. Integrating rural transport within rural development initiatives that include small irrigation, water supply, agriculture, infrastructure, education, health and income-generating activities, results in higher economic development.

A factor crucial to economic and social development of rural areas is rural transport that provides access to transport infrastructure and services for rural people,[5] and which facilitates the delivery of goods and services to people in need. By providing better access, farmers are able to get their crops to market, and people find it easier to reach jobs, schools and hospitals. Because most rural communities depend on agriculture for subsistence and income generation, rural and rural-urban linkages that lead to stronger agricultural productivity and improved food security are fundamental.

FIGURE 5.1. RURAL POPULATION IN SELECTED COUNTRIES, 2015

Source: World Bank statistics.



Rural road development can also stimulate the establishment of local markets, thus increasing community consumption, employment opportunities and economic growth. For example, the objective of Viet Nam Rural Transport Project I was to connect commune centres in 18 provinces to markets by improving 5,000 km of rural roads. As a result, the project created a 10 per cent increase in local markets with higher meeting frequency and service availability.[6]

Among rural development indicators, it is well-documented that rural access has an important role to play in poverty alleviation as well as improving health and education in rural populations. By providing job opportunities and access to health and education facilities, rural roads serve as an important channel to improve living standards in rural areas. Numerous studies have demonstrated the benefits of connectivity for overall rural development. Although transport alone does not provide a universal solution to the challenge of generating inclusive rural development, it is a fundamental condition for poverty reduction.[7]

1. Rural transport and poverty

An estimated 39 per cent of the rural population in developing Asia and the Pacific lives in multi-dimensional poverty.[8] Better transport infrastructure and greater rural-urban connectivity improves access to markets, jobs and other economic activities, providing significant economic benefits to rural communities. It further promotes income generation and improvement of farmers' livelihoods.

Many studies conducted in China, India, the Lao People's Democratic Republic and Nepal show that improved rural-urban transport connectivity is a necessary condition for economic development and poverty alleviation. A World Bank study has shown strong correlation between improved rural access and poverty reduction. For example, in Viet Nam, rural access improved significantly from an average of 76 per cent to 84 per cent at the provincial level from 2002 to 2004; the incidence of poverty declined significantly from an average of 41 per cent in 1999 to 24 per cent in 2004.

In the Lao People's Democratic Republic, increased trading activity and the promotion of farming through technical cooperation measures, which are the result of improved transport connectivity, led to a 22 per cent decrease in the poverty rate during a two-year period.[9]

In addition to generating economic activity, connectivity has also been shown to have a knock-on effect with regard to poverty reduction. A study comparing areas with no road access, dry weather access and all-weather access in the Lao People's Democratic Republic found rural road improvement significantly reduces poverty incidence by decreasing prices of products consumed by rural households.[10] Rural road projects in Bangladesh also improved employment rates, especially in non-farm sectors.[11]

India's policy document[12] states rural roads serve as entry point for poverty alleviation and provision for access to social infrastructure such as health, education and markets. The policy recommends reviewing core rural connectivity master plans every five years in order to account for agricultural and industrial growth taking place.

Rural connectivity can bring the double effects of generating rural economic growth and increasing rural incomes by reducing travel time, creating access to employment opportunities and enabling rural workers to commute to urban centres to work instead of seeking accommodation within the city. Therefore, road connectivity can play a role in reducing disparity between rural and urban areas by increasing the economic prospects of rural residents and reducing the push factors of migration.

2. Rural transport and health

Academics and policymakers usually emphasize the importance of access to health services for improving rural livelihoods. Human health can be viewed as both an effect of poverty as well as a reason for it. People who are experiencing poor physical or mental health are less likely to succeed in competitive job markets, thus making it harder for them to escape poverty.

Access to health is the ability of a population to receive appropriate, affordable and quality medical services when needed. A study in India found road construction could have a positive impact on health-care accessibility by 30 per cent.[13] A rural infrastructure programme in Bangladesh showed an increase of 197 per cent in household income among respondents across nine influence areas, due to reduction in travel costs and increases in secondary school and health-care service attendance[14]. Furthermore, informal health-care providers in Guntur, India observed that as roads improved and people had more wealth, they were more likely to consult doctors. Higher-quality roads helped informal care providers network better and become more capable of setting up practices to service more distant and poorer areas.[15]

Thus, transport is a crucial element in overcoming the geographic separation between people and medical facilities. Improved opportunity costs of travelling to distant medical institutions can help rural people receive preventive health services, maternal health care, medication and faster emergency care.

A review of case studies from many countries illustrates the importance of distance as well as transport infrastructure and services, from remote villages to health centres, and from health centres to hospitals.[16] Poor transport was identified as a major cause of peri-natal mortality in the hills of Nepal (where most journeys were on foot) and with worst outcomes recorded among the most disadvantaged ethnic groups (thought to be associated with insufficient money and a lack of awareness).[17] Connecting villages by all-season roads in Orissa, as part of the Pradhan Mantri Gram Sadak Yojana (PMGSY) project in India, demonstrated health benefits from people increasingly taken to distant hospitals rather than being treated in villages, which locals were convinced saved lives and reduced mortality rates.[18] Many global studies have highlighted the fact that poor access is a major cause of peri-natal mortality and have estimated that up to 75 per cent of mortality resulted from inadequate transport to basic health facilities.[19]

3. Rural transport and education

There is substantial evidence in the region that improved rural accessibility has led to increased school attendance, female enrollments, and primary school attendance and completion rates.

An analysis of the databases associated with the PMGSY rural road project shows school attendance increased 22 per cent as a result of new village access roads, with enrolment from disadvantaged groups increasing significantly.[20] There was a 5 per cent gender-neutral improvement in primary educational enrolment of children aged 5-14 years but a drop in enrolment of children aged 14-20 years, which may be related to greater employment opportunities for young people associated with improved road access.[21]

In areas where not only is the road network sparse but also educational facilities are scarce,[22] accessibility is naturally low due to long distances and high opportunity costs. Integrated road and educational investments have the potential to increase school enrollment and attendance, which in turn contributes significantly to poverty alleviation. However, connectivity by itself is not a sufficient solution to address low school attendance rates. The poorest households often depend on their children's labour to sustain themselves, thus aggravating their educational disadvantage. Although improved transport infrastructure may lower the time travelled by children to school, they may still have to sacrifice schooling to help their family's economic situation. Therefore, without economic support, children may not be able to access the educational benefits from improved connectivity.

C. Status and analysis of rural transport connectivity in the region

There are varying definitions and approaches in which rural access, rural transport and rural connectivity are understood or defined. Different countries have different hierarchical or functional classification of roads. In general, rural roads provide transport connectivity to rural areas and usually carry low volumes of traffic (less than 200 vehicles per day). In some countries, roads other than trunk, feeder or classified roads are considered to be rural roads. In Nepal, district roads and local roads are considered rural roads, and are constructed and maintained by the Department of Local Infrastructure Development and Agricultural Roads (DOLIDAR). Similarly, in Thailand, rural roads are constructed and maintained by the Department of Rural Roads.

In addition, rural transport encompasses other forms of transport routes that provide rural connectivity such as trails and tracks, suspension/rope bridges, water transport, footpaths, bicycle tracks and intermediate tracks. Intermodal transfer hubs in suburban areas should incorporate connections for rural transport services, including non-motorized transport, intermediate modes of transport and public bus services.

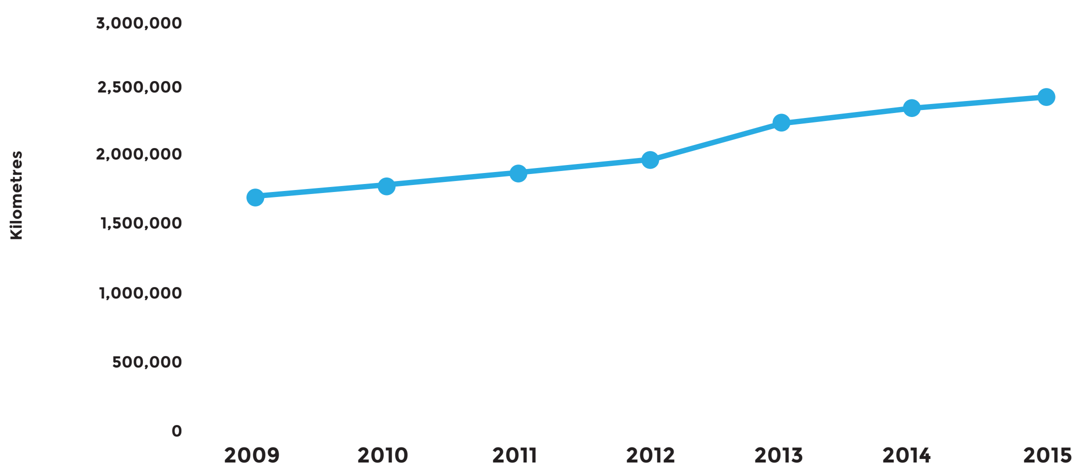
Many countries in the region have focused rural transport policies and strategies on expanding the existing rural road network, connecting more rural and isolated communities and reducing travel time to the nearest road head. Table 5.1 provides an outline of selected rural transport policies and practices in Asia.

TABLE 5.1. SELECTED RURAL TRANSPORT POLICIES AND STRATEGIES

COUNTRY	RURAL TRANSPORT POLICY AND STRATEGIES
Bangladesh	Use labour-intensive rural road construction to increase rural income, and enhance linkages between rural development and rural transport. The Local Government Engineering Department has established a comprehensive rural road asset management system that uses a road inventory database for analysis and to support planning, budget allocation and monitoring.
Cambodia	The vision is to provide every member of the rural population year-round access to basic needs, economic and social facilities, services and opportunities. Strengthening village- and community-based rural infrastructure, maintenance, application of the Integrated Rural Accessibility Planning tool and establishment of an axle load control programme.
China	Plan to connect all communities with a population of more than 10,000 and expand the rural road network.
India	Provide all-weather access to rural settlements, connect communities and use local materials in the construction and maintenance of roads.
Lao People's Democratic Republic	Preserve the road network, secure road access to all communities by 2020, and make provincial, district and rural roads passable throughout the year.
Myanmar	Provide rural road access to all villages by 2030 and upgrade earthen roads to higher standards.
Nepal	Expansion of the road network to connect all district headquarters, reduce travel time to nearest road heads to less than two hours, employ labour-based construction and performance-based maintenance system, and employ local and disadvantaged groups.
Thailand	Upgrade the rural road network and utilize the established comprehensive rural road maintenance management system and databases to support analysis and planning
Viet Nam	Expansion of rural road networks and community mobilization for maintenance of rural roads.

FIGURE 5.2. LENGTH OF RURAL ROADS IN INDIA

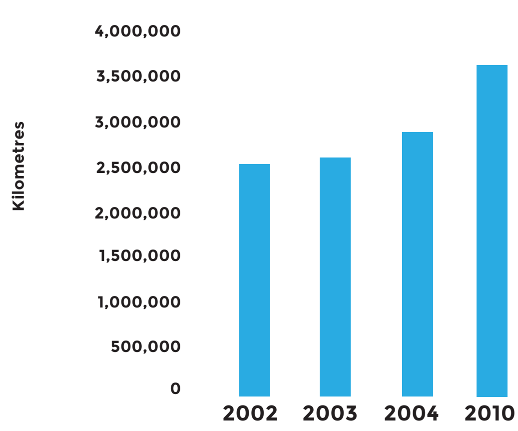
Source: CEIC data.



India has succeeded in increasing the length of its rural roads from 1.7 million km in 2009 to 2.5 million km in 2015 (figure 5.2). The rural road network in India was projected to reach 3.3 million km in 2017, and villages with a population of more than 1,000 will have access to all-weather roads. The PMGSY project provided paved roads to more than 110 million people between 2001 and 2010, which was about 14.5 per cent of the entire rural population or 47 per cent of the unconnected rural population of India.[23] As part of PMGSY, the policy is to connect villages with populations of at least 500 (250 in hilly areas). The Islamic Republic of Iran plans to extend its rural road network from 132,000 km in 2014 to 175,000 km in 2021.

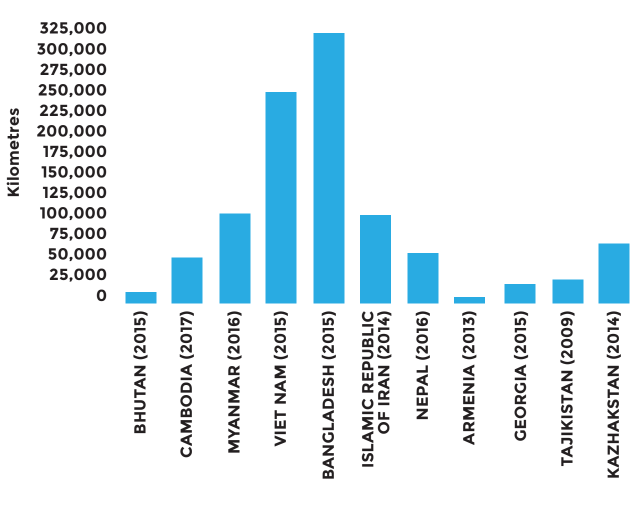
Figure 5.3 shows that China also expanded its rural road network from 2.5 million km to almost 3 million km from 2002 to 2004, and reached 3.7 million km in 2010. China has plans to provide rural roads to connect all communities with a population of more than 10,000.

FIGURE 5.3. LENGTH OF RURAL ROADS IN CHINA



Source: Multiple sources.

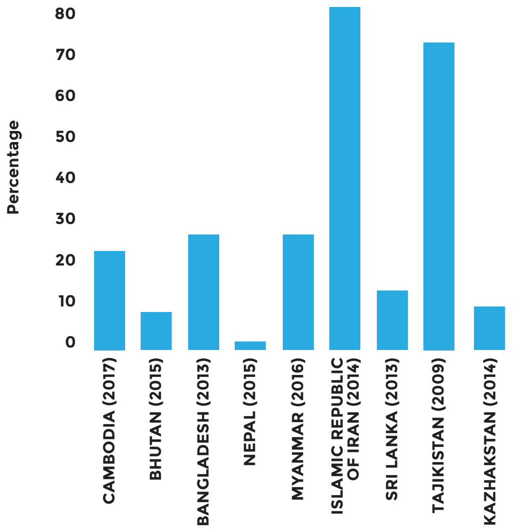
FIGURE 5.4. LENGTH OF RURAL ROADS IN SELECTED COUNTRIES



Source: Multiple sources.

Figure 5.4 shows the progress of rural road development in selected countries. Bangladesh increased rural roads from 301,360 km in 2012 to 321,462 km in 2015. Viet Nam saw a substantial increase from 215,978 km in 2014 to 250,789 km in 2015. While Cambodia lagged behind in total length, the country showed progress by improving rural roads from 28,000 km in 2016 to 34,947 km in 2017. Nepal has a national policy to connect all district headquarters by road access and expansion of the rural network, so that walking time to the nearest road head will not be more than two hours in hilly and mountainous areas. As a result, Nepal's total rural road length reached 57,632 km in 2016. Central Asian countries such as Armenia, Georgia and Tajikistan do not have a significant rural road network due to their small size; however, Kazakhstan, the ninth biggest country in the world, has 70,116 km of rural roads.

FIGURE 5.5. PAVED RURAL ROADS



Source: Multiple sources.

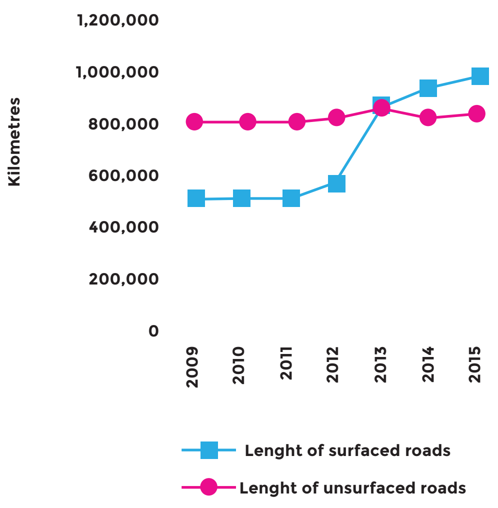
An important characteristic of rural roads is the quality of paving. Figure 5.5 shows the ratio of paved rural roads in selected countries. Except for a few countries, most rural roads in the region are unpaved and the majority have an earthen surface. The length of rural roads in the Islamic Republic of Iran reached 132,000 km in 2014, of which around 80 per cent is paved. Tajikistan has a high ratio of paved roads at 70 per cent. Rural road length in Nepal reached 57,632 km in 2016 (village and district roads); however, only 3.5 per cent are black-topped, 22.2 per cent are gravel and 74.3 per cent are earthen. In Bhutan, the length of rural roads[24] has reached 1,183 km, only 7 per cent of which are paved.[25] The length of rural roads (including upazila, union and rural roads A and B) in Bangladesh now totals 333,590 km — but only 30 per cent are paved.[26] Similarly, in Sri Lanka, only 13 per cent of the total 18,400 km of rural roads are paved. In Myanmar, 70 per cent of village roads are earthen, many of which become impassable in the monsoon season. The percentage of paved roads in Bhutan, Kazakhstan and Nepal remains below 10 per cent.

India, the Islamic Republic of Iran and Bangladesh have made progress in improving rural road quality, especially since 2012. The length of surfaced rural roads in India increased significantly from 2013 to 2015; however, the length of unsurfaced roads remained constant between 2009 and 2015 (figure 5.6). In Bangladesh, the length of paved roads increased from 84,999 km in 2013 to 94,077 km in 2015.[27]

A study in Thailand has shown rural areas have fewer safety and enforcement practices compared to urban areas. Powered two-wheelers are indispensable modes of transport in rural areas, and customized use of two-wheelers with side trailers are often used in rural and semi-urban areas to carry schoolchildren, as shopping carts, and by vegetable and fruit vendors, yet the rate of helmet-wearing is almost half of that in urban areas.

There are some ongoing efforts to strengthen and revitalize local institutions that have a greater role in planning, construction and maintenance of rural access projects. For example, city and village

FIGURE 5.6. QUALITY OF RURAL ROADS IN INDIA, 2009-2015



Source: CEID data..

councils in Nepal have gained more autonomy as part of restructuring efforts and implementation of a new federal Constitution. However, these new local institutions need administrative and technical support in discharging their responsibilities.

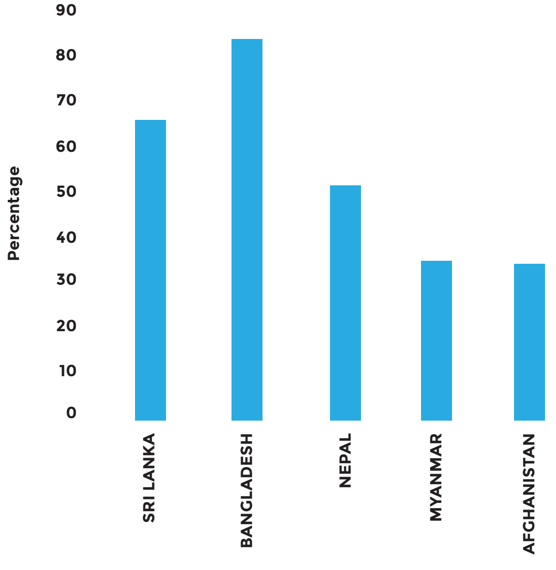
Many countries in the region have focused on increasing rural road length as a priority in rural transport policy. As a result, the rural road network has expanded significantly. However, a wide disparity in rural road quality still exists between developed and developing countries. Among developing countries, the quality of the roads remains a significant barrier to mobility of rural residents. Although Governments have made efforts to upgrade transport infrastructure, much of the rural road network is still comprised of unpaved and earthen roads. While most countries have good rural transport policies and strategies, many still need to strengthen their planning and project implementation capabilities. Lack of funding, coordination, technical know-how and capacities are often cited as bottlenecks to achieving anticipated progress.

D. Linking rural roads to wider transport networks

The Rural Access Index (RAI) provides some measures of rural accessibility. The RAI is a measure of the population living within 2 km (typically 20-25 minutes' walk) of all-weather road access expressed in percentage of total population. Figure 5.7 shows the RAI for selected regional member countries.[28,29] It indicates some improvement of accessibility in Afghanistan, Bangladesh, Myanmar and Nepal.

