CHAPTER 5

Conclusions
5.1 Noticeable contributions

Because of various advantages, smart transport systems including intelligent transport systems, have been adopted for many years around the world. The Asia-Pacific region is not an exception, although the advances in deploying smart transport technologies, in general, are relatively slow and fragmented among countries in the region. Social and environmental needs of such technologies are quite simple; they increase traffic efficiency and safety, thereby mitigating associated negative externalities to society.

Unlike previous studies about smart transport systems, this study was triggered by some fundamental questions: (a) What is the status of nationally determined contributions with regard to the transport sector in the region? (b) Do smart transport systems, including traditional and emerging ones, generate positive benefits to the environment? (c) To what extent can smart transport systems positively affect the environment by focusing on their potential to mitigate greenhouse gas emissions? (d) From the subregional perspective, what are the tangible benefits of smart transport systems in terms of mitigating greenhouse gas emissions? and (e) To what extent can smart transport systems contribute to nationally determined contributions in the region?

Bearing these questions in mind, this study provides meaningful contributions:

a Nationally determined contributions for the transport sector focusing on the Asia-Pacific region were specifically reviewed for the analysis. As of October 2019, 48 ESCAP member countries had ratified the Paris Agreement. A total of 44 nationally determined contributions and eight intended nationally determined contributions have been submitted to UNFCCC by ESCAP member countries, and 38 countries in the region have submitted nationally determined contributions, which contain actions intended for the transport sector.179

b A review was conducted to investigate the benefits from smart transport systems, with a focus on the reduction of greenhouse gas emissions. More than 100 sources covering various applications were reviewed to identify potential benefits. In addition, extensive cases were reviewed from not only the Asia-Pacific region but from other regions, such as the United States and Europe, to overcome the limitations of just focusing on a specific region. The result was summarized in table 2 in chapter 3.

c To attain meaningful lessons learned from the literature review, the overall assessment was conducted from five viewpoints, followed by a review of their limitations. In short, (i) traditional smart transport applications contribute with varying success with regard to the reduction of greenhouse gas emissions, (ii) although emerging technologies are in the test stage, they are effective in helping to mitigate greenhouse gas emissions in various locations, (iii) there are limited sources for reviewing the effectiveness of in-vehicle technologies on the environment, however, eco-driving applications have proven to be effective in decreasing fuel consumption and reducing greenhouse gas emissions, (iv) the magnitude and extent of effectiveness may differ according to smart transport applications and locations where they are deployed, and (v) in addition to benefits for the environment, these technologies also contribute towards the reduction of travel time, traffic stops, crashes and socioeconomic costs, and increase travel speed and user’s satisfaction, among others.

d Given that smart transport systems are usually deployed along corridors and/or well-defined areas, within a country or across different countries, the benefits to greenhouse gas emissions from such systems should be investigated from this aspect. As can be seen from the review (chapter 3), an analysis across different countries was not available. Case studies were performed for South-East Asia, and North and Central Asia countries with a focus on the specific

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179 Based on data extracted from the Transport Knowledge Base (TraKB) Version 0.2.
corridors across the countries and two major cities from each subregion. Case studies showed that smart transport strategies could provide good B/C ratios (from 2.84 through a freight parking and reservation system to 39.42 through a pre-trip traveller information system).

5.2 Policy recommendations

As can be seen from the literature review in chapter 3 and the corridor analysis in chapter 4, there is great potential in using smart transport systems to address transport issues by improving overall efficiency of the transport sector, which also leads to a reduction in greenhouse gas emissions. To maximize the benefits that can be derived from such systems, there is a need for timely intervention through policies that promote smart transport systems with the maximum potential for greenhouse gas reduction. In this regard, the following policy recommendations should be prioritized at the national, subregional and regional levels.

