CHAPTER 1

Introduction
1.1 Background

The transport sector plays a fundamental role in the social and economic development of society. A life without access to modern transport services is next to impossible today. Almost every human activity is linked to the transport sector: connecting students to schools and universities, workers to their workplaces, consumers to sellers or enabling participation in social and leisure activities, to name a few. As the sector is primarily powered by fossil fuels, it is responsible for environmental externalities such as greenhouse gas emissions. In 2016, the transport sector was responsible for 25 per cent of global carbon dioxide emissions, an increase of 71 per cent over 1990 levels, with transport by road responsible for 75 per cent of transport emissions.\(^1\) Apart from greenhouse gas emissions, it also contributes to traffic congestion, noise pollution and road crashes. Rapid economic growth in the Asia-Pacific region in recent decades has resulted in a corresponding rise in motorization and consequently, an increase in the ownership of motorized two- and four-wheeler vehicles, in particular in urban centres. Cities in the Asia-Pacific region are responsible for 75 per cent of the region’s greenhouse gas emissions,\(^2\) which is set to increase because of rapid urbanization. In the absence of integrated public transport systems and against the backdrop of rising income levels, privately owned motorized two- and four-wheelers have become the preferred choice for daily transport in many cities in the region. This has put a strain on urban transport infrastructure, which in some cases has shown that it has been unable to keep pace with the increase in private vehicles. In a study\(^3\) conducted in 2014 on transport infrastructure in Manila, traffic demand in Metro Manila was estimated at 12.8 million trips a day and six million in the adjoining provinces in 2012, and that public transport was used for 69 per cent of the trips. A smaller share of the trips was done by private vehicles as mentioned in the same study, which were responsible for occupying 78 per cent of the road space. Traffic jams are a daily occurrence in most major cities of the region, presenting policymakers with the challenge of meeting the growing transport needs of city dwellers, while reducing the carbon footprint of the transport sector. As part of efforts towards achieving low-carbon mobility, policymakers are considering a mix of technology improvements and policy measures, such as improving vehicle technology and efficiency; promoting a modal shift from private to public transport and non-motorized transport; and reducing individual travel demand through congestion pricing. Technology plays an important role in the process, as advances in information communications technologies (ICT) have resulted in increased deployment of them in the transport sector. Smart transport systems, including intelligent transport systems, is the umbrella term, which embraces a range of technology applications that integrate drivers, vehicles and transport infrastructure in a way that improves overall transport efficiency. The Economic and Social Commission for Asia and the Pacific (ESCAP) has defined intelligent transport systems within the scope of the 2030 Agenda for Sustainable Development and the diverse nature of smart transport technologies: “Intelligent transport systems are an agglomeration of diverse technologies that enhance the sustainability of transport systems in a safer, smarter and greener way.”\(^4\)

\(^2\) E/ESCAP/73/16.
\(^4\) Economic and Social Commission for Asia and the Pacific, “Guidelines for the regulatory frameworks of intelligent transport systems in Asia and the Pacific” (Bangkok, ESCAP, 2019).
1.1.1 Transport and the Paris Agreement on Climate Change

In 2015, countries participating in the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) in Paris at its twenty-first session adopted an international climate agreement, which has come to be known as the Paris Agreement. Following the entry into force of the Agreement in 2016, countries that have ratified the Agreement are required to submit their nationally determined contributions. The climate actions contained in those contributions, if implemented, will determine whether the world will achieve the goals of the Paris Agreement to maintain global average temperatures below 2°C and closer to 1.5°C. Actions aimed at the transport sector appear in several of the nationally determined contributions submitted by ESCAP member countries, reflecting the importance of mitigating transport sector greenhouse gas emissions. Also, the potential use of smart transport systems as a greenhouse gas mitigation strategy has been highlighted in nationally determined contributions submitted by ESCAP member countries from the Asia-Pacific region. In accordance with the Agreement, countries are required to submit subsequent nationally determined contributions every five years from 2015 with subsequent contributions due in 2020 and 2025. The Agreement also requires that subsequent nationally determined contributions submitted to UNFCCC build upon previous efforts and be more ambitious than prior commitments.

5 Nationally determined contributions with references to smart transport including intelligent transport systems as a mitigation strategy were submitted by Azerbaijan, Bhutan, Cambodia, China, Cook Islands, Japan, New Zealand, Sri Lanka and Tuvalu.


