Auditing Sustainable Transport: Guidance for Supreme Audit Institutions

INTOSAI
Working Group
on Environmental
Auditing

Foreword and Acknowledgements

Sustainable transport is a large concept that includes infrastructure planning, financial arrangements, as well as providing transport services for citizens. Transport has many environmental impacts; therefore, a shift toward a more sustainable transport system can benefit the environment and human health.

INTOSAI Working Group on Environmental Auditing (WGEA) adopted the topic of sustainable development into the Work Plan 2020-2022. This is the first time that the INTOSAI WGEA has directly addressed the transport sector. We hope this guidance will broaden the perspective of environmental audits and help mainstream environmental work into all government sectors. On the other hand, we hope this publication reaches readers from transport sector audits who may not yet be familiar with environmental or sustainable development concerns.

The publication also contributes to the follow-up and review of the United Nations Sustainable Development Goals (SDGs), particularly Goal 11 on sustainable cities and communities. In the spirit of sustainable development, it is also connected to several other SDGs, such as goals related to clean energy (SDG 7) and climate action (SDG 13).

This project is innovative because it was conducted in close cooperation between three Supreme Audit Institutions: the SAIs of Indonesia, China, and Thailand. This represents the true spirit of the collaborative work in the INTOSAI WGEA. We would like to convey our gratitude to all the SAIs who have contributed to this document. We want to thank their participation in completing the mini-survey distributed by INTOSAI WGEA Secretariat. We would also like to thank the INTOSAI WGEA project group and Steering Committee members who gave the document valuable input during the process. Last but not least, we would like to convey our gratitude to INTOSAI WGEA Secretariat for their continuing support during the various stages of writing this document.

We hope you will find this document useful and beneficial.

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Annex-II

Quality Assurance Certificate of the Chair of the INTOSAI Working Group on Environmental Auditing

This is to certify that ***Auditing Sustainable Transport: Guidance for Supreme Audit Institutions*** which is placed at level three of Quality Assurance as defined in the paper on "Quality Assurance on Public goods developed outside Due Process" approved by the INTOSAI Governing Board in November 2017 has been developed by following the Quality Assurance processes as detailed below:

i. The project proposal was developed by the team with consultation of INTOSAI WGEA Steering Committee Members;
ii. The project was discussed during the 20th INTOSAI WGEA Assembly meeting held online in January 2021;
iii. The project output draft was circulated among team members, Steering Committee members, and has gone through more than 30-day exposure (from 13 April to 16 May 2022) for comments and circulated among WGEA members via an online portal.

The product developed is consistent with relevant INTOSAI Principles and Standards. The structure of the product is in line with the drafting convention of non-IFPP documents.

The product is valid till 30 September 2028 and if it is not reviewed and updated by 30 September 2028 it will cease to be a public good of INTOSAI developed outside the Due Process.

Helsinki, 8 June 2022

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Quality Assurance Certificate of the Chair of Knowledge Sharing and Knowledge Services Committee (KSC)

Based on the assurance provided by the Chair of the ***INTOSAI Working Group on Environmental Auditing (WGEA)*** and the assessment by the Goal Chair, it is certified that ***Auditing Sustainable Transport: Guidance for Supreme Audit Institutions*** which is placed at level ***3 (Three)*** of Quality Assurance as defined in the paper on "Quality Assurance on Public goods developed outside Due Process" approved by the INTOSAI Governing Board in November 2017, has been developed by following the Quality Assurance processes as detailed in the Quality Assurance Certificate given by the Working Group Chair.

The product is valid till ***30 September 2028*** and if it is not reviewed and updated by ***30 September 2028*** it will cease to be a public good of INTOSAI developed outside the Due Process.