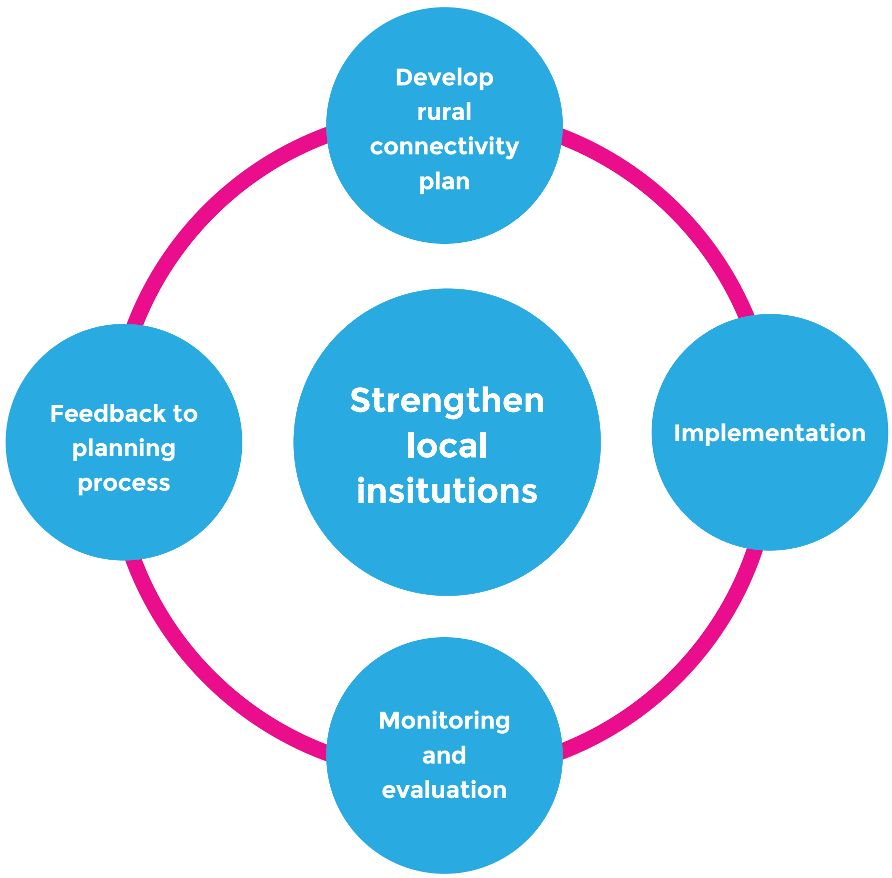
Despite efforts of countries to improve rural transport, the level of rural accessibility and connectivity in the region has not fully achieved the anticipated results, and people living in the rural areas in less developed countries have little opportunity to participate in wider economic activities. Additional efforts will be necessary

FIGURE 5.7. RURAL ACCESS INDEX, 2016



Source: Compiled from multiple sources.

FIGURE 5.8. RURAL TRANSPORT INFRASTRUCTURE PROJECT CYCLE



to improve rural connectivity and accessibility in countries with a low RAI. A new approach to the RAI measurement was piloted in some countries, using GIS techniques.[28] Application of this new methodology would be helpful in tracking the progress of rural accessibility in countries.

Reliable access to a wider transportation network has been recognized as a major enabler of economic and social development. However, large demographic groups in rural Asia remain isolated within communities where poverty is an inherent part of life. Lack of coherent rural development policy frameworks, financing, knowledge of engineering/maintenance as well as misalignment of national and regional priorities are major obstacles to substantial extension of rural road networks. Physical isolation of rural populations and communities needs to be addressed by connecting them to wider national, regional and feeder transport networks.

In this context, a regional policy framework for linking rural roads to the wider transport networks could be a useful tool for rural transport policymakers and practitioners as well as rural communities and related stakeholders. The policy framework could supplement existing mechanisms in countries and communities that support the development of rural connectivity to wider transport networks. The policy framework could incorporate a full project cycle — starting with establishing local institutions and authorities, development of rural connectivity plans, implementation, monitoring, evaluation and feedback to the planning process. Figure 5.8 shows a full project cycle of rural connectivity projects.

E. Selected rural road development projects

1. Local Road Improvement Project, Nepal

The objective of the Local Road Improvement Project in Nepal is to improve all-weather rural accessibility and the livelihoods of the target demographic in four remote districts (Ramechhap, Sindhuli, Okhaldhunga and Khotang). Under the project, road construction, upgrading and maintenance was carried out by people from disadvantaged target groups who live along the influence zone of the roads. The group benefitted directly from cash incomes received for work on roads. The project aims to make 750 km of existing road all-weather and well-maintained, upgrade 200 km of road to all-weather standard and construct 100 km of new all-weather road. The project will generate 2.4 million person-days of employment, at least 60 per cent of which will be given to disadvantaged groups and 35 per cent will be provided to women. The project is implemented by the Department of Local Infrastructure Development and Agricultural Roads and supported by the Swiss Government.[30]

FIGURE 5.9. WOMEN WORKING ON A RURAL ROAD

Source: DOLIDAR

FIGURE 5.10. IMPROVED RURAL ROAD IN VIET NAM

Source: Research for Community Access Partnership.

2. Third Rural Transport Project, Viet Nam

Viet Nam implemented its Third Rural Transport Project with support from the World Bank. The objective of the project was to reduce travel costs, improve access to markets and supply off-farm economic opportunities and social services to poor rural communities in 33 provinces of northern, central and southern Viet Nam.[31] The project, which was implemented from 2007 to 2014, rehabilitated 3,283 km of rural roads, constructed 36 rural bridges, increased the proportion of district roads in good and fair condition to 53 per cent and maintained 19,902 km of district roads. The project also supported development of a rural transport policy and strategy, revised rural road standards and developed guidelines for rural roads maintenance management. As part of the project, the Community Based Rural Road Maintenance Pilot Programme in Ben Tre province resulted in high participation by the local community, met the demand of maintaining rural roads, solicited more finance from businesses, and promoted closer relationships between the government and communities.[32]

Table 5.2. Road construction and improvement by the Department of Rural Development, Myanmar

(in Kilometres)

SURFACE TYPE/YEAR	2011-2012	2012-2013	2013-2014	TOTAL
Bituminous	65	350	525	**940**
Macadam	413	441	1 271	**2 125**
Gravel	265	0	0	**265**
Earth	652	930	2 103	**3 685**
TOTAL	**1 935**	**1 720**	**3 899**	**7 014**

Source: Department of Rural Development, Myanmar

3. Rural Roads Improvement Project, Cambodia

The Rural Roads Improvement Project improved 22 rural roads totalling 542 km in seven provinces of Cambodia,[33] most of which are located around the Tonle Sap Basin. The project also improved drainage structures and culverts. It strengthened the capacity of the Ministry of Rural Development to plan, manage and monitor road maintenance operations. It also increased participation by, and capacity of the private contracting industry, and strengthened local provincial departments and authorities in assuming road maintenance responsibilities. Moreover, the project established an axle load control programme to safeguard rural roads from excessive damage, and enhanced rural road safety in the project area. As a result, about 560,000 residents in the project area now have all-year access to road transport.

4. Rural Roads and Access Project, Myanmar

Since 2011, Myanmar's Department of Rural Development has constructed 3,685 km of earthen roads and improved 2,125 km of village roads to macadam standard, and 940 km to bituminous standard (table 5.2). The annual amount of road construction and development is projected to increase. The Department of Rural Development and the Department of Development Affairs have also collaborated in establishing and improving three interdistrict roads with a total length of 2,300 km. Although not passing through towns, these roads serve to connect many villages and rural areas in order to allow larger vehicles to pass through these regions and bring economies of scale to rural freight transport.[34]

5. Rural road maintenance management system, Thailand

Thailand launched a comprehensive rural road maintenance and database system that aims to improve construction and maintenance of the rural road network and bridges, enhance flood management, provide technical support to local governments, analyse road master programmes and draft rural road standards. Combining both central and regional management, the budget in 2013 was US$425 million (14,000 million baht).[35]

6. Road asset management system, Bangladesh

Created and overseen by the Local Government Engineering Department of Bangladesh, the Road Asset Management System is responsible for the 302,162-km rural road network. The system updates the road inventory database through data surveys and utilizes data analysis to allocate budgets for priority projects,

FIGURE 5.11. SLOPE STABILIZATION OF RURAL ROADS IN BANGLADESH

Source: Jahan and Alam.

and subsequently monitors and evaluates progress and updates information in the road inventory database. Funding for the system is a mixture of revenue budget and foreign development aid.[36] By 2012, the department had reconstructed and rehabilitated 82,260 km of upazila, union and rural roads as well as more than 1,100 km of bridges/culverts.[37] The analysis of available data assists the Government in the most efficient allocation of funding and resources to road construction and improvement.

F. Policies on rural transport development

The review of rural transport policies and strategies in selected Asian countries reveals the national focus on increasing accessibility to rural populations and communities as well as improving physical infrastructure, but not on providing transport and social services. Rather than viewing transport infrastructure as an end, it is beneficial for Governments to perceive it as one of the many requirements for achieving development goals. Roads alone are not helpful in improving the quality of life in rural areas if there are no job opportunities, schools or health-care facilities at the destination, or if children still have to work to help their families instead of going to school. Therefore, the prevalent problem of isolation in rural communities encompasses not only transport but also social and economic dimensions. Thus, an interdisciplinary solution is needed that focus on road construction, transport service provision, social facility connection and economic incentives to decrease the opportunity costs of getting health care and education. In this regard, the recently adopted Vientiane Declaration on Rural Transport[38] also calls for coordinated efforts to improve rural access.

Another issue is the project-based approach to rural road development. Once the project is finished, maintenance is not well-planned. Because of these project-based policies, increasing the length of rural roads compromises the issues of safety, comfort and quality of service. As a result, it is necessary to initiate a debate on the balance between the quantity and quality of rural roads. Well-maintained roads of high quality and standards will ensure greater safety and reliability of rural transport services.

It is often the case that rural access projects are not economically viable if only traditional cost-benefit analysis is considered; in such cases, most are government-funded rather than by the private sector. It would be valuable to explore how to better mobilize and utilize private sector funding, subsidies from the government and contributions from communities for the development of rural transport and services.

Below is a list of local and national policies that could help improve rural connectivity in the Asia-Pacific region:

a. Improve overall planning, implementation and monitoring of rural access projects by taking a full project cycle approach;

b. Make knowledge products and guidelines accessible to local authorities in local languages and simplified versions;

c. Improve overall local and rural governance;

d. Strengthen local institutions and enhance the capacity of local authorities, communities and related stakeholders;

e. Ensure sustainable maintenance of rural roads;

f. Initiate rural transport services;

g. Design effective rural infrastructure financing schemes.

1. Consider full project cycle

Due to the small scale of investment, rural access projects usually do not go through the full project cycle, from planning, implementation, monitoring/evaluation to feedback and the planning process, which results in poorer quality project implementation and unfinished roads. Introducing the full project cycle to rural transport projects, regardless of the size or investment involved, could improve overall planning and development of rural transport networks.

2. Access to knowledge products

Past research has suggested rural transport policy should focus on making rural transport knowledge products accessible to rural communities. One unique aspect of rural access projects is that they are more effective if planned with wider community participation that later results in ownership. Making knowledge products and guidelines accessible at the local level in local languages could enable the local community to participate and enhance the effectiveness of the project. Even when planning is diligent, local authorities often lack the technical capacity to implement projects. Knowledge products (such as those developed by ILO and the International Forum for Rural Transport and Development, guidelines[39] and planning tools, which could be customized and simplified with sketches and drawings, are usually available but not always readily accessible.

3. Improvement of local and rural governance

Local authorities and institutions need support from national Governments to develop legal and regulatory frameworks, enhance institutional coordination, ensure effective public participation, and make effective and timely evidence-based decision-making. Projects should serve the needs of the local community and align with national transport strategies.

4. Strengthen institutions and capacity-building

Capacity-building activities should focus on three levels: (a) the strategic level for national planning and policies related to rural transport; (b) the sectoral level for those responsible for transport and rural development issues; and (c) the project level for implementation. One important aspect of project implementation is monitoring and quality assurance, which should be backed by legal and administrative frameworks. Strengthening technical and project management capacity can improve the quality of rural infrastructures. All related stakeholders should be exposed to good practices and case studies in the implementation of rural access projects.

5. Ensure sustainable maintenance of rural roads

There has been tremendous growth of rural roads in the region. However, most rural roads are earthen and gravel, and are poorly maintained. Due to poor and neglected maintenance, unpaved roads can be damaged during the monsoon season, and poor drainage may make them impassable. Some literature points out maintenance of unpaved roads can be more expensive than paved roads in the long term.

Rural roads are also vulnerable to climate change and extreme weather. Floods and landslides damage roads that serve as main supply lines for relief operations after natural disasters.

Sustainable maintenance of rural roads needs to be carried out with a focus on improving quality. Thailand and Bangladesh provide good examples of rural road maintenance management systems, supported by rural road databases, assessment of conditions and maintenance.

6. Initiation of rural transport services

Sound rural transport policy often includes initiating and improving rural transport services on low-volume roads. There is an opportunity to use intermediate modes of transport as well as indigenous local technology and practices that modify powered two-wheelers and convert pick-ups into customized public transport (Songtao three-wheelers in Thailand, Jeepneys in the Philippines and modified electric rickshaws in Bangladesh).

7. Financing for rural transport

In order to effectively finance rural transport, it is suggested that authorities consider establishing a road fund, generated from fuel levies and other road charges, to cross-subsidize rural road construction and maintenance. As this fund would be separate from governmental budgets, it could be directly distributed to highway and local authorities for rural road maintenance.

In addition, national Governments can tap into foreign aid specifically targeting provision of basic services to rural and poor populations such as the World Bank's Global Partnership on Output-Based Aid. Funding can be directed towards maintaining and constructing roads as well as providing transport services connecting rural areas. For example, the Government of Malaysia subsidizes cars used by farmers to deliver produce, and provides financial support for scheduled bus services and dial-a-ride systems for the disabled, youth and elderly.[40]

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Road safety

A. Introduction

Road traffic crashes resulted in some 733,000 deaths on Asia-Pacific roads in 2013[1]. In addition to the "human" cost, road crashes result in tangible economic losses to victims, their families and nations as a whole. Because of the growing epidemic of road crashes, the issue of road safety has received global attention and has become a global development agenda as reflected in relevant targets of the Sustainable Development Goals (SDGs). This chapter provides an overview and analysis of road safety in the region based on the data obtained from the Global Status Report on Road Safety 2015[2] published by World Health Organization (WHO) and ESCAP calculation. It also lists global and regional mandates aimed at improving road safety, including the Decade of Action for Road Safety[3], the SDGs[4], the Brasilia Declaration[5], and the updated Regional Road Safety Goals and Targets for Asia and the Pacific 2016-2020 that was recently adopted by Asia-Pacific Transport Ministers. In addition, this chapter identifies the major causes of road traffic crashes, and highlights some policies and initiatives to make road safety improvements happen.

B. Regional status of road safety

In the Asia-Pacific region, one person is killed in a road crash every 40 seconds. This is equivalent to 2,000 lives lost per day or 15,000 per week, causing immeasurable economic and social losses. Many more have been injured, yet have survived road crashes. Society might perceive those who have survived road crashes as the "lucky" ones. However, this is not quite true. A recent study[6] found that the majority of the survivors experienced social and economic difficulty, while large numbers of victims lost their jobs and nearly half of those who become disabled lost their homes. In addition, more than one-third experienced divorce due to economic difficulties and mental frustration.

The economic cost of road crashes in countries in Asia and the Pacific has been estimated to be as much as 6 per cent of gross domestic product (GDP), amounting to more than US$500 billion.[7]

1. Road traffic fatalities

Based on the Global Status Report on Road Safety 2015, published by WHO, road traffic crashes kill 1.25 million people annually. In the Asia-Pacific region alone, 733,000 lives are lost each year, accounting for nearly 60 per cent of the global figure. Despite the frightening figures, some positive progress has been made since the start in 2011 of the Decade of Action for road safety in the Asia-Pacific region. Between 2010 and 2013, a 5.6 per cent reduction in road traffic fatalities was realized; however, the average road traffic fatality rate (deaths per 100,000 inhabitants) in 2013 in the Asia-Pacific region was 18.99 deaths, which was higher than the world average of 17.4 deaths.

Figure 6.1 shows the status of road safety in individual countries. In terms of absolute numbers, China and India have the largest number of road traffic fatalities due to the size of population and level of monitoring systems. In terms of the fatality rate per 100,000 inhabitants, Thailand (36.2), the Islamic Republic of Iran (32.1) and Viet Nam (24.5) are the highest. Of the 10 worst-performing countries, four are in the South-East Asia subregion (Thailand, Viet Nam, Malaysia and Myanmar). Among the top performing countries are Australia, Japan, New Zealand and Singapore.

Despite the overall improvement in regional road safety, progress at the national level has been mixed. Figure 6.2 shows the changes in number of road traffic fatalities in countries in Asia and the Pacific. Twenty-three member countries have shown progress in the reduction of fatalities, of which 18 have performed better than the region's average. Among them, four are in the Pacific subregion (Palau, Kiribati, New Zealand and Marshall Islands). The other six top performers include Georgia, Singapore, Afghanistan, Turkey, the Lao People's Democratic Republic and Azerbaijan.


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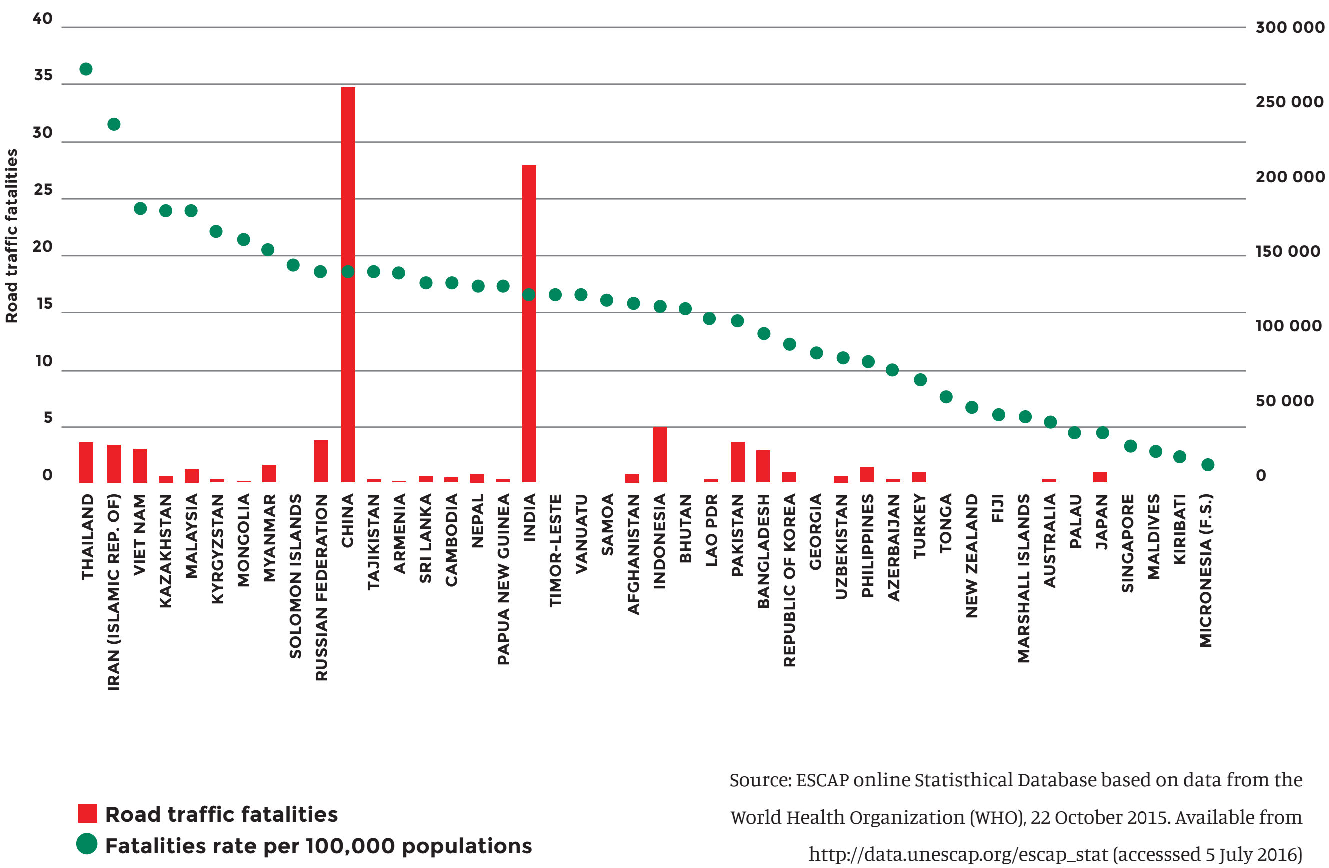
FIGURE 6.1. ROAD TRAFFIC FATALITIES AND FATALITY RATE IN ESCAP REGION, 2013



Source: ESCAP online Statisthical Database based on data from the World Health Organization (WHO), 22 October 2015. Available from http://data.unescap.org/escap_stat (accesssed 5 July 2016)