5.2.1 National level recommendations

(A) SPECIFICATION OF THE NEEDS

As explained, there are various expectations from the implementation of smart transport systems, including, among others, improvements in road safety, better mobility and reliability, increase in user's convenience and energy efficiency. As reviewed in chapter 3, each application has different advantages. For example, eco-driving applications can contribute towards increasing fuel efficiency, while electronic toll collection systems can optimize traffic flows near toll gates on expressways. Although both applications may eventually lead to a reduction in greenhouse gas emissions from the environmental perspective, their primary objectives are different. Given that each city or country has different priorities and realities, the requirements at the city, province and national levels should be prioritized according to the issues faced, and social and environmental conditions. At the same time, such requirements should be determined with consideration of the overarching plans and/or strategies led by the responsible government agency at the national level.

(B) PRIORITIZATION OF THE SPECIFIC TARGET AREAS

Based on the analyses discussed in chapters 3 and 4, the degree, extent and effectiveness of smart transport applications in mitigating greenhouse gas emissions vary from case to case and depend on individual situations. For example, a traveller information system covers a limited area in a given city or state, whereas a road weather information system covers a much larger area. Similarly, considering the different issues affecting a city or country, the specific target areas need to be prioritized based on the national strategies or priorities. In some specific corridors, a response to severe weather conditions, such as recurrent flooding, may be required as quickly as possible because of the potential for unexpected traffic delays.

(C) CONDUCT OF PERFORMANCE EVALUATIONS

Adoption of new technologies in the transport sector is the result of the rapid advancement of ICT. Even though smart transport systems have been found to be relatively cost-effective tools in tackling transport environmental issues,\(^\text{180}\) they are not a panacea to address all environmental issues. A performance evaluation by an independent or external party is necessary in this regard in order to determine proper countermeasures to maximize the benefits of mitigating greenhouse gas emissions. As can be seen in chapter 3, although additional assessments need to be conducted, there is no guarantee that smart transport systems can resolve all transport problems adequately considering the associated high investments. Furthermore, in chapter 4, the analysis reveals that different applications provide a varying scale of benefits – the range of B/C ratio is 2.84–39.42.

In this sense, and in order to apply the most suitable strategy in a given area, city or country, performance evaluations are needed to identify the requirements for such evaluations to be effective.

**(D) USING SMART TRANSPORT TECHNOLOGIES FOR NATIONALLY DETERMINED CONTRIBUTIONS**

Among nationally determined contributions or intended nationally determined contributions, which were submitted by 52 countries in the Asia-Pacific region, 38 countries' detailed actions are aimed at the transport sector. Moreover, at least nine countries include references to smart transport-related technologies in their nationally determined contributions. As shown in chapters 3 and 4, smart transport systems can bring positive benefits in terms of reducing greenhouse gas emissions. Nationally determined contributions are one of the main elements of the Paris Agreement through which countries expect to contribute to the goal of keeping global average temperatures below 2°C above pre-industrial levels. Considering the effectiveness of smart transport systems with regard to the environment, the use of smart transport technologies to mitigate greenhouse gas emissions can be further explored in revised versions of the nationally determined contributions, due in 2020 and 2025. In addition, given that different ministries sometimes work on the nationally determined contributions and smart transport systems, respectively, proactive discussions and consultations for revised versions among different ministries are encouraged to incorporate the component of smart transport systems.

5.2.5 Regional-level recommendation

**(F) PREPAREDNESS FOR THE EMERGING TECHNOLOGIES**

Various forms of smart transport technologies are emerging, such as cooperative-intelligent transport systems, connected vehicles, autonomous vehicles and smart mobility. As reviewed in chapter 3, studies indicate that these emerging technologies affect the environment. Although emerging technologies are expected to bring unprecedented benefits to society and environment, the Asia-Pacific region is not adequately ready to adopt them. Strong policy support to prepare for the new era of automation is necessary to avoid conflicts and to incorporate these new technologies. It is, therefore, essential to plan for these new emerging technologies and to better integrate them into future transport planning in order to maximize their potential for mitigating greenhouse gas emission and reducing environmental externalities. Also, it is encouraged that the upcoming ESCAP Regional Action Programme for 2022–2027, and other relevant frameworks and strategies developed by ESCAP be considered for efficient preparedness of such emerging technologies.