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Contents

Executive Summary 8

Introduction 10

1. Global Overview of Transport Issue 12

2. Understanding Governmental Responses to Achieving Sustainable Transport 27

3. Selection and Design of Sustainable Transport Auditing 45

4. Implementation and Cases of Sustainable Transport Auditing 52

Appendix 74

Bibliography 77

List of Acronyms

APCAP	Asia-Pacific Clean Air Partnership
ASI	Avoid-Shift-Improve
BFV	Biofuel Vehicle
CBM	Coal-Bed Methane
CCAC	Climate and Clean Air Coalition
CCC	Committee on Climate Change
CEF	Connecting Europe Facility
CF	Certificate of Fitness
CNG	Compressed Natural Gas
CPCB	Central Pollution Control Board
CZK	Czech Koruna
DfT	Department for Transport
ECMT	European Conference of Ministers of Transport
ESIF	European Structural and Investment Funds
ETC	Electronic Toll Collection
EU	European Union
EV	Electric Vehicle
FCEV	Fuel Cell Electric Vehicle
FCEV	Fuel Cell Electric Vehicles
GEF	Global Environment Fund
GHG	Greenhouse Gas
GoWB	Government of West Bengal
GV	Gas Vehicle
HEV	Hybrid Electric Vehicle
HLAG	High-Level Action Group
HSD	High-Speed Diesel
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ICT	Information and Communication Technology
IEA	International Energy Agency
IMO	International Maritime Organization
INTOSAI	International Organization of Supreme Audit Institutions
ISA	International Standards of Auditing
ITF	International Transport Forum
ITS	Intelligent Transport Systems
IWT	Inland Water Transport
LNG	Liquefied Natural Gas
MOE	Ministry of Environment
MoRD	Ministry of Regional Development
MoT	Ministry of Transport
NAAQ	National Ambient Air Quality
NGO	Non-Governmental Organisation

OECD	Organisation for Economic Co-operation and Development
PT	Public Transport
PCCs	Pollution Control Committees
PPP	Public-Private Partnership
PUC	Pollution Under Control
RACI	Responsible, Accountable, Consulted and Informed
RMD	Road and Motorway Directorate
SAIs	Supreme Audit Institutions
SDGs	Sustainable Development Goals
S**LoCat**	Sustainable, Low-Carbon Transport
SPCBs	State Pollution Control Boards
STUs	State Transport Undertakings
SuM4All	Sustainable Mobility for All
TOD	Transit-oriented development
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
WGEA	Working Group on Environmental Auditing

List of Tables

Table 1.1	Definition of sustainable transport given by different organisations
Table 1.2	Characteristics of the triple bottom line of sustainable urban transport
Table 1.3	Overview of some of the sustainability-related impacts of transport
Table 3.1.	Optional techniques and methods for auditing sustainable transport
Table 4.1.	Cases of sustainable transport auditing
Table 4.2.	Global road safety performance indicators
Table 4.3.	Main results of the monitoring assessment, data source and timeline

List of Figures

Figure 1	Roadmap to Achieving SDG 11 in the Transport Sector by 2030
Figure 1.1	Demand for passenger transport by mode
Figure 1.2	Projected freight transport demand by mode
Figure 1.3	Urban travel by mode group
Figure 1.4	Concept of the four-policy goal framework
Figure 1.5	Direct and indirect transport targets and indicators
Figure 1.6	The four-policy goal framework
Figure 2.1	Characteristics of legally binding and non-binding instruments
Figure 2.2	Avoid-Shift-Improve instruments
Figure 2.3	Sustainable urban transport system (UNECE, 2015)
Figure 2.4	Interchange functions (Dauden et al., 2014)
Figure 3.1	Priority evaluation model of the topic of sustainable transport audit

Executive Summary

Transport is a growing concern for the sustainable development of the world, as it leads to many environmental impacts including carbon emissions, land occupancy, traffic noise and depletion of resources. To achieve the United Nations Sustainable Development Goals (SDGs), particularly the Goal 11 on Sustainable Cities and Communities, the public and private sector have to pay more attention to the development of transport, and better understand the ideas, technologies, and methodologies in this regard.