2. Vulnerable road users

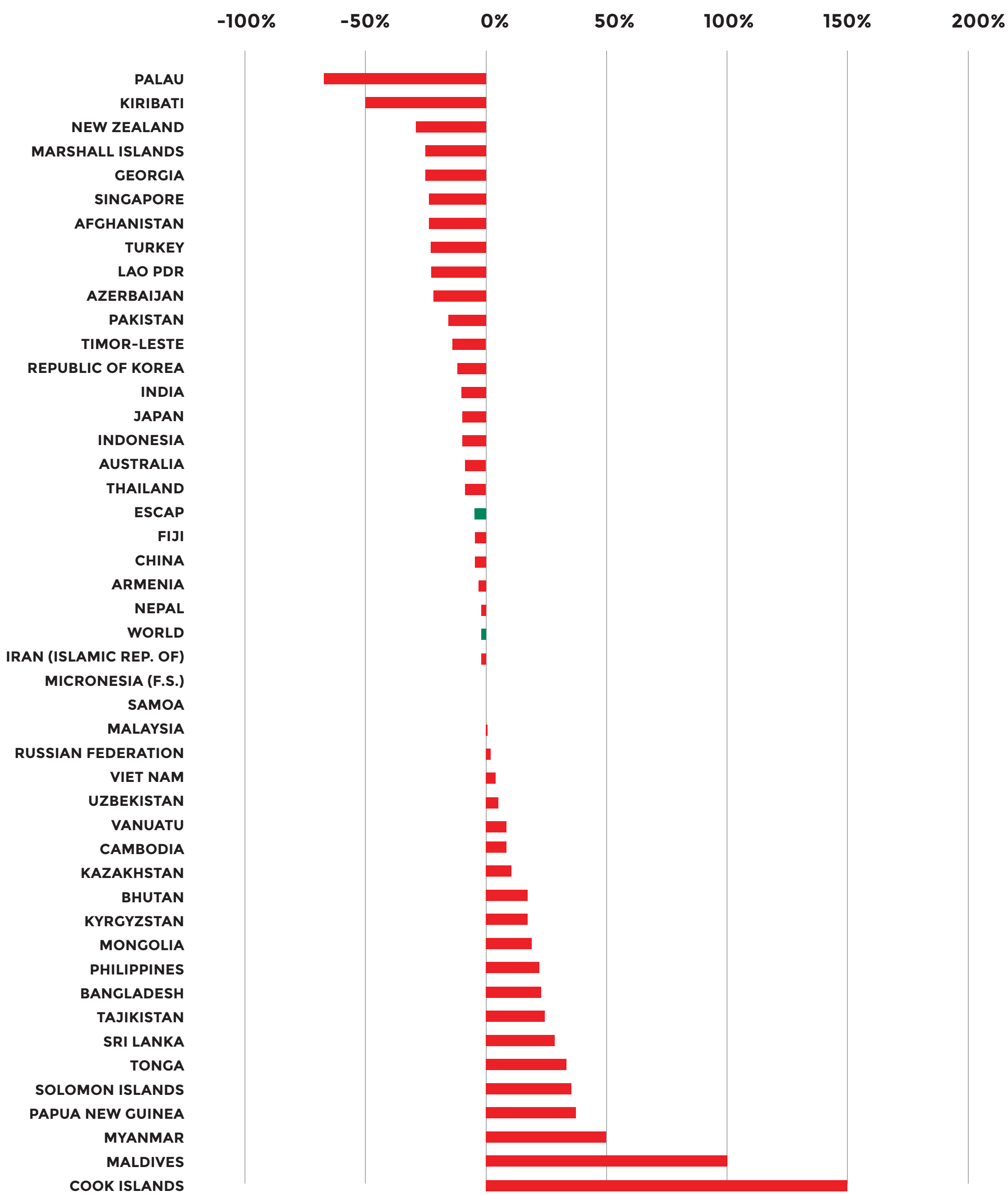
Motorcyclists, cyclists and pedestrians are collectively known as "vulnerable road users" (VRUs). Road fatalities among VRUs are a cause of serious concern in many countries. According to the Global Status Report on Road Safety, 2015, published by WHO, 47 per cent of the world's road traffic fatalities involve VRUs. In Asia and the Pacific, road traffic deaths among VRUs account for 55 per cent of total road traffic fatalities.

Among different types of VRUs, riders and passengers of motorized two- and three-wheelers account for the highest proportion at nearly 30 per cent. Pedestrians and cyclists have a lower share of nearly 20 per cent and about 5 per cent, respectively. Drivers and passengers of motorized 4-wheelers share around 22 per cent. Figure 6.3 shows the distribution of road traffic fatalities by type of road users in Asia and the Pacific.

More than 21 countries in Asia-Pacific have a VRU share of 50 per cent or higher. Road traffic deaths in Kiribati and Palau are solely attributed to VRUs. Of the top 10 countries with the highest share of VRUs, six are in the South-East Asia subregion. Bhutan has the lowest share of VRU deaths. Of the top 10 countries with the highest share of non-VRUs, six are in the North and Central Asia subregions. Figure 6.4 shows the proportion of VRU vs. non-VRU fatalities of countries in the region.

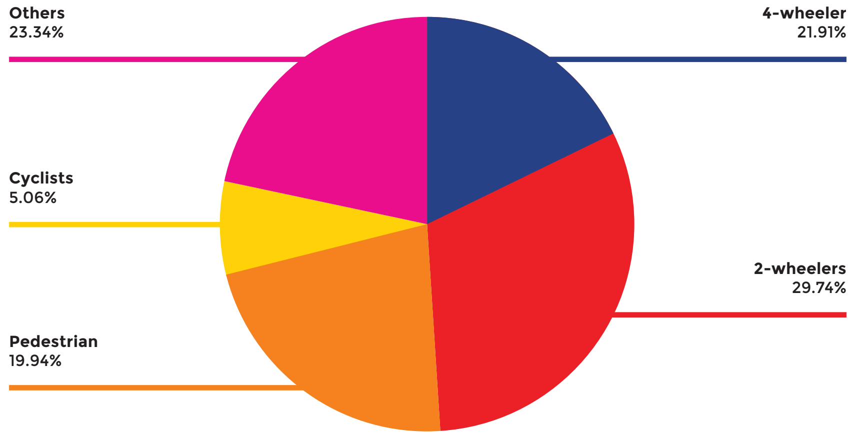
The relative importance of VRU safety varies in different subregions of Asia and the Pacific. Approximately two-thirds of road traffic fatalities are among VRUs in South-

FIGURE 6.2. CHANGE IN ROAD TRAFFIC FATALITIES IN COUNTRIES IN THE ASIA-PACIFIC REGION, 2010-2013



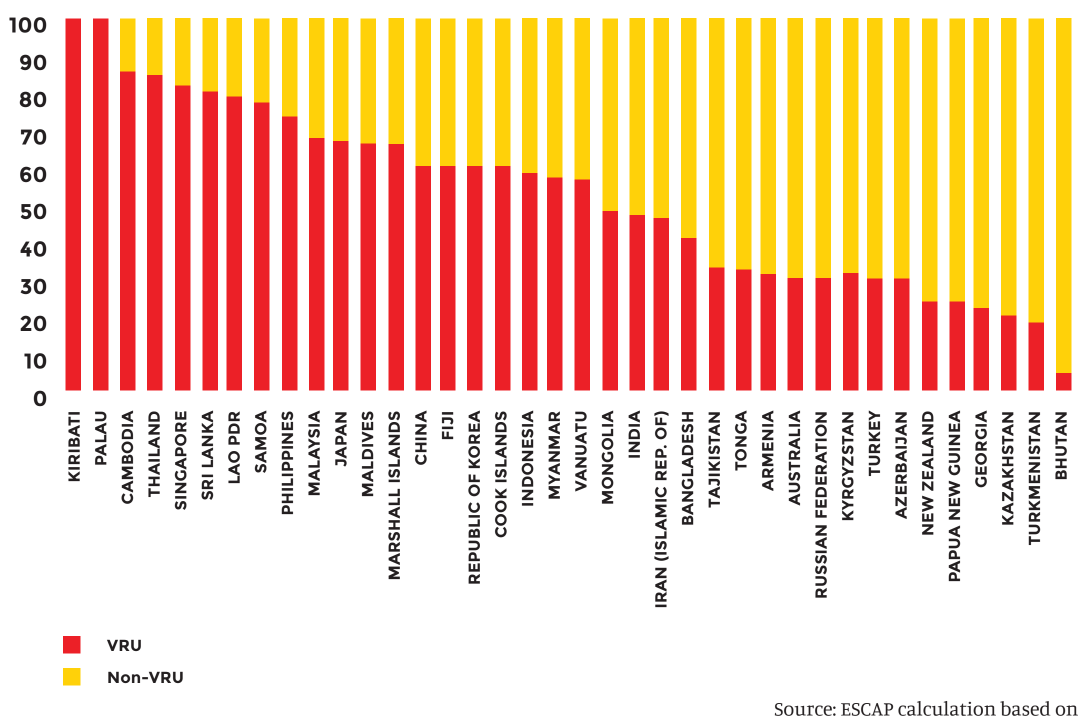
Source: ESCAP calculation based on data from WHO, Global Status Report on Road Safety 2015.

FIGURE 6.3 DISTRIBUTION OF ROAD TRAFFIC DEATHS BY TYPE OF ROAD USER, 2013



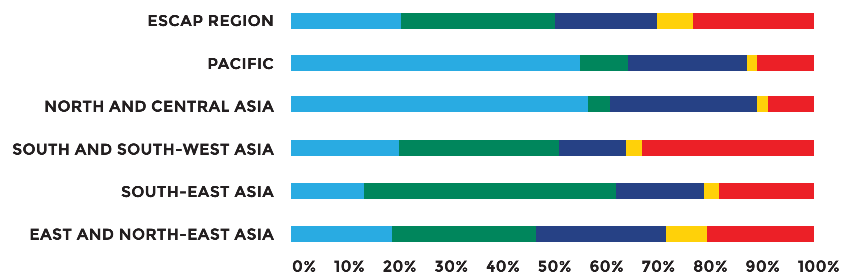
Source: ESCAP calculation, data from WHO, Global Status Report on Road Safety 2015.

FIGURE 6.4. SHARE OF VULNERABLE ROAD USER FATALITIES, 2013



Source: ESCAP calculation based on data from the WHO Global Status Report on Road Safety, 2015

FIGURE 6.5. DISTRIBUTION OF ROAD TRAFFIC DEATHS IN ASIA AND THE PACIFIC, 2013



Sources: ESCAP calculation and data from WHO, Global Status Report on Road Safety 2015.

East Asia and the East/North-East Asia subregions at 68.56 per cent and 61.11 per cent, respectively. The share of the South and South-West Asia subregion in VRU deaths is slightly less than half. In the North and Central Asia and Pacific subregions approximately one-third of total road traffic deaths are among VRUs.

The distribution of road traffic deaths by type of user also varies among the subregions. Pedestrian deaths have the highest proportion, at 26.61 per cent, in the East and North-East Asia subregion. Drivers and passengers of motorized four-wheelers have the highest proportion of 58.54 and 56.03 per cent in the North/Central Asia and Pacific subregions, respectively. Motorized two-wheeled vehicle drivers and passengers have the highest shares of fatalities at 49.01 and 30.20 per cent in South-East Asia and the South/South-West Asia subregions, respectively. Among these subregions, South-East and North-East Asia have the highest share of cyclist fatalities of 8.15 per cent compared with other subregions. Figure 6.5 shows the distribution of road traffic fatalities by subregion and top road user.

Figure 6.5 clearly shows that while road safety may be a common cause of serious concern in the region, each subregion is facing specific challenges that may require special attention in order to address geographic, socio-economic, climate and cultural differences.

C. Causes of road traffic crashes

Identifying the key causes of road crashes can help to target policies and actions, and to identify where funds can be focused to reach optimal outcomes.

Table 6.1 shows the top causes of road crashes in Asia-Pacific countries. The three most common causes can be identified as negligence and rule violation by drivers including overtaking, dangerous lane changing and tailgating; speeding and drink-driving are the other two most commonly found causes of road crashes for countries in the region.

1. Negligence and rule violation by drivers

One of the top reported causes of road crashes in many countries in Asia and the Pacific is negligence and rule violation by drivers which is mainly subject to driver behaviour. In Turkey and the Philippines driver error is the cause of 89 and 79 per cent of road crashes respectively. Violation of safe driving practice accounts for nearly 58 per cent of road traffic crashes in Japan. Nepal and Pakistan reported 44 per cent and more than 28 per cent of road crashes are due to negligence and careless drivers.

Changing driver behaviour is one of the most challenging to achieve. Unlike infrastructure or changes in vehicle technology where the return on investment may be more immediate, behavioural change of drivers as well as other types of road users is a long-term continuous process in awareness raising, education and the strict enforcement of road traffic laws and regulations.

2. Speeding

Speeding is the number one cause of road crashes in many Asia-Pacific countries including China (14 per cent), India (37 per cent), and Sri Lanka (30 per cent). With China and India by far the countries with the highest of absolute number of road crashes due to speeding.

Despite the fact it is one of the major causes of road crashes, many drivers are still not aware of the risk involved and drive too fast creating a higher risk of losing control and crashing. Base on the Global Status Report on Road Safety 2015, most countries in the ESCAP region have imposed national speed limits, however, the effectiveness of overall enforcement varies substantially. On a scale of 1 to 10, DPR Korea and Turkmenistan report the highest enforcement level at 10. South-East Asian countries, by average, have lower enforcement levels compared with East and North-East Asia and North and Central Asia subregions. The majority of countries in South-East Asia have enforcement levels of between 5 and 6. The enforcement of speed limits is low in Afghanistan (1), Bangladesh (3), India (3), Kiribati (3), Mongolia (2), Papua New Guinea (2), and Thailand (3).

TABLE 6.1. TOP CAUSES OF ROAD CRASHES IN ASIA-PACIFIC COUNTRIES

Bangladesh	Reckless driving, speeding, overloading, mechanical failures
Bhutan	Inexperienced drivers, speeding, drink-driving, overloading, mechanical failure
Cambodia	Speeding, drink-driving
Lao PDR	Traffic rules violation, drink-driving, speeding
Japan	Violation of safe driving practices (careless driving, improper streering/brake)
Republic of Korea	Failure to perform safe driving, traffic lights violation
Fiji	Speeding, Dangerous driving
Myanmar	Driver's offense, pedestrian's negligence
Viet Nam	Driving in wrong lane, speeding, wrong navigation
India	Speeding
Sri Lanka	Overtaking, turning, speeding, drink-driving
Nepal	Negligence by drivers and pedestrians, speeding, overtaking, drink-driving
Pakistan	Careless driving, dozzing off
Philippines	Driver's error, defective vehicle, bad road condition

Source: Multiple sources.

3. Drink-driving

It is estimated that between 41,000 and 51,000 road traffic fatalities are attributed annually to alcohol or drink-driving in the Asia-Pacific region[8]. Table 6.2 shows the percentage of road traffic deaths attributed to drink-driving together with the alcohol limits given in related national laws. Marshall Islands attributes 100 per cent of road traffic deaths to alcohol yet has no drink-driving law. The blood alcohol content (BAC) has not yet been defined in several Pacific Island and Central Asian countries, among which Papua New Guinea and Azerbaijan rank among the top five countries with the highest percentage of drink-driving. Of those countries that have defined their BAC level, only Armenia, Malaysia and Singapore still have a BAC level that is higher than 0.05 g/dl. In countries that have made substantial progress in improving road safety, drink-driving continues to be a persistent cause of road accidents and fatalities.

In terms of the number of fatalities due to drink-driving, China has the largest figure at nearly 10,000 per year, closely followed by India at 9,750 and the Russian Federation which is ranked third at 2,700 fatalities per year.

Of 43 countries that have reported the existence of a national drink-driving law, only 28 countries have defined the level of blood alcohol content (BAC).

TABLE 6.2. ATTRIBUTION OF ROAD TRAFFIC DEATHS TO ALCOHOL IN SELECTED COUNTRIES

	DEFINITION OF DRINK-DRIVING BY BAC	EXISTENCE OF A NATIONAL DRINK-DRIVING LAW	ATTRIBUTION OF ROAD TRAFFIC DEATHS TO ALCOHOL
MARSHALL ISLANDS	NO	NO	100.0
PALAU	0.1 g/dl	YES	100.0
PAPUA NEW GUINEA	NO	YES	56.0
VIET NAM	0.00-0.05 g/dl	YES	34.0
AZERBAIJAN	NO	YES	31.0
NEW ZEALAND	<= 0.05 g/dl	YES	31.0
AUSTRALIA	0.049 g/dl	YES	30.0
THAILAND	<= 0.05 g/dl	YES	25.8
TONGA	<= 0.03 g/dl	YES	25.0
MALAYSIA	<= 0.08 g/dl	YES	23.3
VANUATU	NO	YES	22.0
MONGOLIA	< 0.04 g/dl	YES	20.2
SOLOMON ISLANDS	NO	YES	16.4
CAMBODIA	< 0.05 g/dl	YES	15.0
FIJI	<= 0.08 g/dl	YES	14.6
REPUBLIC OF KOREA	< 0.05 g/dl	YES	14.3
SINGAPORE	<= 0.08 g/dl	YES	10.6
RUSSIAN FEDERATION	0.03 g/dl	YES	8.6
JAPAN	< 0.03 g/dl	YES	6.2
GEORGIA	< 0.03 g/dl	YES	5.3
KYRGYZSTAN	NO	YES	5.3
INDIA	<= 0.03 g/dl	YES	4.7
CHINA	< 0.02 g/dl	YES	3.8
TURKEY	<= 0.05 g/dl	YES	3.3
TAJIKISTAN	NO	YES	3.2
TURKMENISTAN	<= 0.03 g/dl	YES	2.2
ARMENIA	<= 0.08 g/dl	YES	1.9
PHILIPPINES	< 0.05 g/dl	YES	1.4
KAZAKHSTAN	NO	YES	0.5

Source: WHO Global Status Report on Road Safety 2015.

D. Policies and initiatives on road safety

Of the 45 countries for which data are available in the Global Status Report on Road Safety, nine still do not have a national road safety strategy in place. For those that do have national plans, only seven have fully allocated funding to implement the strategy[9]. Despite the limited resources, various road safety activities have been implemented between 2015 and 2017, of which some examples are highlighted below.

1. Recent national initiatives in the Asia-Pacific region

Safe road infrastructure remains a key challenge in most developing countries of the region. To improve road safety infrastructure, in 2015 Viet Nam conducted, for the first time, a road safety audit for new road construction while Pakistan has budgeted US$9.3 million to address road safety black spots on National Highways during 2016 and 2017.

In Thailand and Viet Nam, tracking devices are being installed to monitor driving hours, rest time and driving speed. The devices will send data to control centres and penalties will be applied to drivers who violate related rules and regulations. In India, efforts have been made to improve driver behaviour and 13 Model Driver Training Institutes have been set up to provide training for heavy and light motor vehicles.

Across the region, awareness-raising campaigns have been undertaken to alter road-user behaviour. One of the more effective disseminating channels for road safety messages is media and television. In 2016, Myanmar broadcast road safety video clips of Global Road Safety ambassador, Michelle Yeoh, on prime-time national television on a daily basis. Similarly, Cambodia, through the leadership of the Minister of Public Works and Transport and in partnership with the International Wine and Spirits Alliance, launched an extensive year-long safe driving education initiative in 2017. The television programme, featuring celebrities playing real life re-enactments, is being shown in high schools, and entertainment and restaurant venues as well as through an extensive year-long schedule of television advertising. The national television networks that have donated airtime, to cover different themes on road safety for a 12-month period.

Launched in May 2017, the Singapore Road Safety Month focuses on road safety for motorcyclists, elderly pedestrians and children and on cultivating good "Road Sense". Together with the Info-communications Media Development Authority of Singapore, Traffic Police and the private sector, the Singapore Road Safety Council has developed three Virtual Reality (VR) immersive experiences to educate children, drivers and motorcyclists on road safety. This so- called "IM Road Safety Savvy" experience uses 360-degree videos and VR interactive games to teach children about road safety. It also provides drivers and motorcyclists with detailed perspectives of the consequences of distracted driving while educating them on safe riding measures.

Bangladesh tackles its main causes of road crashes and injuries by launching campaigns against unsafe overtaking and riding motorcycles without helmets. The campaigns were commenced in 2015 and 2016 and were continued throughout 2017. In 2015, Bhutan implemented an awareness campaign on road safety that was conducted by the Royal Bhutan Police to regulate road behaviour of drivers and pedestrians.

In terms of legislation, Viet Nam is revising its road traffic laws to include key road safety components. Bangladesh is also revising its existing Motor Vehicle Act 1983 to reduce road accidents.

In addition to the above-mentioned initiatives to improve road safety, a long-term programme to improve child safety has been taken by the Republic of Korea since 1995 and substantial progress has been made. After two decades of implementing various policies a 96 per cent reduction in child traffic fatalities was achieved in 2016, compared with the highest child fatalities figure in 1988 (box 6.1).