7 A/RES/70/1.

8 E/ESCAP/MCT(3)/11.

1.1.2 Transport and the 2030 Agenda for Sustainable Development

The 2030 Agenda for Sustainable Development, adopted by the General Assembly in 2015, consists of 17 Sustainable Development Goals and 169 targets. The Goals apply to all countries and require governments to work towards ending all forms of poverty, fighting inequalities and tackling climate change, while ensuring no one is left behind. The goals are integrated and balance the three dimensions of sustainable development: economic, social and environmental. While there is no goal dedicated to sustainable transport in the 2030 Agenda, it has been mainstreamed in several of the Goals, as transport is a key enabler of social and economic development. Moreover, several of the targets are directly linked to transport, such as target 3.6 which deals with reducing the number of deaths as a result of road traffic crashes, 7.3 which requires the doubling of the global rate of improvement in energy efficiency, 9.1 on sustainable and resilient infrastructure in support of economic development and 11.2 on safe, accessible and sustainable transport systems. Transport is also indirectly linked to several Goals, such as those related to climate change and health, which highlights the cross-sectoral nature of transport and its importance in achieving the Sustainable Development Goals. In this regard, smart transport systems play an important role to move towards sustainable transport systems, as they improve the overall efficiency of transport systems by optimizing transport networks and reducing environmental externalities. This was also highlighted by the ministers of transport and representatives of the members and associate members of ESCAP in a declaration adopted at the Ministerial Conference on Transport at its third session, held in Moscow from 5 to 9 December 2016, which recognized “the role of new technologies, including intelligent transport systems, to increase the efficiency, safety and effectiveness of transport systems”.

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1.1.3 Smart transport systems and low carbon mobility

Smart transport systems can be fully integrated into the overall transport ecosystem as part of vehicle systems, road infrastructure, and management and operational strategies. These systems can directly and indirectly affect efforts to mitigate greenhouse gas emissions. Just to name a few, in vehicle systems, by using satellite navigation systems, drivers are able to optimize their travel routes and avoid incidents along their trip, which improve the overall efficiency of the transport ecosystem. Similarly, eco-driving systems installed in vehicles help drivers to reduce the fuel usage and associated costs by providing trip information. Smart transport systems can also be installed in road infrastructure along highways, arterial or feeder roads and major intersections to provide real-time traffic information to users. Variable message signs and mobile applications are representative tools used to broadcast traffic information gathered from detecting equipment. Electronic toll collection systems that automatically collect tolls without the need for a vehicle to come to a halt or weigh in motion systems that calculate vehicle loads on the go without the need for queuing at dedicated weigh stations are other examples. In addition to improving the overall driving experience, smart transport systems can contribute towards managing and operating traffic conditions in an effective way. Congestion pricing mechanisms are increasingly relying on smart transport technologies to enforce congestion policies. Vehicles entering predefined areas at certain hours can be automatically charged a congestion tax by deploying sensors in vehicles that track their movements. Congestion pricing is a strategy being used in cities to reduce individual travel demand during peak hours and encourage the modal shift to public transport. Supporting shared mobility using smart transport applications is another way to influence individual travel demand and, in some cases, make possible a shift to greener transport modes, such as e-scooter sharing or electric vehicle sharing.

1.2 Purpose of the study

It has been proven that smart transport systems can be used effectively to address traffic issues, improve transport efficiency and reduce greenhouse gas emissions. The beauty of such systems is their potential to generate quick results without the need for significant transport infrastructure investment. Nonetheless, despite the potential benefits of these new technologies, many countries in Asia and the Pacific are not leveraging them to improve the overall efficiency of their transport systems and reduce related greenhouse gas emissions. This is primarily because of limited awareness and understanding of these technologies, and low technical capacity to deploy them in support of greener transport systems. In this regard, this study is intended to increase the technical capacity of policymakers by providing details on smart transport systems to mitigate greenhouse gas emissions. In addition, it is expected to be a bridge between low awareness and understanding of such systems, and their actual benefits in reducing greenhouse gas emissions. This will eventually strengthen the technical capacity of policymakers in member countries in the region to use smart transport systems.

1.3 Scope of the study

The following information is included in the study in order to attain its main objective:

- An overview of nationally determined contributions for the transport sector focusing on the Asia-Pacific region;
- A review of smart transport applications that can contribute towards mitigating greenhouse gas emissions;
- Highlights and assessments of successful cases of smart transport applications in the Asia-Pacific region and other regions (the United States and Europe) to draw meaningful lessons learned;
An impact analysis of selected smart transport strategies in given areas at the subregional level (South-East Asia, and North and Central Asia);

A list of contributions and policy recommendations that may be useful for policymakers in the region.

In terms of smart transport systems covered in this study, the following are the scope of the areas:

All smart transport applications (i) deployed within vehicles that can improve vehicle efficiency to reduce greenhouse gas emissions, (ii) embedded in transport infrastructure that can increase overall efficiency of transport systems, and (iii) used as strategies to optimize traffic conditions and efficiency.

All smart transport technologies that (i) have been applied in the beginning stage of development (i.e., traditional intelligent transport systems) and (ii) have become known because of new techniques (emerging technologies), such as cooperative-intelligent transport systems, connected vehicles, autonomous vehicles and smart mobility.

Although various benefits can be obtained from smart transport systems, considering the main goal of this study, benefits relevant to environmental issues, such as greenhouse gas emissions, are of major interest. Other benefits are also explored to increase the general awareness and understanding of the advantages of smart transport systems. To be clear, although many aspects of smart transport systems are considered in this study, only the above-mentioned points are covered; others points, such as institutional or regulatory perspectives, are beyond the scope of this study.