Since transport is a broad and diverse area, even a proper audit topic of sustainable transport will be a challenge for SAIs to identify. Once the topics are selected, it will still be difficult to determine where and how to start as there are many uncertainties in different policy contexts.

The main purpose of this project is to provide an understanding of the status of SDG 11, focusing on sustainable transport and supporting Supreme Audit Institutions (SAIs) to understand issues concerning this topic and to identify a suitable audit approach. This audit guidance was developed to help auditors to understand the concept and nature of sustainable transport and the reason and process it has to be audited, clarify the role that SAIs can play in auditing governments' responses to sustainable transport, provide cases studies for SAIs and auditors to help them learn the experiences of their counterparts and help them to conduct audits on specific topics.

The guidance is divided into four chapters. The first chapter provides background on sustainable transport issues and will be particularly useful for readers who are new to the subject. It defines the scope of sustainable transport and describes current trends and recent developments for sustainable transport globally with regard to the follow-up and review of the SDG Target 11.2 of UN SDGs and addresses the challenges of its development. The effect of the COVID-19 pandemic on the transport sector is also elaborated on in this chapter.

The second chapter aids in the understanding of governmental responses to this issue concerning international agreements or treaties on sustainable transport, policies/programmes regarding the topic, and instruments used to manage such policies or programmes based on the experiences of several countries.

The third chapter introduces the three basic steps in the selection and design of sustainable transport auditing,

Step 1: To understand the status and challenges of sustainable transport;

Step 2: To select the audit topics and evaluate their priorities;

Step 3: To lay down the objectives, audit question, techniques and methods of auditing sustainable transport.

The last chapter provides some cases on sustainable transport auditing conducted by several SAIs with detailed introduction on audit objectives, criteria, scope, findings and recommendations. Here the audit topics are divided into five sub-topics, including planning, funding, safety, environmental impact and new energy and technology application. These cases demonstrate that SAIs can play a major role in facilitating governments' actions to fulfill their SDGs commitments.

Introduction

Transport plays a crucial role in economic and social development as it can strengthen connectivity at all levels, stimulate economic integration, improve social equity, enhance rural-urban linkages, and build resilience. The transport sector can also boost global economic growth throughout the production chain, at all geographical scales. It is also an essential prerequisite for a society's development and the improvement of people's lives, providing economic and social opportunities and benefits. Nevertheless, there is also recognition of negative environmental, social, and health impacts. Almost a quarter of global greenhouse gas emissions come from transport, and these emissions are projected to rise substantially in the years to come, further exacerbating global warming. Other pollutants directly impact health: casualties and deaths from accidents are also on the rise.

The global attention given to transport has increased in recent years. The emerging issue of the 2030 Agenda for Sustainable Development also put sustainable transport under the spotlight as it drives sustainable development, fundamental to meeting the needs of people in their personal and economic lives, while respecting the ability of future generations to meet their needs. Transport contributes directly to the five SDGs targets on road safety (Target 3.6); energy efficiency (Target 7.3); sustainable infrastructure (Target 9.1), urban access (Target 11.2), and fossil fuel subsidies (Target 12.c), which emphasise that sustainable transport is not needed solely for its own sake but is more important to facilitate the achievement of various SDGs. Furthermore, transport also contributes indirectly to the eight SDG targets on agricultural productivity (Target 2.3), air pollution (Target 3.9), access to safe drinking water (Target 6.1), renewable energy (Target 7.2), sustainable cities (Target 11.6), reduction of food loss (Target 12.3), climate change adaptation (Target 13.1), and climate change mitigation (Target 13.2).

As a result, sustainable transport is becoming particularly important in terms of the achievement of Agenda 2030 targets. Clearly, sustainable transport strives for an optimal balance between economic, social, and environmental perspectives. This requires all implementation and follow-up processes to be participatory and inclusive, including all levels and sectors of government, civil society and the private sector, members of parliament and national human rights institutions, among others.