BOX 6.1. THE REPUBLIC OF KOREA ACHIEVES 96 PER CENT REDUCTION IN CHILD TRAFFIC FATALITIES[10]

In the Republic of Korea, the number of the child deaths from the road traffic accidents fell 96 per cent from 1,766 deaths in 1988 to 71 deaths in 2016. The proportion of the child fatalities among the total road traffic fatalities fell from 15.3 per cent in 1988 to 1.6 per cent in 2016. Few other countries have made such a remarkable improvement in child safety. To make this achievement, the Republic of Korea has implemented various policies designed to reduce the child traffic fatalities. Road safety policies for children can be categorized into the aspects of 4E: engineering, education, enforcement and encouragement.

In terms of engineering, the most prominent measure was the introduction of the school zone system in 1995. It led to the designation of safety areas for children around all kindergartens and elementary schools as well as the installation of road safety facilities within a 300-metre radius from the school gate. There is now a total of 16,355 school zones. Almost all high population density areas around schools in urban areas are designated as school zones with a speed limit of 30km/h which contributes greatly to the reduction of child fatalities.

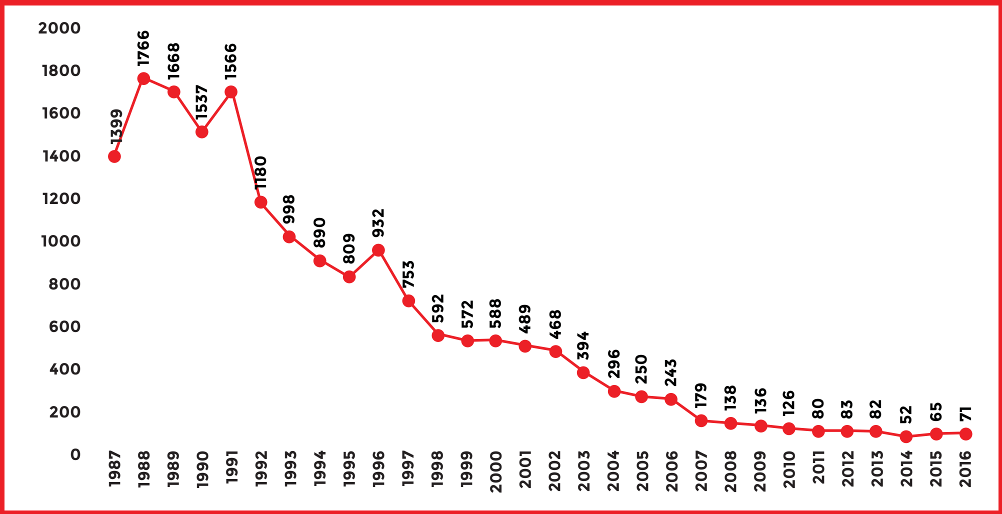
Another aspect of the engineering side is the operation of buses at kindergartens, primary schools and private teaching institutes. All school buses and vans must be registered with the local police station and be equipped with safety requirements including yellow body colour, roof warning lights, all seats with belts, side stop signs and an alarm when reversing. There are about 67,000 school buses nationwide. The supervisors of the school and school bus drivers have to participate periodically in education programmes for safe school bus operation.

As for education, in 1996 the Ministry of Education required kindergartens and elementary schools to conduct road safety education for their students following ministry guidelines. Since that time, all children have been given compulsory education on how to protect themselves on the road. The Child Welfare Act in 2008 stipulates compulsory road safety education of 10 hours every year for all school students. Road safety education has long-term effects and contributes to the low accident rate of children compared to adults.

In terms of enforcement, the National Police Agency implemented a new penalty system in 2011 under which drivers violating traffic rules in school zones are punished with double fines and double penalty points. A driver causing an accident involving a child in the school zone will be prosecuted and punished criminally according to the amendment of Traffic Accident Management Special Act in 2007. In order to reduce the child passenger fatality a driver who violates the child safety seat regulation will pay a double penalty fine compared to the ordinary seat belt violation from 2016.

As for encouragement, the formulation and utilization of voluntary civic groups has been very effective in the Republic of Korea. The Green Mothers Association was formed in 1971 at all primary schools, encouraged by the National Police Agency, and the 562,000 members began their activities as crossing guards near schools and carried out various child safety campaigns.

Through the above-mentioned policies, the Republic of Korea has reduced the number of the child traffic fatalities by 96 per cent over 28 years. The Republic of Korea's experience could be valuable to other countries.



Source: Dr. Jaehoon SUL, The Korea Transport Institute.

E. Global and regional road safety goals and targets

1. Global and regional mandate

Since 2003, seven Resolutions[11] have been adopted by the United Nations General Assembly to strengthen international cooperation and multisectoral national action to improve road safety. Resolution 64/255 of 10 May 2010 proclaimed 2011-2020 as the Decade of Action for Road Safety, with the goal of stabilizing and then reducing the forecast level of road traffic fatalities around the world by increasing activities conducted at the national, regional and global levels.

To provide an overall framework for activities that may take place in the context of the Decade, the United Nations Road Safety Collaboration developed a Global Plan that includes five main pillars:

(a) Road safety management;
(b) Safer roads and mobility;
(c) Safer vehicles
(d) Safer road users;
(e) Post-crash response.

The importance of the issue was re-emphasized under the 2030 Agenda for Sustainable Development that was adopted by the United Nations General Assembly in 2015. Goals 3 and 11 of the SDGs contain targets that are specific to road safety. Target 3.6 is to halve global deaths and injuries from road traffic accidents by 2020. Target 11.2 is to provide access to safe, affordable, accessible and sustainable transport systems for all by 2030, thereby improving road safety — notably by expanding public transport with special attention to the needs of those in vulnerable situations such as women, children, persons with disabilities and older people. The global SDG indicators, which were agreed at the forty-eighth session of the United Nations Statistical Commission held in March 2017, also include a road safety indicator that is the death rate due to traffic injuries.

The Second Global High-Level Conference on Road Safety held in Brasilia in November 2015 mapped a way forward for global road safety that reconciled the Decade of Action and the SDGs through the Brasilia Declaration. It includes 30 operative paragraphs that recommend actions in the following areas, each of which are related to the pillars of the Global Plan for the Decade of Action for Road Safety:

(a) Strengthening road safety management and improving legislation and enforcement;
(b) Promote safer roads and the use of sustainable modes of transportation;
(c) Protect vulnerable road users;
(d) Develop and promote the use of safer vehicles;
(e) Increase awareness and build capacity of road users;
(f) Improve post-crash response and rehabilitation services;
(g) Strengthen cooperation and coordination towards global road safety.

At the regional level, the Ministerial Declaration on Improving Road Safety in Asia and the Pacific, with the goal of saving 600,000 lives and preventing a commensurate number of serious injuries on the roads of Asia and the Pacific during 2007-2015, was adopted by the Ministerial Conference on Transport, held in Busan, the Republic of Korea in November 2006. The declaration included a goal of addressing road safety, and invited the members and associate members of the ESCAP Commission to take action in the following areas:

(a) Making road safety a policy priority;
(b) Making roads safer for vulnerable road users, including children, senior citizens, pedestrians, non-motorized vehicle users, motorcyclists and persons with disabilities;
(c) Making roads safer and reducing the severity of accidents (building “forgiving roads”);
(d) Making vehicles safer and encourage responsible vehicle advertising;
(e) Improving national and regional road safety systems, management and enforcement;
(f) Improving cooperation and fostering partnerships;

(g) Developing the Asian Highway as a model of road safety;
(h) Providing effective education on road safety awareness to the public, young people and drivers.

The period of the regional goal in the Ministerial Declaration ended in 2015. As road safety remains a major concern in the region, and as the issue has not yet been fully resolved, updated Regional Road Safety Goals and Targets for Asia and the Pacific 2016-2020 were launched in line with the global road safety mandate of the Decade of Action for Road Safety and the SDGs.

2. Updated Regional Road Safety Goals and Targets for Asia and the Pacific, 2016-2020

Based on the comparison among the recommended actions in the Brasilia Declaration, the Global Plan for the Decade of Action for Road Safety and the existing Regional Road Safety Goals, Targets and Indicators — and keeping in mind the data availability issues — the updated Regional Road Safety Goals and Targets for Asia and the Pacific 2016-2020 was adopted by Transport Ministers at the Ministerial Conference on Transport held in December 2016 in Moscow.

The updated Regional Road Safety Goals and Targets for Asia and the Pacific 2016-2020 serves as an important guideline for policy formulation and implementation as well as assessment tools to determine progress in improving road safety at the national and regional levels in this critical period. The current performance of the Asia-Pacific region in reducing road traffic fatalities is far from achieving SDG target 3.6, which aims to halve the number of global deaths and injuries from road traffic accidents by 2020, with only a 20 per cent reduction being achieved if the region continues at the present pace. Reaching the target will be even more challenging due to increasing motorization rates in the region, which have averaged 7.2 per cent per annum in past years.

TABLE 6.3. UPDATED REGIONAL ROAD SAFETY GOALS AND TARGETS FOR ASIA AND THE PACIFIC 2016-2020

GOALS AND TARGETS	INDICATORS FOR MONITORING ACHEIVEMENTS
OVERALL OBJECTIVE **50 PER CENT REDUCTION IN FATALITIES AND SERIOUS INJURIES ON THE ROADS OF ASIA AND THE PACIFIC OVER THE PERIOD 2011 TO 2020.**	
(a) Reduce the fatality rates by 50 per cent from 2011 to 2020.	(1) Number of road fatalities (and fatality rates per 100,000 inhabitants).
(b) Reduce the rates of serious road injuries by 50 per cent from 2011 to 2020.	(2) Number of serious road injuries (and injury rate per 100,000 inhabitants).
GOAL 1: MAKING ROAD SAFETY A POLICY PRIORITY	
(a) Create a road safety policy/strategy, designate a lead agency and implement a plan of action.	(3) Information on existing national road safety policy, strategy, plan of action, and their implementation
	(4) Name of designated lead agency on road safety. Description of responsibilities of local, regional and national government organizations, including related coordination mechanism at the national level.
	(5) National road safety reports or impact evaluation reports of government programmes.
(b) Allocate sufficient financial and human resources to improving road safety.	(6) Information on the amount of funding and number of qualified human resources allocated to road safety projects and programmes (public, private and donors) and research and development to create a safer road environment.
GOAL 2: MAKING ROADS SAFER FOR VULNERABLE ROAD USERS, INCLUDING CHILDREN, ELDERLY PEOPLE, PEDESTRIANS, NON-MOTORIZED VEHICLE USERS, MOTORCYCLISTS AND PERSONS WITH DISABILITIES	
(a) Reduce by 50 per cent the pedestrian death rate in road crashes.	(7) Numbers of pedestrian deaths.
(b) Increase the number of safe crossings for pedestrians (e.g. with subway, overhead crossings or traffic signals).	(8) Number of new safe crossings or improvements constructed or planned.

GOALS AND TARGETS	INDICATORS FOR MONITORING ACHEIVEMENTS
(c) Make the wearing of helmets the norm and ensure minimum helmet quality, in order to reduce the motorcyclist death rate by 50 per cent (or reduce it to below the average motorcyclist death rate of the ESCAP region).	(9) Number of motorcyclist deaths and motorcyclist deaths per 100,000 inhabitants. (10) Existing laws or administrative rules for the mandatory use of helmets and specifying minimum helmet quality standards. Information on helmet use (percentage).
(d) Ensure minimum child safety measures, in order to reduce the child death rate by 50 per cent.	(11) Number of child fatalities in road crashes. (12) Existing laws or administrative rules on measures for child safety in cars (child restraints) and on motorcycles (child helmets) (13) Use of child seat restraints and child helmets (percentage).
(e) Equip all school children with basic road safety knowledge.	(14) Existing or planned education programmes on road safety in school, starting class and its coverage.
(f) Ensure safe transportation access to elderly people and persons with disabilities.	(15) Information on safe transportation access to elderly people and persons with disabilities.

GOAL 3: MAKING ROADS SAFER AND REDUCING THE SEVERITY OF ROAD CRASHES ("SELF-EXPLAINING" AND "FORGIVING ROADS")

(a) Integrate a road safety audit into all stages of road development starting at the design stage, conduct road safety inspection, carry out necessary improvement works, and improve hazardous locations.	(16) Number of, and information about, road safety audits carried out for road design, new road construction and major improvements. (17) Number of improvement programmes carried out to make roads "forgiving"(e.g. addressing black spots, removing or cushioning roadside obstacles).
(b) Increase separate/secure road space for pedestrians and cyclists in urban and suburban areas (where space permits).	(18) Existing length of pedestrian and bicycle tracks in kilometres per 100,000 people or per 10,000 kilometres of roads (along highways and city roads). Programme to construct pedestrian and bicycle track.

GOALS AND TARGETS	INDICATORS FOR MONITORING ACHEIVEMENTS
GOAL 4: MAKING VEHICLES SAFER AND ENCOURAGING RESPONSIBLE VEHICLE ADVERTISING	
(a) Make regular inspection of road vehicles mandatory and ensure enforcement of inspection (starting in urban areas).	(19) Existing laws or administrative rules on vehicle inspection, frequency of inspection (annual), number of vehicle inspection facilities and organizations.
(b) Ensure safety requirements for new vehicles are in line with international standards.	(20) Existing laws and regulations specifying vehicle safety standards and implementation.
GOAL 5: IMPROVING NATIONAL AND REGIONAL ROAD SAFETY SYSTEMS, MANAGEMENT AND ENFORCEMENT	
(a) Accession/ratification and implementation of the United Nations instruments on road safety.	(21) Information on accession/ratification of United Nations instruments on road safety.
(b) Implement a national (computerized) database, including a mobile reporting system where possible, that provides information on road crashes.	(22) Information on existing integrated road safety database and responsible organizations.
	(23) The existence of definitions of road fatality and serious injury being used for data collection, with an indication as to whether they are based on internationally accepted definitions.
(c) Aim to provide road safety at the stage of road network planning.	(24) Information about the incorporation of road safety at the stage of road network planning.
(d) Introduction of laws and regulations regarding mandatory use of helmets and seat belts, drinking and driving, use of mobile phones and speed limits.	(25) Information on laws or administrative rules on compliance regarding helmet use (including percentage use).
	(26) Information on laws or administrative rules on compliance regarding seat-belt use and use of mobile phones (including percentage use).
	(27) Information on laws or administrative rules on compliance regarding drinking and driving and speed limits.
(e) Allow alcohol tests for prosecution (breathalyser and/or behavioural tests).	(28) Information on existing alcohol-level testing rules and types of tests and alcohol limits used and allowed for prosecution.

GOALS AND TARGETS	INDICATORS FOR MONITORING ACHEIVEMENTS
(f) Make it the general practice to keep motorcycle headlights on at all times.	(29) Information on existing laws or administrative rules on keeping motorcycle headlights on while driving.
(g) Increase responsiveness to post-crash emergencies and improve the ability of health and other systems to provide appropriate emergency treatment and early rehabilitation for crash victims.	(30) Information on a single nationwide telephone number for use in case of emergencies including road crashes. (31) Information on rehabilitation services.
(h) Apply new technologies in traffic management and intelligent transport systems, including navigation systems, to mitigate the risk of road traffic crashes and maximize response efficiency.	(32) Information on the use of intelligent transport systems in improving road safety.
GOAL 6: IMPROVING COOPERATION AND FOSTERING PARTNERSHIPS	
(a) Encourage and recognize initiatives sponsored by the private sector.	(33) Number of major partnerships in the area of road safety, funding (private sector and public-private initiatives).
(b) Create new and deepen existing partnerships with non-governmental organizations.	(34) Number, scope and funding of major partnerships with non-governmental organizations.
GOAL 7: DEVELOPING THE ASIAN HIGHWAY NETWORK AS A MODEL OF ROAD SAFETY	
(a) Reduce the total number of fatalities and road crashes on the Asian Highway network.	(35) Total number of fatalities and road crashes on the Asian Highway network in each country per year.
(b) Reduce the number of fatalities on all Asian Highway network segments to less than 100 per billion vehicle-kilometres.	(36) Number of fatalities per billion vehicle-kilometres for each Asian Highway network segment per year.
(c) Increase resource allocation for measures related to road safety along the Asian Highway network.	(37) Amount of resources allocated to safety-related works for Asian Highway network segments from Governments and donors.
(d) Improve Asian Highway network segments to be forgiving to road users if a crash occurs; demonstrate best practice.	(38) Information on road safety assessment and rating programme for the Asian Highway network.

GOALS AND TARGETS	INDICATORS FOR MONITORING ACHEIVEMENTS
GOAL 8: PROVIDING EFFECTIVE EDUCATION ON ROAD SAFETY AWARENESS TO THE PUBLIC, YOUNG PEOPLE AND DRIVERS	
(a) Carry out targeted awareness campaigns and training programmes.	(39) Information on the number of national road safety awareness campaigns and training programmes carried out.
(b) Introduction of policies to reduce work-related road traffic crashes.	(40) Information on policies to regulate and improve professional drivers' work conditions.

Endnote

1 Based on data from WHO Global Status Report on Road Safety 2015 and ESCAP calculations.

2 World Health Organization, *Global Status Report on Road Safety 2015*, Geneva:WHO, 2015

3 See https://daccess-ods.un.org/TMP/1816896.94523811.html

4 See https://sustainabledevelopment.un.org/post2015/transformingourworld

5 See www.who.int/violence_injury_prevention/road_traffic/Final_Brasilia_declaration_EN.pdf?ua=1.

6 Jung, N. and J. Sul, *Handbook of Measuring Socio-economic Consequences of Traffic Crashes*, Korea Transport Institute, 2014.

7 The estimate derived from sum of estimated GDP loss of the 19 countries in 2013 and its percentage of GDP multiply by 2013 GDP of ESCAP region. Data source: estimated percentage GDP lost(WHO, Global Status Report on Road Safety 2013 and 2015, 2010 and 2013) and GDP (ESCAP Statistical Database, accessed 2 June 2016).

8 Based on data from WHO Global Status Report on Road Safety 2015 and ESCAP calculations.

9 World Health Organization, *Global Status Report on Road Safety 2015*, Geneva:WHO, 2015

10 Full report is available at https://english.koti.re.kr/component/file/ND_fileDownload.do?q_fileSn=4948&q_fileId=20140423_0004948_00150840

11 Resolutions A/70/260 (2016), A/68/269 (2014), A/66/260 (2012), A/RES/64/255 (2010), A/RES/62/244 (2008), A/RES/60/5 (2005) and A/RES/58/289 (2004)

Intelligent transport systems

A. Urban intelligent transport systems

1. Intelligent transport systems blaze the way

Transport boosts economic and social development by facilitating the movement of people, goods, labour, resources and products. However, on the negative side, in 2014 the transport sector accounted for 64.5 per cent of oil consumption and 27.9 per cent of total final consumption of energy around the globe which was an increase from 45.4 per cent and 23.2 per cent respectively in 1973.[1] Carbon dioxide (CO_2) emissions in the ESCAP region increased 3.07 per cent between 2011 and 2012, reaching 26,725.5 million metric tons (mt) of CO_2 equivalent.[2] In 2010, transport in the ESCAP region contributed 7.33 per cent of total CO_2 emissions, up from 7.13 per cent in 2008. Simultaneously, time losses and transport costs from traffic congestion impose an economic cost of 2-5 per cent of gross domestic product in Asia annually.[3] The adoption of Intelligent Transport Systems can play an important role in addressing these negative elements of transport.

Until now, providing more transport infrastructure was the usual response to the increasing demand for vehicle capacity and mobility. Similarly, road networks in many urban areas in Asia and the Pacific are reaching maturity, operating at or near capacity through most periods of the day. It is increasingly acknowledged that coping with traffic congestion by constructing new infrastructure is no longer a valid option due to financial, space and environmental considerations.

Information and Communication Technology (ICT), which is already pervading most of our lives, has started to revolutionize urban transport through Intelligent Transport Systems (ITS). Urban ITS utilizes wireless communications, mobile devices, computer technologies and electronic equipment to reduce travel time, travel costs, traffic crashes and associated negative externalities within urban areas by exchanging real-time traffic information, vehicle information and road conditions.

Urban ITS can provide tailor-made information to assist travellers in determining optimized trips by avoiding unnecessary journeys, congested routes and better coordination of urban transport modes. In addition, urban ITS can meet ever-growing needs of travellers for new flexible mobility services, such as car sharing, bike-sharing schemes or personal rapid transit. All these advantages can enhance the efficiency of traffic operations and services in urban areas.

Because many urban ITS applications have already demonstrated substantial capabilities of enhancing safety, efficiency and smooth operation of transport modes at relatively modest cost, in recent years new technologies have been developed, such as Vehicle-to-Vehicle (V2V), Vehicle-to-Infrastructure (V2I) and Vehicle-to-Everything (V2X). By using such technologies, various advancements have been captured for connected vehicles, autonomous vehicles (or self-driving vehicles) and smart cities in some urban areas of the region.