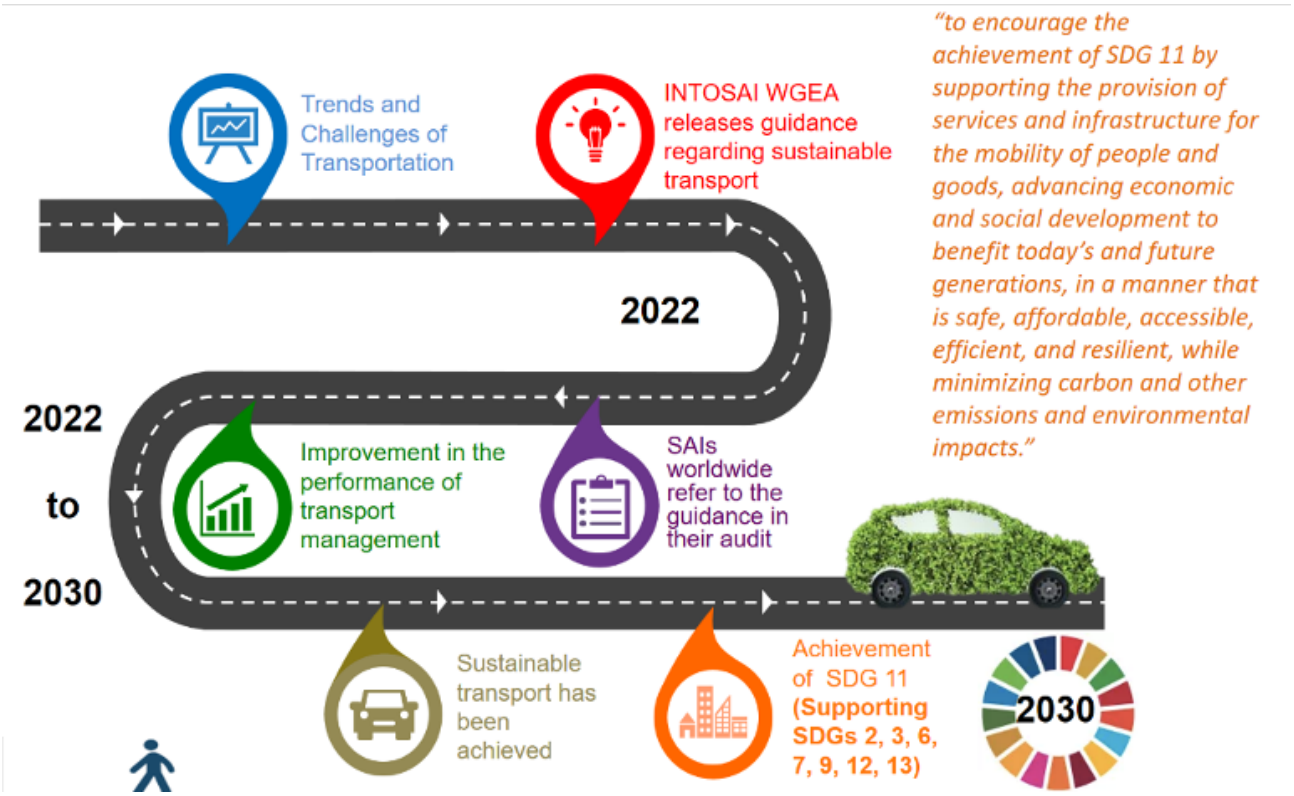
Purpose

The main purpose of this project is to provide an understanding of the status of SDG 11, focusing on sustainable transport and supporting Supreme Audit Institutions (SAIs) to understand issues concerning this topic and to identify a suitable audit approach. Based on the main purpose, the guidance on auditing sustainable transport aims to 1) provide comprehensive data and information on the follow-up and review of SDG 11 to address the challenge of its development, 2) present governmental responses to achieving sustainable transport, which includes international agreements/treaties, and policy instruments used to manage such policies or programmes, and 3) give examples on how the topic can be approached in audits and to sum up the methodology and challenges related to performing audits in this field, as well as to compile performed and ongoing audits on the subject, to help SAIs and auditors learn the experiences of their counterparts.