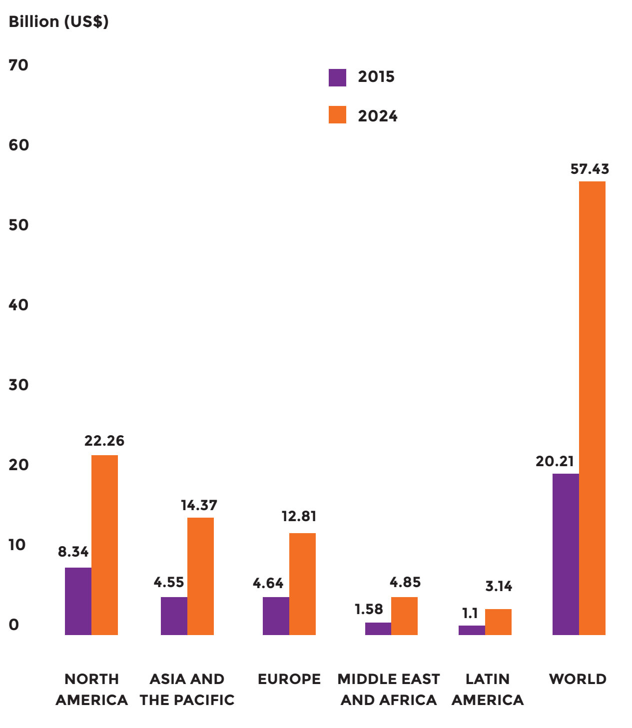
The Ministerial Conference on Transport held in Moscow in 2016 recognized the importance of ITS in urban transport systems, and new regional action programmes for 2017-2021 include the role of ITS for sustainable development, such as "establishment of regional policy frameworks and tools of ITS" and "application of ITS to [preventing] road traffic crashes". It is expected that, by harnessing state-of-the-art urban ITS technologies, the regional endeavour of pursuing sustainable urban transport can be strengthened significantly. This will also support achieving the Sustainable Development Goals[4] — particularly Goal 11 (to make cities and human settlements inclusive, safe, resilient and sustainable), especially Goal 11.2 (by 2030 to provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons).

Growing interest in intelligent transport systems in the Asia-Pacific region

With continuous demands for the incorporation of new technologies in order to mitigate greenhouse emissions in urban transport systems, ITS have been implemented by leading countries for more than two decades in the Asia-Pacific region.

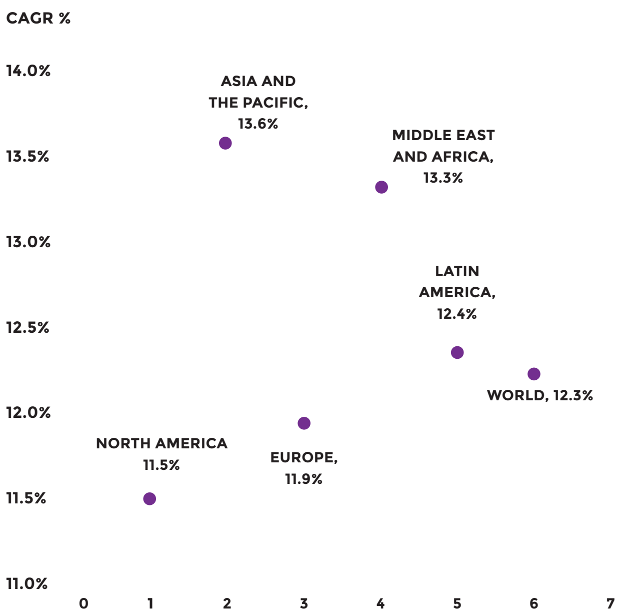
According to the analysis of ITS market size, the market was valued at US$20.21 billion in 2015. However, the market size was expected to grow constantly to US$57.43 billion by 2024, with a compound annual growth rate (CAGR) of 12.3 per cent. Figures 7.1a and 7.1b show that while North America leads the worldwide ITS market, the second largest market could change from Europe (US$12.81 billion) to the Asia-Pacific region (US$14.37 billion) in 2024. The Asia-Pacific market is expected to record the fastest growth rate (CAGR) of 13.6 per cent from 2015 to 2024.

FIGURE 7.1A ITS MARKET SIZES, BY REGION, 2015-2024



Source: ESCAP calculation and illustration based on data from Transparency Market Research, 2016.

FIGURE 7.1B. COMPOUND ANNUAL GROWTH RATE, BY REGION, 2015-2024

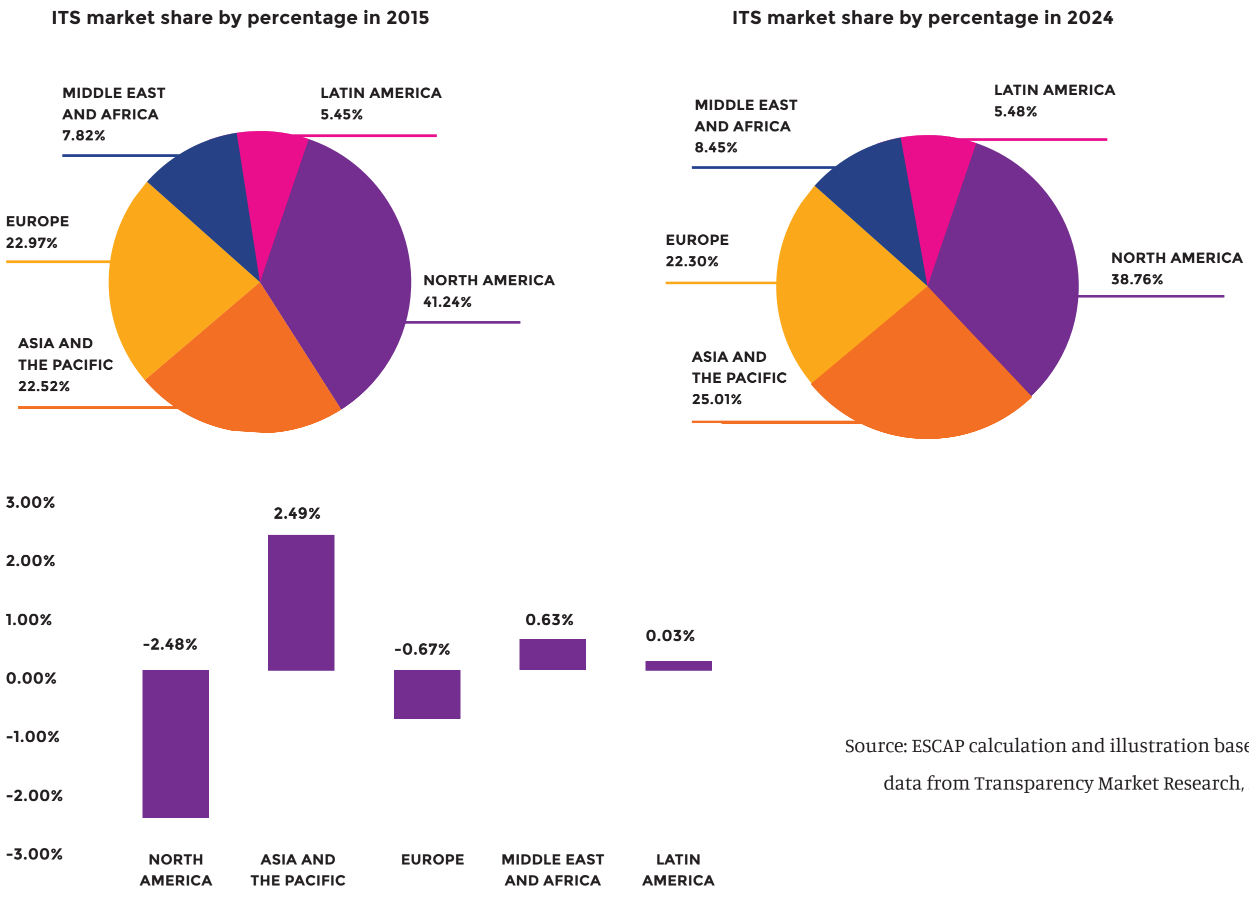


Source: ESCAP calculation and illustration based on data from Transparency Market Research, 2016.

Figure 7.2 shows the expected change in ITS market share from 2015 to 2024, with Asia and the Pacific increasing 2.49 per cent, whereas North America and Europe show a decrease in market share.

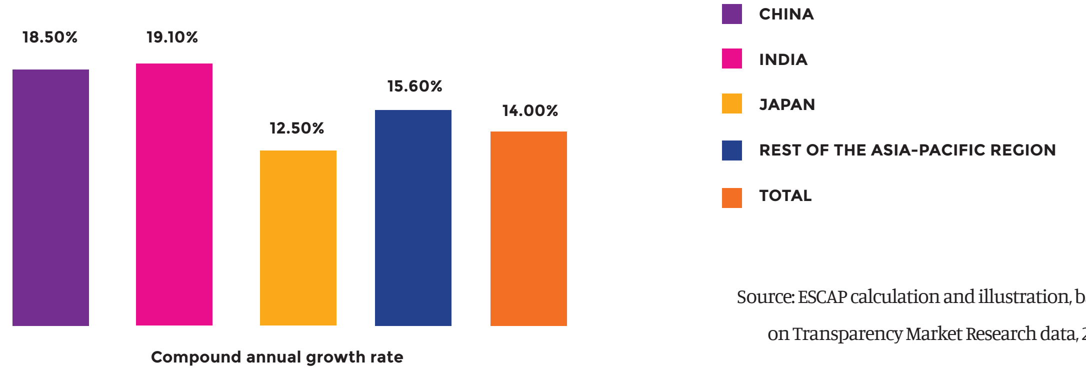
Rapid growth of ITS markets is expected in some developing countries of the region — for example, 18.9 per cent in China and 19.1 per cent in India, which is almost double North America's expected growth of 11.5 per cent. This indicates increasing demands for ITS in the Asia-Pacific region.

FIGURE 7.2 ITS MARKET SHARE CHANGES, BY REGION, 2015-2024



Source: ESCAP calculation and illustration based on data from Transparency Market Research, 2016.

FIGURE 7.3. ITS MARKET CHANGES IN THE ASIA-PACIFIC REGION, 2015-2024



Source: ESCAP calculation and illustration, based on Transparency Market Research data, 2016.

TABLE 7.1. INVESTIGATION OF ITS APPLICATIONS IN SAMPLE COUNTRIES

	BHUTAN	CHINA	INDIA	INDONESIA	JAPAN	MALAYSIA	PHILLIPPINES	REP. OF KOREA	SINGAPORE	THAILAND	TURKEY	VIET NAM
Advanced Traffic Management System												
Advanced traffic signal control		✓	✓		✓	✓	✓	✓	✓		✓	
Automatic traffic enforcement		✓	✓		✓	✓	✓	✓	✓	✓	✓	
Electronic toll collection		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Advanced Traveller Information System												
Mobile/online/ roadside traffic information		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Real-time parking information					✓			✓	✓			
Advanced Public Transport System												
Automatic fare collection			✓	✓	✓	✓	✓	✓	✓	✓	✓	
Automatic passenger counter			✓									
Automated passenger information	✓	✓	✓	✓	✓	✓		✓	✓			✓
Automatic vehicle location	✓	✓	✓	✓	✓	✓		✓	✓			✓
Urban public transport management		✓	✓		✓	✓	✓	✓	✓		✓	

Note: This table was created based on literature reviews from relevant multiple sources, including reports and meeting materials. There is a possibility that because of limited public sources the information presented might be slightly different from the actual situation in each country.

2. Selected applications of urban intelligent transport systems in Asia and the Pacific

In response to urban dwellers' demands, many ITS applications have been developed around the globe. However, given that the Asia-Pacific region has its own singularity, some specific urban ITS applications can be found that have been frequently used in urban areas of the region. Table 7.1 describes the result of investigations into selected urban ITS applications in sample countries.

(a) Advanced Traffic Management System

The Advanced Traffic Management System (ATMS) aims to improve traffic flows and safety in urban areas by utilizing various road facilities. ATMS uses a top-down approach through transport management centres where real-time traffic data is integrated and processed, and the proper actions/responses are determined. To achieve smooth traffic operations on urban roads, cutting-edge traffic sensing technologies, information communications and data-processing techniques are incorporated to diagnose traffic patterns and problems as well as develop optimal traffic management strategies. Real-time operational solutions capable of mitigating traffic issues are provided by a variety of information dissemination technologies, such as variable message signs, mobile devices and car navigation systems. A wide array of examples can be found in countries of the region, including Electronic Toll Collection (ETC), Advanced Traffic Signal Control (ATSC) and Automatic Traffic Enforcement (ATE) (figure 7.4).

FIGURE 7.4. TRANSPORTATION OPERATION COORDINATION CENTRE IN BEIJING

Source: Changju Lee, ESCAP.

Based on investigation by ESCAP, ETC is most widespread among ATMS applications in the region (11 of 12 countries), followed by ATE (9 of 12 countries) and ATSC (8 of 12 countries). One possible reason is the proven effectiveness of ETC, both in mitigating traffic delays caused by manual payments in urban toll expressways and in managing urban traffic demands by charging vehicles for the usage of roads in congested areas (figure 7.5).

FIGURE 7.5. ELECTRONIC TOLL COLLECTION SYSTEM ("EASY PASS") AND VARIABLE MESSAGE SIGN IN BANGKOK

Source: Changju Lee, ESCAP.

(b) Advanced Traveller Information System

Advanced Traveller Information Systems (ATIS) keep travellers updated with pre-trip and en-route traffic information in given areas. Traveller information ranges from incident information, such as crashes or road works, to real-time traffic conditions. In operational terms, relevant data need to be collected and analysed to provide real-time information to the public. Various devices, such as surveillance cameras, fixed sensors (e.g., loop detector and vehicle detection systems), probe cars and mobile phones collect data. The Internet, radio, Variable Message Signs (VMS), mobile/online services and navigation devices are the major distributors (11 of the 12 selected countries) of processed information to the public in the region.

The real-time parking information system is a good provider of specific information about available parking spots and feasible routes to reach them. However, currently only leading ITS countries, such as Japan, the Republic of Korea and Singapore (figure 7.6) have adopted the real-time parking information system in urban areas.

FIGURE 7.6. PARKING GUIDANCE SYSTEM IN SINGAPORE

Source: www.onemotoring.com.sg.

(c) Advanced Public Transport System

The Advanced Public Transport System (APTS) employs diverse information technologies and traffic management strategies for urban public transport systems. The goal of APTS is to enhance the efficiency and reliability of urban public transport operations, and the safety and convenience of users. The adoption of APTS is transforming the traditional services of urban public transport into more streamlined ones. APTS also offers more information for decision-makers to make more efficient judgements on operations and management of urban public transport. From the perspective of travellers, APTS provides real-time information on urban public transport services through the Internet, mobile devices and information terminals; users can thus select the most feasible services. Examples of APTS applications in the Asia-Pacific region include urban public transport management, Automatic Fare Collection (AFC), Automated Passenger Information (API) (figure 7.7), Automatic Vehicle Location (AVL) and Automatic Passenger Counter (APC) systems.

FIGURE 7.7. AUTOMATED PASSENGER INFORMATION SYSTEM AND AUTOMATIC FARE COLLECTION SYSTEM IN SEOUL, REPUBLIC OF KOREA

Source: Changju Lee, ESCAP.

Of the various types of APTS applications (table 7.1), AFC has been implemented in urban areas of 10 of the 12 selected countries using electronic public transport cards (called “smart cards”). Because API systems provide real-time passenger information, which primarily includes arrival and departure times together with location information from the AVL system, these two systems have been introduced in many countries. In India, the APC has been implemented in the urban bus system.

BOX 7.1. A VARIETY OF SMART CARDS USED IN THE ASIA-PACIFIC REGION

Many Asian and Pacific countries have progressively adopted smart cards with AFC systems to increase the efficiency of urban public transport operations and user convenience. For example, Australia uses Smartrider in Perth, GoCard in Brisbane, Myki in Melbourne, Metrocard in Adelaide and Opal in Sydney. Other countries also have diverse types of smart cards, such as China (Yikatong), Japan (Suica and Pasmo), the Philippines (Beep), Republic of Korea (T-money and EB) and Singapore (EZ-Link).

FIGURE 7.8. YIKATONG (SMART CARD FOR TRANSPORT SYSTEMS), BEIJING

Source: European Centre for Chinese Studies at Peking University.

Sources: ITS Korea, 2014; Ma and others, 2012; Nishi and others, 2015.

Since smart cards were adopted in 1996 in the Republic of Korea the number of card users for urban public transport has been increasing. As of 2012, 95 per cent of urban public transport users carried smart cards for their commute. In Japan, more than 100 million smart cards had been issued as of 2015 and their usage rate in the Tokyo Metropolitan Area has surpassed 90 per cent.

In China, the Beijing Transportation Corporation began to issue smart cards in 2006, and users who carry the cards can receive up to a 60 per cent discount. Such a large benefit to users has strongly encouraged usage. As of 2010, more than 90 per cent of transit users paid fares by smart cards, equivalent to 16 million transactions per day.

3. Benefits of urban intelligent transport systems In The Asia-Pacific Region

Urban ITS can play a major role in addressing issues related to traffic congestion. ITS can provide more efficient, safer and greener transport services in urban areas, and specific benefits from urban ITS can be found with supporting cases in the Asia-Pacific region.

(a) Benefits observed by beneficiaries

Table 7.2 provides a summary of urban ITS benefits identified in the Asia-Pacific region from the viewpoint of beneficiaries, including user, authority and operator, and society.

(i) Selected cases of user's benefits

- Urban ITS can contribute to saving travel time by providing information about estimated traffic and road conditions, weather and incidents. In the Osaka-Kobe area of Japan, dynamic message signs have provided travel time savings averaging 9.8 minutes per vehicle during periods of congestion and up to 38 minutes per vehicle during incident congestion.[5]

- Optimized route and parking guidance from urban ITS, based on up-to-date information, helps users to avoid traffic delays. In Japan, it was found that after several road tests the dynamic route guidance system in the Vehicle Information and Communication System (VICS, the forefront of ITS in Japan) resulted in a 15 per cent reduction in travel time.[6]

- Urban ITS increases user safety during travelling by offering technical assistance. In Australia, a forward collision avoidance system could reduce fatalities by 16 per cent, and lane departure warnings could reduce fatalities by 7 per cent.[7]

- Informing travellers about the real-time operational status of multiple transport modes in urban areas encourages the use of multimode travel through improved connections and accessibility. In 2011, bus information systems in the Republic of Korea were adopted in 72 local cities and resulted in a 21.4 per cent increase in bus passengers.[8]

TABLE 7.2. URBAN ITS BENEFITS OBSERVED IN THE ASIA-PACIFIC REGION

BENEFICIARY	OBSERVED BENEFITS
User	• Reduction of trip uncertainty - Delivers real-time traffic/urban public transport information - Broadcasts weather conditions - Warns of dangerous roads and incidents in advance • Reduced travel time and cost - Utilizes up-to-date traffic information - Guides optimal travel routes and parking areas • Increased travel convenience - Assists drivers in the driving process - Integrates multimodal/intermodal transport services - Provides better transfer, accessibility and connection
Authority and operator	• Improved traffic management - Monitors real-time traffic conditions - Maintains the equilibrium between users and road capacities • Better traffic safety - Increases crash/incident monitoring and response - Enhances the efficiency of traffic law enforcement
Society	• Minimized environmental issues - Reduces individual's trip frequency and duration - Decreases traffic congestion - Reduce fuel consumption • Increased economic opportunities - Provides better transport services - Increases economic, social and trade activities - Creates new urban transport industries

Sources: Multiple sources.

(ii) Selected cases of authority and operator's benefits

- Authorities and operators can monitor and manage traffic flows in urban areas by collecting real-time data through various surveillance equipment such as closed-circuit television, detectors and mobile devices. Singapore's electronic road-pricing system demonstrates this benefit. It controls traffic demand by charging fees on drivers to maintain target speeds of 45 to 65 kilometres per hour on expressways and 20 to 30 kilometres per hour on arterials.[9]

- Authorities and operators incorporate various urban ITS applications to increase traffic safety. Automatic crash notification systems in China, which can automatically call emergency services when a collision occurs, are expected to reduce the fatality rate by about 5 per cent.[10] A fully-adaptive traffic system in Australia, called Sydney Coordinated Adaptive Traffic System (SCATS), has shown a reduction in road crashes of between 15 to 50 per cent with the use of detection, ramp metering, incident management, VMS and dynamic speed limits.[11]

- Automatic traffic enforcement systems help regulate speed limits and prevent dangerous driver behaviour (e.g., red-light running and exceeding speed limits). In Hong Kong, China, after red light cameras and speed enforcement cameras were installed in 2016, the number of red light violations was reduced by about 43-55 per cent accompanied by a 40 per cent reduction in the number of traffic crashes.[12] Speed limit enforcement helped Guizhou province in China to reduce the number of crashes by 79.33 per cent, with a decrease of 39.3 per cent in deaths and 57.61 per cent in injuries from 2005 to 2006.[13]

(iii) Selected cases of society's benefits

- Enhanced multimodal connectivity and optimized traffic flows promoted by urban ITS can minimize individual travel times and traffic congestion together with reduced fuel consumption. In Indonesia, it is estimated that about 20 per cent of traffic congestion could be avoided by the delivery of traffic information and traffic support system offered by ITS projects.[14] In Jeju, the Republic of Korea, a 31.9 per cent reduction in traffic delays was achieved through the introduction of urban ITS, which generated a 42.4 per cent decrease in fuel consumption. In Gwacheon, the Republic of Korea, a 56.4 per cent reduction in traffic delays was observed together with an 11.8 per cent reduction in fuel consumption.[15]

- Applying urban ITS technologies encourages car-sharing as well as mass transit usage, which contributes to lower pollution and decreases the carbon footprint. In Nagoya, Japan, a personal integrated travel assistance system was tested; the results showed approximately 20 per cent less carbon dioxide emissions by switching the mode from cars to urban public transport, walking or riding bicycles.[16]

- Enhanced urban mobility by ITS technologies can give better transport services that lead to more economic, social and trade activities. ITS projects in Makassar and Jakarta, Indonesia, generated annual economic savings for road transport. Savings are around US$305 per year for a logistics vehicle, around US$405 per year for a taxi and around US$108 per year for a general vehicle. [17]

- Urban ITS can create new transport industries and job opportunities. Private car-sharing businesses in South-East Asia, such as "GrabTaxi", is widely spread across Indonesia, Malaysia, the Philippines, Singapore, Thailand and Viet Nam. As of 2015, GrabTaxi's application for smartphones had been downloaded 4.8 million times[18] and an investment of US$100 million was planned for the next few years.[19]

(b) Analysis of benefits from urban ITS applications

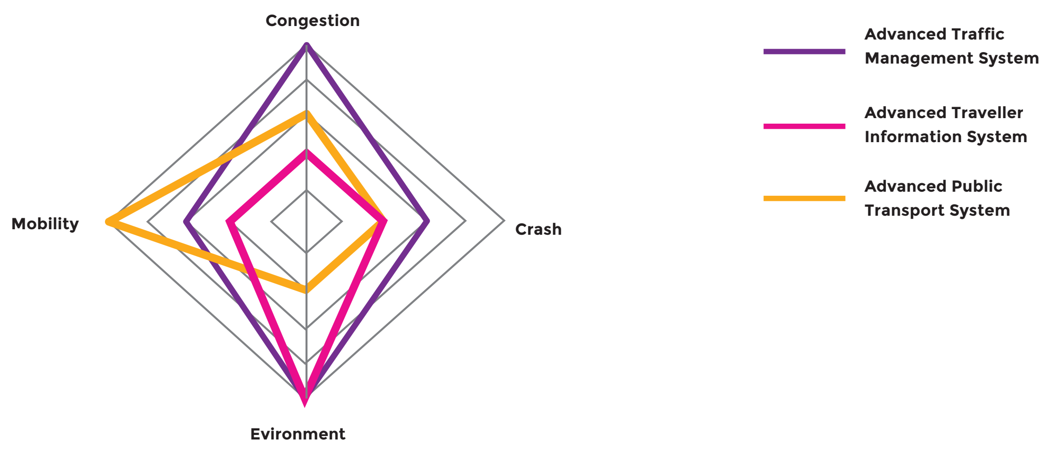
Qualitative comparative analyses conducted by ESCAP describe the relative benefits of ITS (figure 7.9) and each application (figure 7.10). In the analyses, "5" implies relatively high benefits and "1" implies relatively low benefits.

Comparatively, ATIS contributes more to increased mobility by providing real-time information, whereas the ATMS strength is in reducing congestion and negative environmental externalities by optimizing traffic flows in urban transport networks. APTS can encourage a modal shift from private passenger cars to multimodal transport, thereby contributing to a decrease in negative environmental effects generated by individual vehicles.

Based on the analysis by application, (figure 7.10), reduced trip uncertainty can be achieved by providing up-to-date information through mobile/online tools including VMS, real-time parking information and API. For travel convenience, ETC and AFC systems are relatively better solutions. Most of the applications (e.g., ATSC, ETC, API and mobile/online/roadside traffic information systems) can contribute to reduced travel time and costs. However, ATE contributes to improved traffic safety by discouraging drivers from violating traffic laws and regulations.

Because environmental issues are deeply related to traffic congestion applications, such as ETC, mobile/online/roadside traffic information and real-time parking information systems that help mitigate traffic congestion will help decrease negative environmental issues. Social costs can be lowered by minimizing the impact of traffic problems, such as crashes, delays and congestion, through ATE, ETC, AFC and API systems. Similarly, urban ITS will contribute to increased economic opportunities. API and traffic information systems will reduce total travel times, thus providing economic benefits to society while urban ITS can create opportunities for new transport industries that create jobs and provide better transport services.

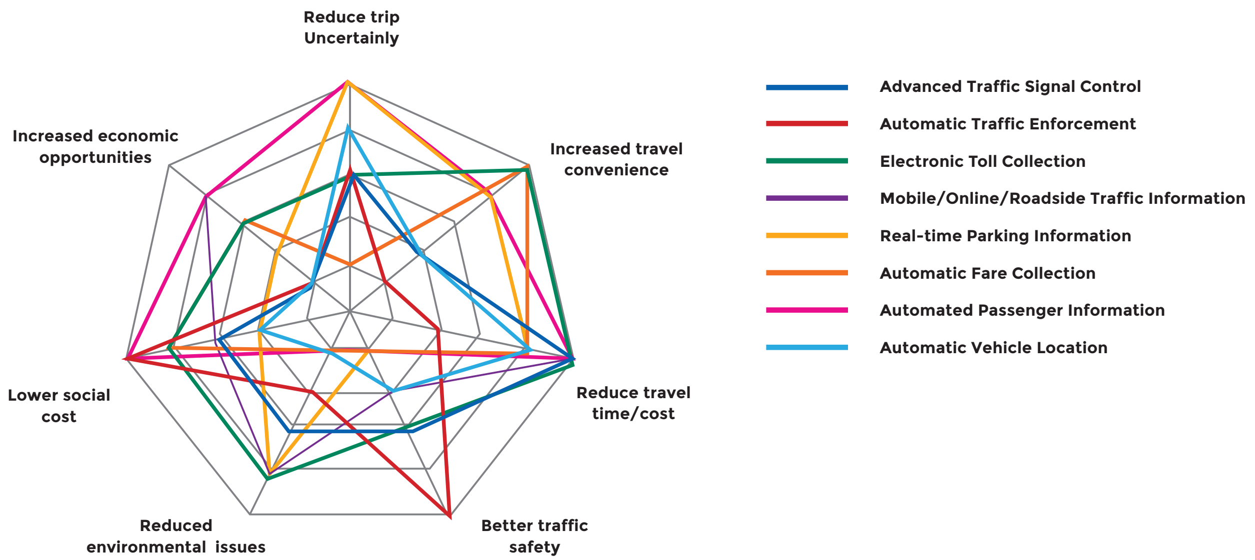
FIGURE 7.9 QUALITATIVE COMPARATIVE ANALYSIS BY SYSTEMS



Source: ESCAP analysis.

Note: The analysis is qualitatively-based on extensive literature reviews.

FIGURE 7.10 QUALITATIVE COMPARATIVE ANALYSIS BY APPLICATION



Source: ESCAP analysis.

Note: The analysis is qualitatively-based on extensive literature reviews.

4. Moving towards a new generation of urban intelligent transport systems

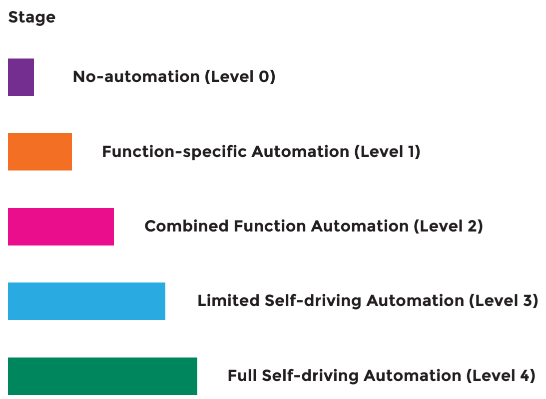
ITS technologies in urban transport systems have evolved rapidly in recent years, as a result of developments in artificial intelligence, the Internet of Things (IoT) and big data analytics. Three new concepts, "cooperative ITS (C-ITS)", "autonomous vehicle (AV)" and "smart city", are mostly being pursued in the region's urban areas. According to the United States Department of Transportation,[20] the level of vehicle automation can be categorized into five levels (figure 7.11); C-ITS and AV are level 3 and level 4, respectively.

(a) Cooperative Intelligent Transport Systems

In response to increasingly complex user demands, a new concept called C-ITS was created that integrates each ITS application into a fully-connected network, based on V2V, V2I and V2X technologies, requiring vehicular on-board units, infrastructure roadside units and central managerial systems. C-ITS enables various modes (i.e., cars, buses, trucks, trains and taxis) and transport infrastructure to communicate with each another. Drivers can be provided with information that enables them to react promptly to unexpected situations, such as bad road conditions and sudden stops ahead, through numerous applications.

A large number of applications for C-ITS are being developed, mainly focusing on safety (e.g., red light violation warning and forward collision warning); mobility (e.g., dynamic speed harmonization and cooperative adaptive cruise control); environment (e.g., dynamic eco-routing and eco-approach/departure at signalization intersections) and weather (e.g., weather response traffic information).[21] C-ITS takes advantage of the latest enhancements in technology and the integration of various systems. Some leading ITS countries in the Asia-Pacific region already have plans to implement C-ITS as part of their urban transport strategies. Selected activities for C-ITS are detailed below.

FIGURE 7.11 DEVELOPMENT LEVELS OF VEHICLE AUTOMATION



Source: ESCAP, based on the definition by the Center for Advanced Automotive Technology, 2017.

- **Australia** : In 2012, the strategic plan for C-ITS was released, which included a series of tasks to be undertaken across six areas of policy requirements: (a) international and national engagement; (b) technical requirements; (c) platform deployment requirements; (d) trials and demonstrations; (e) marketing; and (f) communications.[22] A C-ITS testing facility, as part of the "Cooperative Intelligent Transport Initiative", has been established in Illawarra for heavy vehicles, and trial test projects have taken place.[23]

- **China** : Technology studies on vehicle and road cooperation (e.g., on-board, roadside, communication and control systems) were conducted from 2011 to 2014.[24] Two national standards (China V2X standards) for C-ITS were released in 2014, and automobile manufacturers, Internet companies and research institutions are currently working together to promote intelligent driving technology.[25]

- **Japan** : The concept of C-ITS was verified through regional trials concerning Smartway, Advanced Safety Vehicles and Driving Safety Support Systems (DSSS). In launching the C-ITS projects nationwide 15 locations had been selected for DSSS as of 2010, and by 2011, 1,600 locations had been selected for the ITS Spot project.[26]

- **Republic of Korea** : A plan for C-ITS was introduced in 2013.[27] As of 2014, pilot projects were to be implemented on urban roads in Daejeon and Sejong, with 90 units of roadside communication and about 3,000 on-board devices installed in vehicles with an approximately US$15 million budget.[28]

(b) Autonomous vehicles

Autonomous vehicles (also called "self-driving" or "driverless" cars) are able to travel without human intervention. Technically, autonomous vehicles use satellite positioning systems and diverse sensors (i.e., radar, ultrasonic, infrared, laser etc.) to detect the surrounding environment. Information is interpreted on board in order to find appropriate routes taking into consideration obstacles and traffic signage by using wireless networks, digital maps, automated controls in vehicles and communication with smart infrastructure and a control centre. So far, autonomous vehicles have existed mainly as prototypes; however, autonomous vehicles have recently started to be commercially available, and cities are amending legislation to permit driverless vehicles on roads. Some Asian and Pacific countries are actively preparing for autonomous vehicles in urban areas. Selected activities for autonomous vehicles are detailed below.

- **Australia** : Vehicles with an advanced level of automation, including self-parking systems or traffic jam assistance, are already commercially available in Australia.[29] Australia's first driverless shuttle bus, " IntelliBus", which has been going through trials in Perth, is able to carry 11 people with a maximum speed of 45km/h in controlled environments.[30] South Australia had the first on-road trials of driverless cars in 2015.[30]

- **China** : Because autonomous vehicles are technology-intensive, many private automobile manufacturers and Internet-oriented technology companies (e.g., Baidu, Inc.) are actively undertaking research and development. Chinese car manufacturers are also participating in the development of autonomous vehicles like Chang'An Automobile.[31]

- **Japan** : The "Autopilot System Study Group" was set up in 2012 to study automated driving. In addition, an automated driving system programme was selected in 2014 as part of "Cross-Ministerial Strategic Innovation Promotion Programme" for the purpose of developing new technologies that avoid crashes and alleviate congestion. [32]

- Singapore: The Land Transport Authority in Singapore established the first test site for self-driving vehicle technologies and mobility concept in 2015.[33] The commercial autonomous vehicle (called "Auto Rider"), the first fully-operational self-driving vehicle in Asia, is already available to the public at Gardens by the Bay (figure 7.12).[34]

FIGURE 7.12. AUTO RIDER AT GARDENS BY THE BAY, SINGAPORE

Source: Changju Lee, ESCAP.

(c) Smart City

Growing urbanization is a global phenomenon, and cities need to rethink how to accommodate this migration to enable people to live in a sustainable city with adequate infrastructure and services. Redesigning urban infrastructure is essential to adapting cities to evolve with regard to social needs and growing economic competition. Citizens have higher expectations for their quality of life and it is the role of public authorities to ensure efficient urban transport systems, provide seamless connectivity and meet environmental challenges through technology enhancements and capabilities.

With combinations of urban ITS technologies and new advancement in the IoT, the concept of the smart city has emerged and is now gaining momentum in Asia and the Pacific. Future applications in urban areas are expected to be more integrated and interconnected with core ITS technologies. Urban transport infrastructure planning will no longer be isolated; rather, the structure, sources of energy and various urban transport modes of cities need to be taken into account together. In real-time, the movement of each vehicle, including urban public transport, can be monitored and controlled in a coordinated way. Also, environmentally-friendly transport modes, such as autonomous vehicles and personal rapid transit, can be operated with a combination of intelligent traffic signal operations and smart infrastructure. Selected activities related to smart cities are detailed below.

- **Malaysia** : Smart Cities Asia[35] is a conference organized by the Knowledge Group of Malaysia, bringing together different stakeholders to discuss themes around the development of smart cities in the region. Main themes include smart development, smart ICT, smart mobility, smart citizens, smart energy, smart water and waste management.

- **Republic of Korea** : The concept of smart cities has been of interest for more than 10 years in the Republic of Korea. According to IESE Business School's Cities in

Motion index (the Smartest Cities),[36] Seoul ranked eighth globally and first in Asia. Under the master plan for the "ubiquitous city" from 2009 to 2013 (previous concept for smart city) around US$20 million was invested by the Government. In August 2016, the Republic of Korea chose the smart city project as one of nine major national strategies and around US$300 million has been budgeted for 2017-2021.[37] Major components of a smart city related to transport are smart parking, smart crosswalks, smart mobility and smart infrastructure.

- **Singapore** : Singapore Smart Mobility 2030[38] is the ITS strategic plan developed by the Intelligent Transportation Society of Singapore together with the Land Transport Authority. The plan aims to produce a more comprehensive and sustainable ITS ecosystem in Singapore by 2030. The major focus areas are to: improve quality of transport information: enhance the travel experience with smarter interactivity; improve environment safety; and enable greener mobility.

5. The way forward

Figure 7.14 presents a timeline of ITS national initiatives (e.g., ITS master plans) in the region. In the 1990s, only leading ITS countries had formulated national plans, while several other countries took action in the 2000s and 2010s. Most countries in the region, however, still do not have government-led ITS initiatives. Many countries that have lagged behind are expected to initiate ITS national plans in the near future due to the following reasons:

- In recent years, new trends in urban ITS development, such as big data, open access, and connected and autonomous vehicles have been receiving increasing attention from Governments in the Asia-Pacific region;

- ITS markets in the Asia-Pacific region are projected to grow at a rate of 13.6 per cent from 2015 to 2024, as estimated in figure 7.1;

- There are growing demands for mobility services in urban areas, with the growth of megacities in Asia and the Pacific (17 of the world's 28 megacities with a population of more than 10 million are located in the region).[39]

BOX 7.2. NEW DEVELOPMENT OF A SMART CITY IN THE REPUBLIC OF KOREA

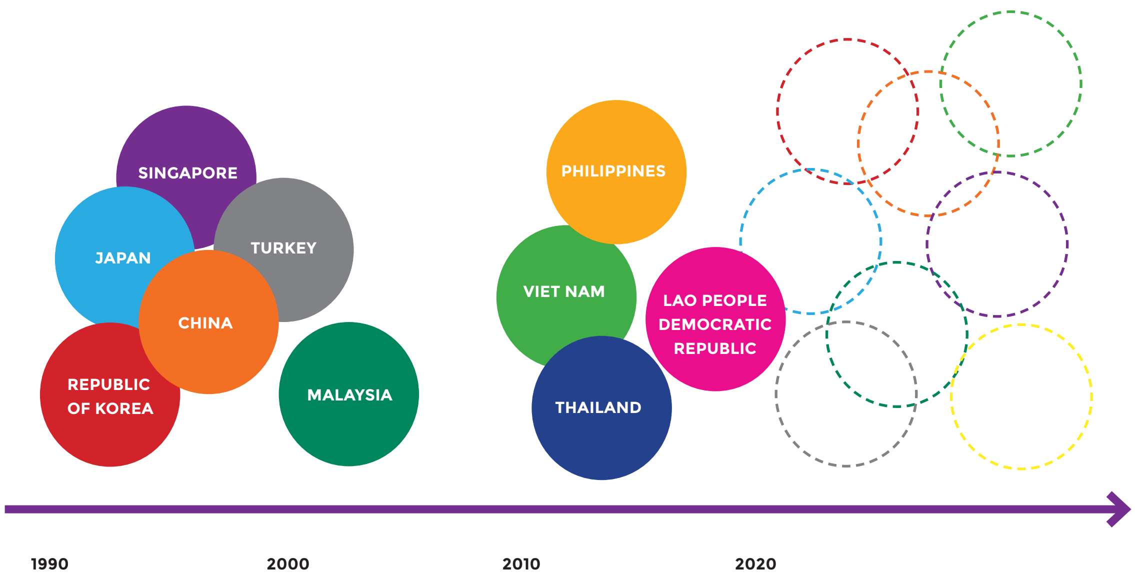
In 2007, the Republic of Korea decided to relocate ministries, executive offices and national institutions away from Seoul to the Multifunctional Administrative City (MAC) in Sejong, about 120 km (75 miles) south of Seoul, in order to mitigate overcrowding and promote balanced regional economic development. MAC was also designed as a centre of research, education and high-tech industry, thereby facilitating the application of cutting-edge information and communication technologies in promoting smart city concepts.

Among the three major goals – smart infrastructure (for energy, transport and safety), smart ecology (for CO_2 reduction, resource circulation and water) and smart life (for health, culture and education) – the plan for a smart transport system is the key to attaining the objective of "zero energy city" by 2030. Autonomous vehicles, personal rapid transit, intelligent traffic signals and car sharing are the main components to be implemented within smart transport systems. A reduction of up 77 per cent in greenhouse gases and up to 25 per cent use of renewable energy are expected to be achieved with the completion of the smart city.

FIGURE 7.13. BI-MODALITY TRAM IN SEJONG, REPUBLIC OF KOREA

Source: NAACC 2016, NAACC, 2017.
Source : Changju Lee, ESCAP.

FIGURE 7.14. TIMELINE OF ITS NATIONAL INITIATIVES IN THE ASIA-PACIFIC REGION



Source: Multiple sources.

While urban ITS technologies are increasingly being adopted in the region, fragmented and inconsistent approaches are often followed in each country without standardization and harmonization. To enhance consistent and harmonized urban ITS services, an integrated approach should be planned, taking into account the policy necessity, multimodal demands, public-private dialogue and experience sharing. A set of possible policy directions for urban ITS development can be itemized as follows:

- Setting up a platform, policy dialogue or discussion group consisting of related stakeholders and experts in urban ITS;

- Preparing regional policy and regulatory frameworks for urban ITS with clear future directions and plans;

- Produce guidelines for technical standards and services harmonization;

- Conducting relevant research on new technologies and services in urban ITS.

ITS can be one of the most effective tools for attaining the goals of urban transport policies. Exploring the benefits and potentials of urban ITS would serve as a major contribution toward sustainable urban transport and the SDGs.

B. ITS for expressway

Intelligent transport systems (ITS) on highways and expressways can substantially reduce congestion and improve road safety as well as increase intercity and rural-urban connectivity. Examples of ITS on highways and expressways in the region are reviewed in this section.

In January 2016, with a view to assessing ITS deployment in the Asia-Pacific region, ESCAP conducted a survey to gather information on the status and practices of

ITS deployments in Asian Highway member countries as part of a study implemented in collaboration with the Korea Expressway Corporation (KEC). Responses received from 21 member countries indicated that ITS services varied extensively across the region.

1. Types of ITS services for highways and expressways that are largely in use in the region

Figure 7.15 shows that six ATMS functions were included in the list of the most widely-used ITS services across the Asian Highway Network, indicating that traffic management aspects of ITS are currently a priority in the ESCAP region, with user-oriented services such as ATIS and APTS also receiving attention.

An increased number of countries introduce ITS, benefits in terms of traffic operation and safety are being reported. For example, the introduction of ETCS showed reduced congestion on access-controlled highways, leading to shorter travel time, while the introduction of the EMS component of ITS led to reduced road mortality through improved emergency response time. Figure 7.16 shows the perceived impact of selected ITS components on road operation and the perceived main benefits of selected ITS services on highways and expressways in ESCAP member countries.

While benefits are evident, member countries of the region are encountering several challenges in deploying ITS services, with a lack of funding being the most critical barrier. Lack of knowledge and experience in ITS deployment were also reported to be major challenges. Figure 7.17 shows the key barriers to deployment of ITS services in the region.

FIGURE 7.15. MOST POPULAR ITS SERVICES FOR THE HIGHWAYS AND EXPRESSWAYS IN THE ESCAP REGION[41]

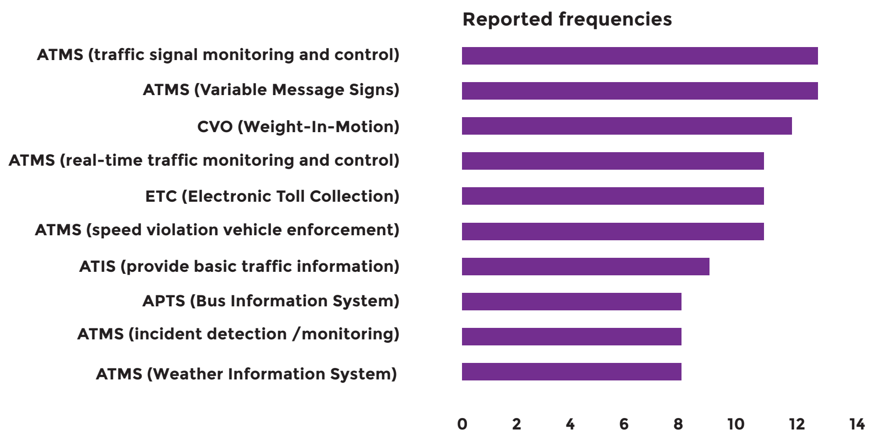


FIGURE 7.16. MAIN BENEFITS OF ITS DEPLOYMENTS IN THE HIGHWAYS AND EXPRESSWAYS IN THE ESCAP REGION[40]

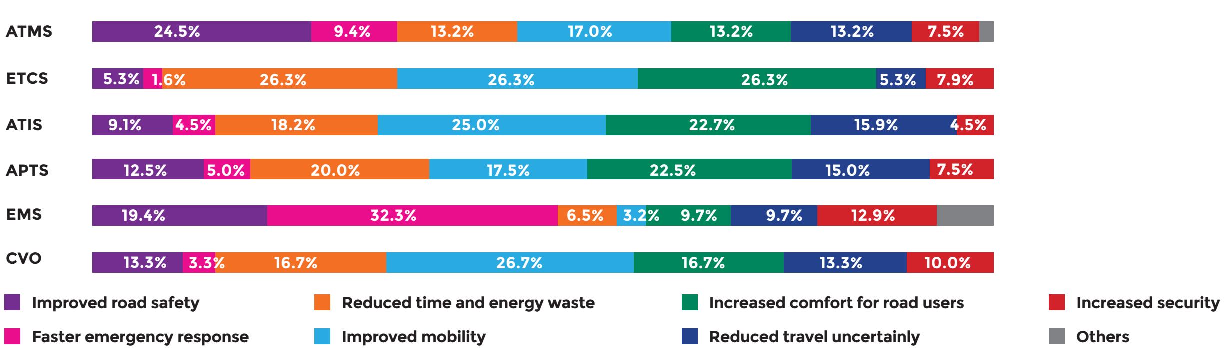
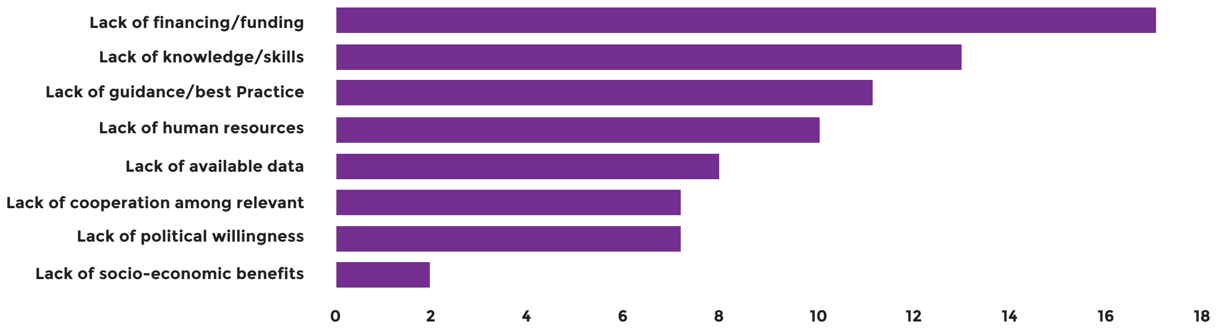


FIGURE 7.17. KEY CHALLENGES TO THE DEPLOYMENT OF ITS[41]



2. ITS deployment experiences in selected member countries

(a) Expressway network operation monitoring and service system in China[41]

Since 1995, the Government of China has placed high priority on the development and deployment of ITS through research and the development of a national strategy and architecture, The National ITS architecture of China was published in 2000. Subsequently, during the "12th Five-Year Plan" from 2011 to 2015, modern technologies were adopted, such as new generation broadband mobile communications, next-generation Internet, IoT and cloud computing, which have continuously enhanced the capacity of information collection, processing and transmission.

The system covers 100,000 km of expressways and 400,000 km of trunk highways, and includes systems for national network condition evaluation, cross-provincial network monitoring and large-scale road meteorological warnings. This initiative has helped in the development of 20 national standards and five industrial specifications. The results were implemented widely, which improved the overall operational efficiency, emergency response and services of the national expressway network.[41]

As a result, the ITS industry has become an important part of the global ITS. The ITS market worth in China increased dramatically from RMB 17.5 billion to RMB 40.8 billion during 2010-2014.

Moreover, with the continuous development and adoption of related policies on ITS by the Government of China, significant success has been achieved in the development of ITS in the country.

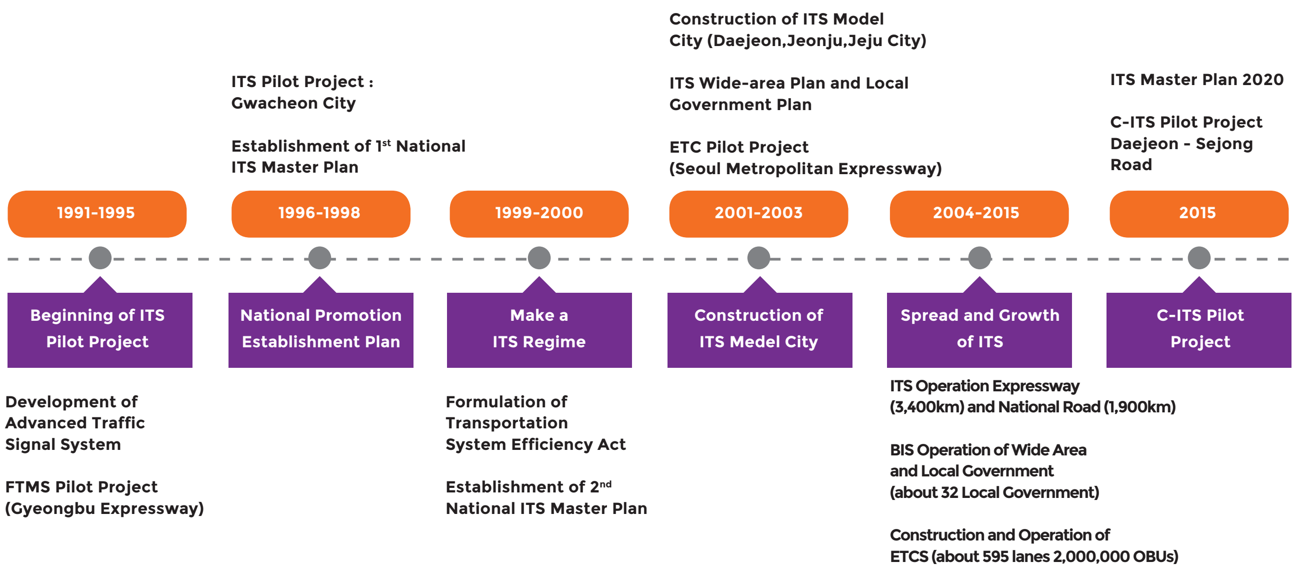
FIGURE 7.18 EXPRESSWAY ITS NEAR BEIJING

Source: Ishtiaque Ahmed, ESCAP.

(b) Freeway Traffic Management System in the Republic of Korea[42]

The main ITS services implemented by the Korea Expressway Corporation (KEC) can be grouped into four categories: (a) Freeway Traffic Management System (FTMS); (b) Electronic Toll Collection System (ETCS); (c) Tunnel Traffic Management System (TTMS); and (d) Overloaded Vehicle Enforcement System (OVES).

FIGURE 7.19. ITS DEVELOPMENT IN THE REPUBLIC OF KOREA[42]



In 1995, KEC examined the feasibility of automated toll collection system in order to mitigate traffic congestion and delays (due to cash payment at tollbooths) and initiated the first ETCS (Electronic Toll Collection System), so-called "Hi-Pass", at three toll plazas in metropolitan Seoul. After upgrading Hi-Pass, KEC expanded the operation to all KEC toll plazas in 2007. Another key component of the ITS operation of the Republic of Korea was to establish a hierarchy of ITS centres that collect, analyse, manage and provide traffic information for ITS services (figure 7.19).

FTMS uses both direct and indirect methods to control traffic flows. Direct control of expressway traffic includes a Lane Control System (LCS), ramp metering and toll booth operation, while indirect control optimizes traffic flow by providing descriptive and prescriptive traffic information to users in cases of severe traffic congestion

KEC has developed various provisions for more efficient use of expressways and to ease traffic congestions. In this regard, KEC strives to meet customer needs via the Internet, television and radio broadcasting stations. Traffic information is provided to several types of users in order to promote traffic information such as breaking traffic news, detour info and travel time. KEC also provides customers with fast and accurate traffic information during holidays and summer vacation season, when the needs of travellers increase sharply. By doing so, KEC encourages traffic dispersion and contributes to alleviating traffic congestion.[42]

(c) ITS development, eCall and ERA-GLONASS in the Russian Federation[43]

ITS in the Russian Federation began with the introduction of the Global Navigation Satellite System (GLONASS) in 2003, and ITS development was extended by the Federal Road Agency (ROSAVTODOR) in 2009. A plan for technical and regulatory development was carried out in accordance with national legislation, the Doctrine of Information Security of the Russian Federation and the national Transport Strategy. A technical Committee on ITS (TC 57) was created in 2012. At the end of 2014, following implementation of plans by the federal Government and local authorities, the first complex ITS in the country started easing traffic problems in and around the capital. Several projects were developed in cities such as Moscow, Saint Petersburg, Sochi and Kazan, with modern traffic management and traveller information services, which could serve as demonstration sites as well as act as a model and practical illustration of the benefits of ITS.

FIGURE 7.20. TRAFFIC INFORMATION CENTRE NEAR SEOUL

Source: Ishtiaque Ahmed, ESCAP.

FIGURE 7.21. TRAFFIC MANAGEMENT CENTRE IN MOSCOW

Source: Ishtiaque Ahmed, ESCAP.

One of the major initiatives related to ITS is the eCall system, which is an emergency call generated manually by vehicle occupants or automatically via activation of in-vehicle sensors when an accident occurs. When activated, the in-vehicle eCall system establishes a connection with the closest Public Safety Answering Point (PSAP), which can be either a public authority or a private eCall centre that operates under licensing from a public authority. At the same time, a minimum set of data (MSD) — including key information about accident time, location and vehicle description — is sent to the PSAP operator receiving the voice call. The minimum set of data may also contain the link to a potential Service Provider by including its IP address and phone number.

The use of in-vehicle emergency calls (eCall) to deploy emergency assistance saves lives and reduces the social burden of road accidents by improving the notification of such accidents, speeding up the emergency service response and lowering the subsequent effects of fatalities, severity of injuries and traffic flows.

ERA GLONASS (the emergency help system on the roads) is based on the use of the global navigation system GLONASS) and has been in use since 2011. There are already some pilot projects, including the GLONASS-based navigation equipment in Sochi.

(d) ITS Multi-lane Free Flow Electronic Toll Collection System in Turkey[44]

A motorway initiative of the Government of Turkey covering some ITS applications was planned in the 1980s. The first non-stop tolling system was inaugurated in 1999. Some traffic management and traveller information systems applications were installed on state highways in the late 1990s. With the construction of dual carriage highways, medium and large-size tunnels were equipped with Tunnel Control Systems in the 2000s. In 2011, the General Directorate of Highways (KGM) of Turkey installed ITS applications throughout the entire highway network. All toll lanes were transformed into cashless tolling lanes in 2011.

Multi-lane Free Flow (MLFF) toll collection (collection of tolls at the free flow speed on the road by means of various systems (e.g., cameras, DSRC or RFID antenna, installed on overhead gantries) was inaugurated on the second Istanbul Straight Bridge in 2014. It does not require an enlarged toll plaza or any additional area to build one. Vehicles do not need to slow down and can pass through at speed to pay the toll (figure 7.22). It has been decided to extend it to the entire motorway network in Turkey, starting from mainline toll plazas.

FIGURE 7.22. MULTI-LANE FREE FLOW ELECTRONIC TOLL COLLECTION IN ISTANBUL, TURKEY

Source: The General Directorate of Highways (KGM), Turkey 2017.

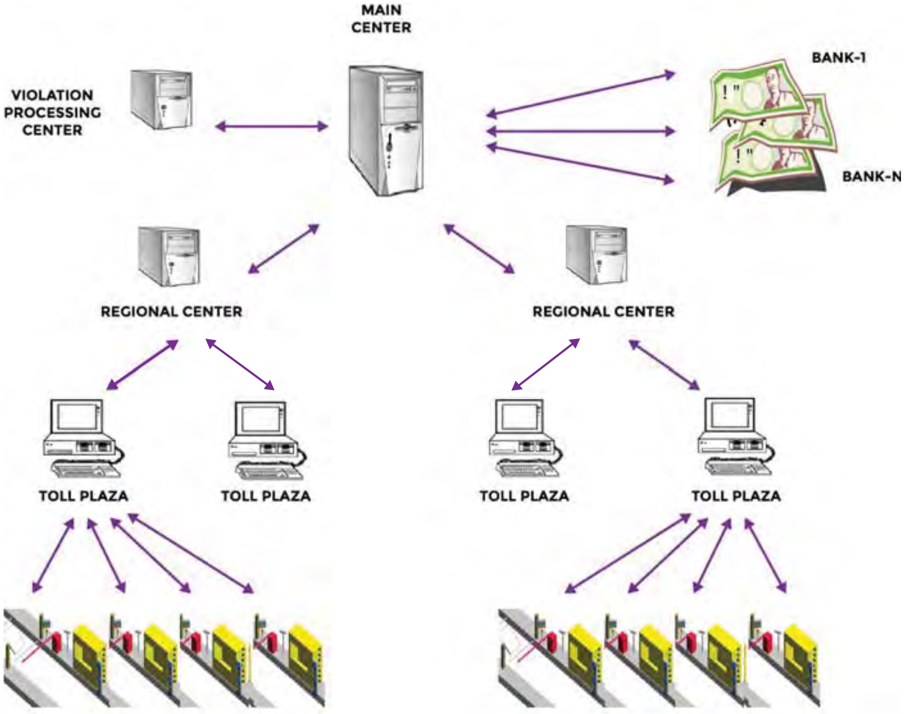
In addition to existing ITS applications on motorways and state highways, a plan to establish Traffic Management Systems Centres in 17 regional divisions and headquarters has commenced and will be finalized by 2023.

A non-stop tolling lane such as DSRC can handle 1,800 vehicles per hour. The non-stop tolling system provides additional benefits and can be used for travel time estimation and traffic management. A sample general architecture of a DSRC-based tolling system is shown in figure 7.23.

(e) ITS development in Japan

ITS deployment in Japan began in 1973, when a Traffic Control Centre was established on the Metropolitan Expressway. In 1980, a trial operation of the Highway Advisory Information Radio System was carried out. The development of an ITS Road Map took place in 2011.[46] ITS in Japan entered its second phase in 2014, when the Ministry of Land, Infrastructure and Tourism (MLIT) embarked on its "ETC2.0 Project", which aims to deliver a range of applications for vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communications. These applications are being developed based on various types of Cooperative ITS (C-ITS) systems, and a number of innovations for resolving traffic issues are being released.[46]

FIGURE 7.23. GENERAL ARCHITECTURE OF DSRC-BASED ELECTRONIC TOLL COLLECTION SYSTEM IN TURKEY[44]



(f) A projected shift from present to future ITS

Future road transport systems in the region will make use of the rapid development of advanced technologies. Projected major progress in ITS for highways and expressways: are:

(i) Cooperative ITS (C-ITS). This will allow communication and sharing information between ITS stations, which are beyond the scope of existing stand-alone systems. For example, vehicles will communicate with each other and/or with roadside infrastructure, enhancing the quality and reliability of information available about vehicles, their location and the road environment;

(ii) New Energy Vehicles — for example, electric, hybrid electric and hydrogen powered vehicles — are projected to be in more use;

(iii) Intelligent Regional Traffic Coordinating and Monitoring Systems will facilitate analysis of large-scale highway network data, advanced risk assessment of multimodal transport networks, hazardous freight management applications and emergency response facilities;

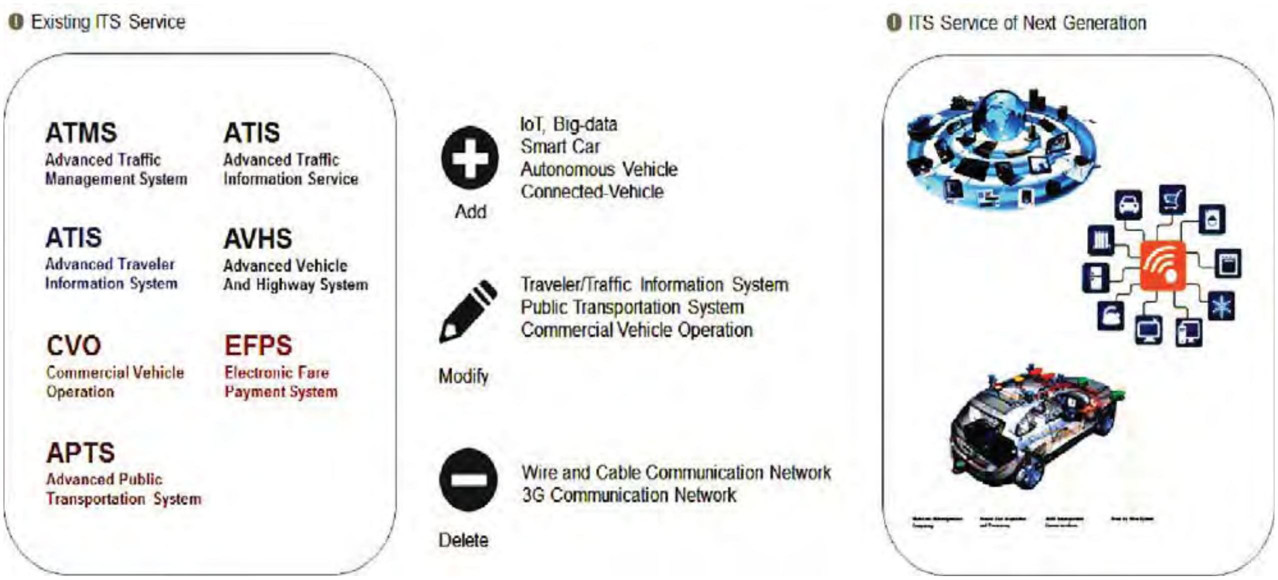
(iv) Integrated Traffic Information Services will use the Next Generation Internet and Broadband Mobile Communication Network, thereby improving the efficiency and safety of the transport system;

(v) Next Generation Transport Control and Operation systems will use modern technologies — for example, big data, cloud computing and next-generation mobile communication systems.

C. ITS for international transport

Recognizing the need for an integrated and comprehensive approach to address non-physical barriers, ESCAP member countries adopted the Regional Strategic Framework for Facilitation of International Road Transport (RSF), which identifies six fundamental issues in international road transport and possible solutions for addressing them. It also provides seven modalities to support smooth road transport in the region. The framework serves as a primary policy document for ESCAP member countries and their development partners for planning and implementing transport facilitation measures.

Figure 7.24. Shift in the ITS services from the present to the next generation[40]



Source: ESCAP study

One of the modalities under RSF is to encourage ESCAP member States in the application of new technologies for transport facilitation. Accordingly, to provide a concept for the use of new technologies — such as: information communication technologies (ICT), electronic seals (e-seal/e-lock), radio frequency identification and cellular/satellite communications systems in transport facilitation — ESCAP developed a secure cross-border transport model for the development of intelligent transport systems for cross-border and transit transport.

Since the development of the model, many ESCAP member countries have expressed interest in its practical application and have taken steps to implement electronic vehicle tracking systems. Bhutan and India recently completed a feasibility study for a pilot application of the secure cross-border transport model on the Bhutan-India transit transport corridor. The test and trial runs undertaken as the part of the study demonstrated the viability of these technologies for transit transport facilitation.

In addition, the use of electronic tracking of goods and vehicles in transit is now part of many bilateral and subregional transport agreements. For example, the Afghan-Pakistan Transit Trade Agreement 2010 contains provisions for tracking goods in transit. Article 13 of the Protocol 1 on international carriage by road of goods and baggage in transit provides that contracting parties will allow only vehicles with a tracking system in transit and that the movement of vehicles will be tracked in respective countries. The Bangladesh, Bhutan, India and Nepal Motor Vehicle Agreement, signed in June 2015, also contains provision for tracking of goods and vehicles.

The increased commercialization of technologies has made development of such intelligent transport systems accessible; these systems are getting wider acceptance in the facilitation of international road transport, particularly for transit transport. A number of companies in the private sector are now offering solutions for electronic tracking of goods and vehicles. Tracking technologies and related software are evolving rapidly, leading to better and more economical versions coming onto the market at regular intervals. Estimates indicate that there are at least 60 private sector companies offering solutions for electronic tracking.

However, the existence of numerous solutions with different specifications of electronic tracking systems poses enormous challenges for countries in decided on an appropriate intelligent transport system that can provide benefits of real-time tracking while taking care of concerns such as data privacy.

Intelligent transport systems with different standards/specification that lack interoperability will eventually pose challenges for transport facilitation, as has been experience in the case of East Africa Community countries where different electronic tracking systems operational in those countries eventually became a hindrance to transit transport facilitation. Thus, there appears to be a case for laying down common standards/minimum requirements for ITS for use in cross-border and transit transport facilitation.

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Conclusion

Across all sectors of transport there is a clear need for strong leadership in order to continue the implementation of intergovernmental agreements on roads, railways and dry ports while also promoting integrated planning to overcome intermodal and sectoral boundaries.

While the Intergovernmental Agreement on the Asian Highway Network, the Intergovernmental Agreement on the Trans-Asian Railway Network and the Intergovernmental Agreement on Dry Ports provide the foundation for regional connectivity, the quality and capacity of this infrastructure across the region is uneven and some links are still missing. It is believed that the development of international intermodal corridors would provide a framework for a coordinated approach to address development issues across all modes, including interoperability and technological innovations.

The foundation has been established for an integrated intermodal transport and logistics system in Asia-Pacific region, with stepping stones for seamless cross-border transport and transit. However, regional transport operational connectivity has yet to be achieved as transport operations remain fragmented due to various historical, political and economic reasons as well as a lack of cooperation among the member countries. Doors are not yet open for moving all types of goods where and when needed. Achieving effective transport operational connectivity will require constant and long-lasting political will and commitment as well as an institutionalization of the integration processes, including removal of non-physical barriers to transport and ensuring harmonization of regulations, standards, norms and practices. The Asia-Pacific region's diversity is a strength but the region's economies could do much better together and individually if their diverse standards, regulations and practices were harmonized.

Rapid motorization in the region's cities has led to worsening traffic congestion, more road crashes, and an increase in emissions and air pollution. Further, increasing numbers of disadvantaged people inhabit urban areas and create growing demand for affordable urban public transport systems. Although the region's cities feature a mixed array of urban transport — such as paratransit, public transport, taxi services and non-motorized transport —plenty of opportunities remain for improvement. The major challenges faced by the countries and cities in the Asia-Pacific region include extending coverage, managing congestion, reducing emissions and pollution, enhancing safety and ensuring affordability.

Rural connectivity that links to wider networks varies enormously in availability and quality, and suffers from challenges associated with high costs and poor performance. The demand for rural connectivity in the region is huge, but the funding available and financial returns on projects are insufficient to meet this need. Additional financial options and evaluation methodologies are required to make rural connectivity projects affordable, feasible and sustainable. In order to improve rural connectivity to wider networks, effective policies and strategies are necessary and there is a need to enhance the capacity of stakeholders and local communities to plan and implement rural connectivity programmes. Innovative and inclusive policies have shown great returns in the region and these policies need to be documented and replicated for achieving a truly integrated transport network that includes access to the Asian Highway, the Trans-Asian Railway and dry ports.

While the Asia-Pacific region managed to reduce the fatality figure between 2010 and 2013 at an average rate of 1.9 per cent each year, this rate is far from sufficient to enable us to accomplish the Goal target 3.6. A reduction of less than 20 per cent will be achieved if the region continues at the current pace. It will be even more challenging considering the fact that the motorization rate in the region increased at an average of 7.2 per cent each year between 2010 and 2013.

In order to advance the development of integrated intermodal transport systems and ensure save and inclusive transport systems, key milestones in realizing the vision of an integrated intermodal transport and logistics system as well as sustainable regional transport connectivity that supports the achievement of transport-related Sustainable Development Goals (SDGs) include: (a) regional transport infrastructure connectivity (figure 8.1); (b) regional transport operational connectivity(figure 8.2); (c) sustainable urban transport; (d) rural connectivity to wider networks; and (e) improving road safety (figure 8.3).

Table 8.1 shows the direct contribution of the above areas to the achievement of the SDGs and related targets. In addition. it provides a range of examples showing how countries and the Asia-Pacific region as a whole are shaping the transport sector of the future by addressing key thematic areas and strategic directions to reach the 2030 Agenda for Sustainable Development as well as targets that are specifically related to transport.

To achieve the transport-related SDGs it is important that economic factors are considered, together with social and environmental externalities in all transport decision-making. Recognizing the importance of this process, Transport Ministers in Asia and the Pacific have identified and adopted seven key thematic areas and strategy directions for moving forward. They are captured under ESCAP's Regional Action Programme for Sustainable Transport Connectivity in Asia and the Pacific, phase I (2017-2021).

FIGURE 8.1. CONTRIBUTION OF REGIONAL TRANSPORT INFRASTRUCTURE CONNECTIVITY TO SDGS

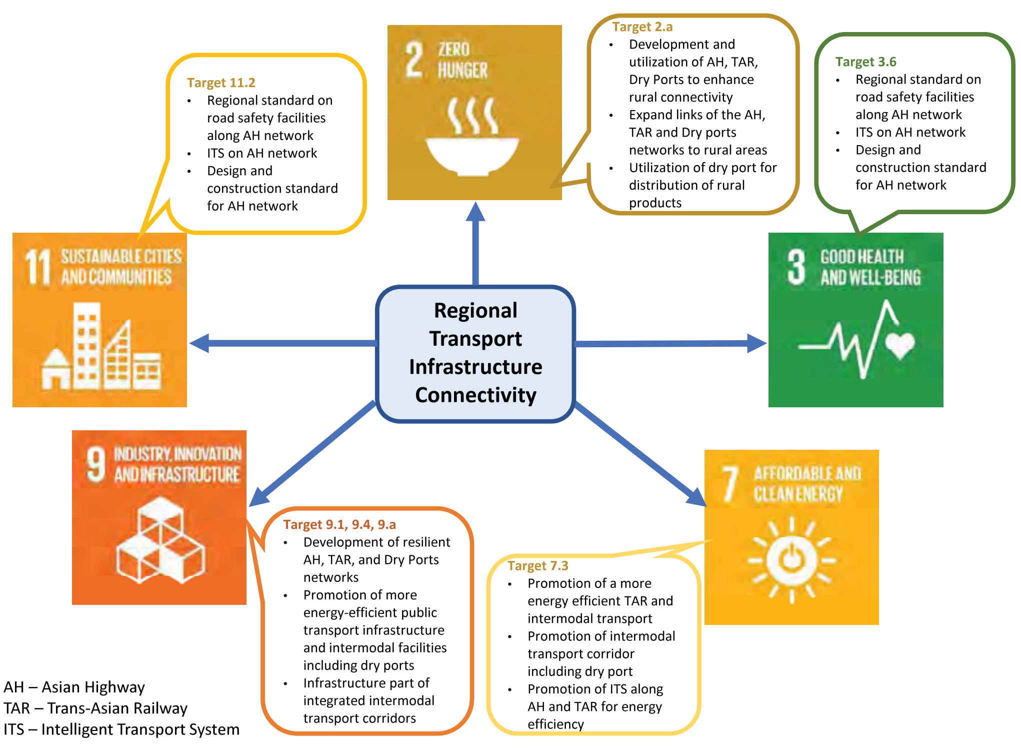

FIGURE 8.2. CONTRIBUTION OF REGIONAL TRANSPORT OPERATIONAL CONNECTIVITY TO SDGS

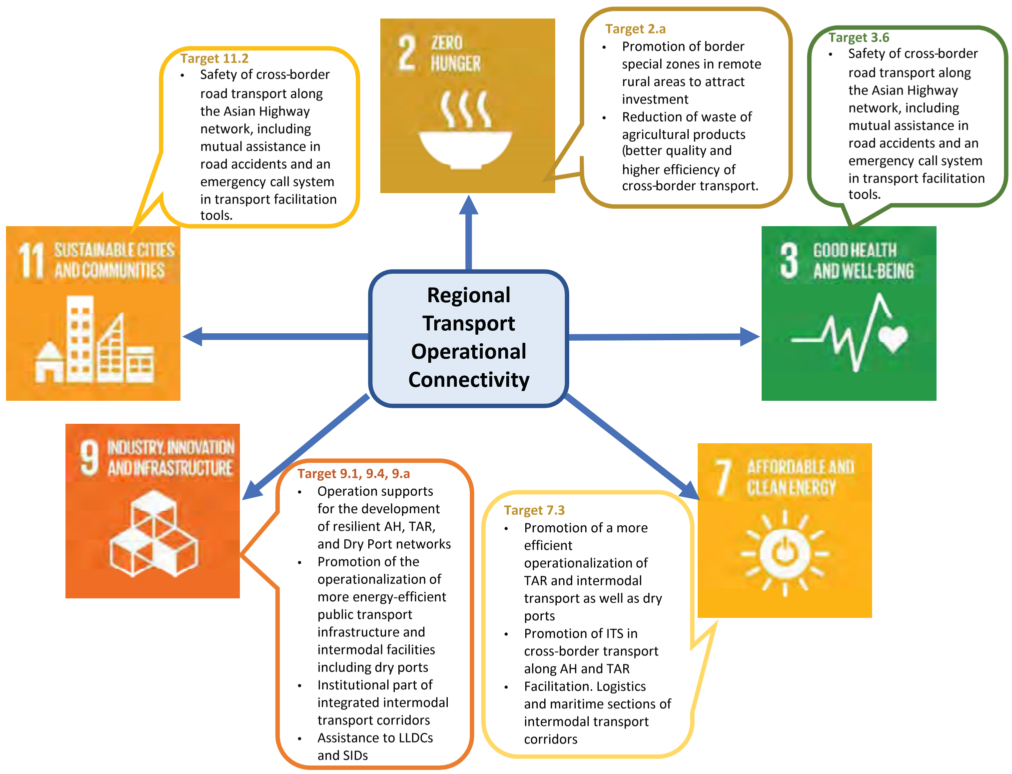

FIGURE 8.3. CONTRIBUTION OF URBAN, RURAL TRANSPORT AND ROAD SAFETY TO SDGS

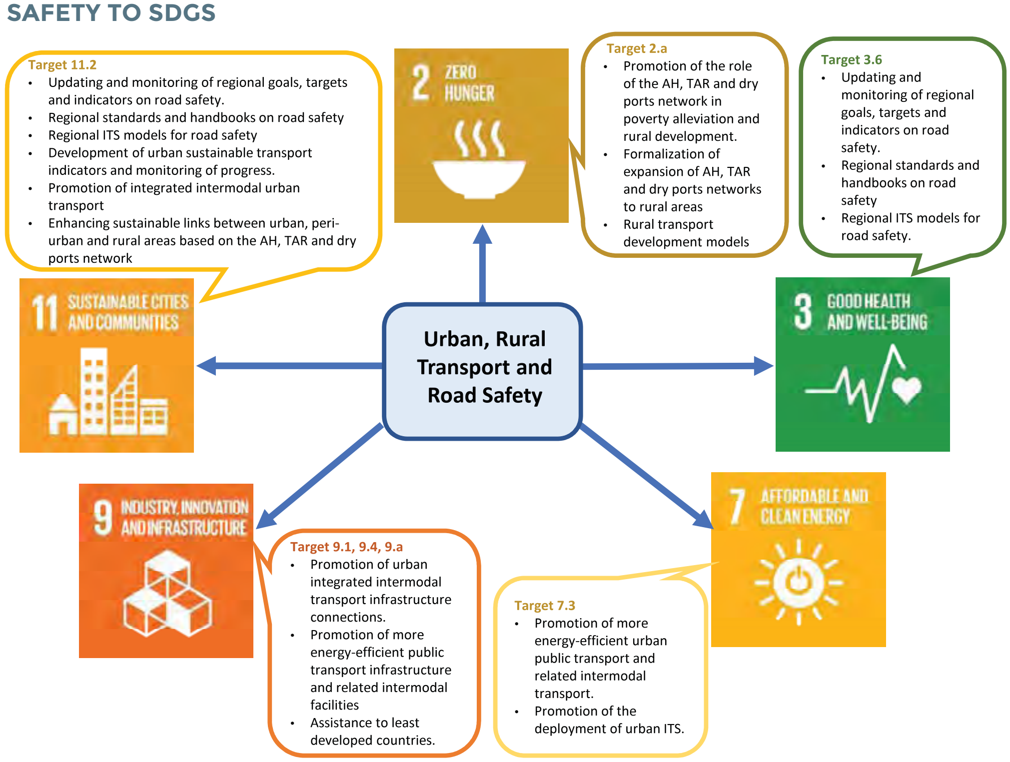

Table 8.1. Contribution of the Regional Action Programme for Sustainable Transport Connectivity in Asia and the Pacific, phase I (2017-2021) to the SDGs and related targets

SUSTAINABLE DEVELOPMENT GOAL	TARGETS WITH DIRECT CONTRIBUTION FROM THE TRANSPORT SECTOR	CONTRIBUTION OF THE REGIONAL ACTION PROGRAMME
Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture.	2.a. Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries.	**Regional transport infrastructure connectivity:** • Further development and utilization of the Asian Highway network, the Trans-Asian Railway network and the network of dry ports to enhance connectivity in rural areas. • Full utilization of inland dry ports as logistics centres for collection and distribution of rural production materials and products. • Inclusion of more road routes and railway lines in remote rural areas in the Asian Highway network and Trans-Asian Railway network and more inland dry ports in the regional dry port network. **Regional transport operational connectivity:** • Promotion of border special zones in remote rural areas to attract investment. • Reduction of waste of agricultural products (better quality and higher efficiency of cross-border transport). **Urban and rural transport and road safety:** • Examination and promotion of the role of the Asian Highway network, Trans-Asian Railway network and the network of dry

SUSTAINABLE DEVELOPMENT GOAL	TARGETS WITH DIRECT CONTRIBUTION FROM THE TRANSPORT SECTOR	CONTRIBUTION OF THE REGIONAL ACTION PROGRAMME
		ports in poverty alleviation and rural development. • Formalization of further extension and expansion of the Asian Highway network, the Trans-Asian Railway network and the network of dry ports to include more road routes and railway lines in remote rural areas. • Rural transport development models.
Goal 3. Ensure healthy lives and promote well-being for all at all ages	3.6. By 2020, halve the number of global deaths and injuries from road traffic accidents.	**Regional transport infrastructure connectivity:** • Regional standards on road safety facilities along the Asian Highway network. • Intelligent transport systems on the Asian Highway network. • Design and construction standards for the Asian Highway network. **Regional transport operational connectivity:** • Safety of cross-border road transport along the Asian Highway network, including mutual assistance in road accidents and an emergency call system in transport facilitation tools. **Urban and rural transport and road safety:** • Updating and monitoring of regional goals, targets and indicators on road safety. • Regional standards and handbooks on road safety.

SUSTAINABLE DEVELOPMENT GOAL	TARGETS WITH DIRECT CONTRIBUTION FROM THE TRANSPORT SECTOR	CONTRIBUTION OF THE REGIONAL ACTION PROGRAMME
		• Regional intelligent transport system models for road safety.
Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all.	7.3. By 2030, double the global rate of improvement in energy efficiency.	**Regional transport infrastructure connectivity** • Promotion of a more energy-efficient Trans-Asian Railway network and its related intermodal transport. • Promotion of dry ports as an efficient intermodal interchange. • Promotion of intelligent transport systems along the Asian Highway network and the Trans-Asian Railway network for energy efficiency. • Promotion of intermodal transport corridors incorporating economic, social and environmental dimensions. **Regional transport operational connectivity:** • Promotion of the operationalization of a more energy-efficient Trans-Asian Railway network and its related intermodal transport. • Promotion of the operationalization of dry ports as an efficient intermodal interchange. • Promotion of intelligent transport systems in cross-border transport along the Asian Highway network and the Trans-Asian Railway network for energy saving. • Facilitation, logistics and maritime sections of intermodal

SUSTAINABLE DEVELOPMENT GOAL	TARGETS WITH DIRECT CONTRIBUTION FROM THE TRANSPORT SECTOR	CONTRIBUTION OF THE REGIONAL ACTION PROGRAMME
		transport corridors incorporating economic, social and environmental dimensions.
		Urban and rural transport and road safety: • Promotion of more energy-efficient urban public transport and related intermodal transport. • Promotion of the deployment of urban intelligent transport systems.
Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation,	9.1. Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.	**Regional transport infrastructure connectivity:** • Further development of a resilient Asian Highway network, Trans-Asian Railway network and network of dry ports. • Promotion of more energy-efficient public transport infrastructure and related intermodal facilities. • Promotion of dry ports as an efficient intermodal interchange. • Infrastructure part of integrated intermodal transport corridors
	9.4. By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities.	**Regional transport operational connectivity:** • Operational support to further develop a resilient Asian Highway network, Trans-Asian Railway network and network of dry ports. • Promotion of the operationalization of more energy-efficient Trans-Asian Railway network and related intermodal transport.

SUSTAINABLE DEVELOPMENT GOAL	TARGETS WITH DIRECT CONTRIBUTION FROM THE TRANSPORT SECTOR	CONTRIBUTION OF THE REGIONAL ACTION PROGRAMME
		• Promotion of the operationalization of dry ports as an efficient intermodal interchange. • Institutional part of integrated intermodal transport corridors. • Assistance to landlocked developing countries and Small Island Developing States.
	9.a. Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and Small Island Developing States.	**Urban and rural transport and road safety:** • Promotion of urban integrated intermodal transport infastructure connections. • Promotion of more energy-efficient public transport infrastructure and related intermodal facilities. • Assistance to least developed countries.
Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable.	11.2. By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.	**Regional transport infrastructure connectivity:** • Regional standards on road safety facilities along the Asian Highway network. • Intelligent transport systems on the Asian Highway network. • Design and construction standards of the Asian Highway network. **Regional transport operational connectivity:** • Safety of cross-border road transport along the Asian Highway network, including mutual assistance in road accidents and

SUSTAINABLE DEVELOPMENT GOAL	TARGETS WITH DIRECT CONTRIBUTION FROM THE TRANSPORT SECTOR	CONTRIBUTION OF THE REGIONAL ACTION PROGRAMME
		an emergency call system in transport facilitation tools. **Urban and rural transport and road safety:** • Updating and monitoring of regional goals, targets and indicators on road safety. • Regional standards and handbooks on road safety. • Regional intelligent transport system models for road safety. • Promotion of the deployment of intelligent transport systems. • Development of urban sustainable transport indicators and monitoring of progress. • Promotion of integrated intermodal transport to make urban transport safe, affordable, accessible, sustainable and socially inclusive. • Assistance in enhancing sustainable links between urban, peri-urban and rural areas based on the Asian Highway network, the Trans-Asian Railway network and the network of dry ports.

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