Vision

The output of the project is audit guidance that covers prevailing trends of sustainable transport, government policies and actions addressing challenges faced by sustainable transport, and sustainable transport audit design, which includes experiences of SAIs in auditing the subject in the form of case studies. Possible outcomes of the project would be the global improvement of transport management to achieve sustainable transport, catalysed by audit results presented by SAIs. The recommendations provided in the audit are expected to improve not only the effectiveness, efficiency, and economy of sustainable transport management, but also environment and equity aspects. Guidance to perform such an audit is required to ensure the audit engagement is right on target and that it presents beneficial recommendations. The guidance will also provide insights into previous experiences of related audits. By utilising the guidance, SAIs are expected to conduct audit accordingly, which will eventually lead to the improvement of transport management and establishing a sustainable transport system. This condition then contributes to the achievement of SDG 11 and supports the achievement of SDG 2, SDG 3, SGD 6, SDG 7, SDG 9, SDG 12, and SDG 13. The outcome is the vision of the project that could be visualised by the following figure.

Figure 1: Roadmap to Achieving SDG 11 in the Transport Sector by 2030



1. Global Overview of Transport Issue

This chapter covers the fundamental background of transport issues, the scope of sustainable transport, current trends and recent developments for sustainable transport, and addresses the challenge of its development globally.

1.1. Definition of Transport

The term 'Transport' can be defined as the activity in which 'people and goods move from one location to another location' (Ramstedt, Krasemann & Davidsson, 2013). Transport allows the flow of human and goods around the world that supports and improves the quality of human life (Leda, 2010).

1.2. Mode of Transport

The mode of transport can be defined and categorised differently depending on the perspective we apply. The most common way to consider the mode of transport is the environment, which includes land, water and air (Dostál & Adamec, 2011.) According to Eurostat (2019), 'transport mode refers to the way in which passengers and/or goods can be transported' and the modes for both passengers and goods may include rail, maritime (sea), road, inland waterways and air, while pipeline is only a mode for goods.

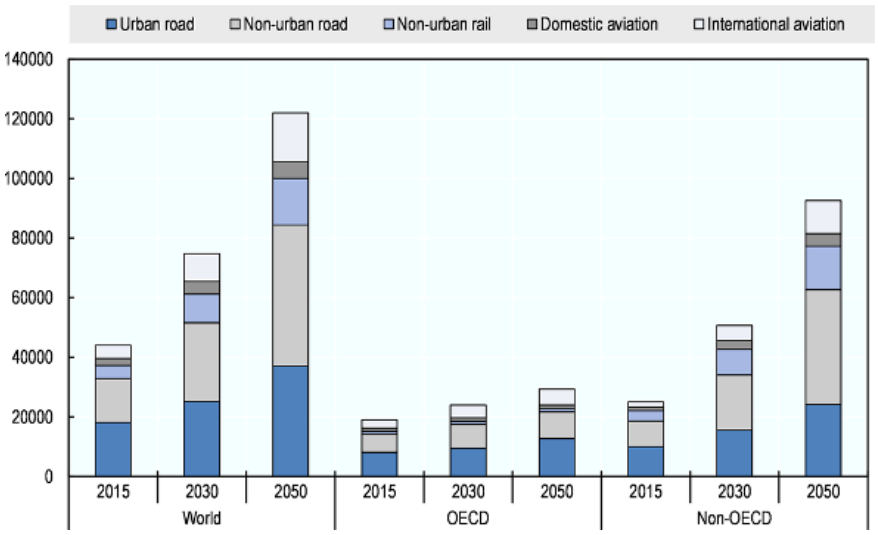
In addition, there are other parameters that can also be used to classify transport, such as the object of transport (passenger transport-freight transport), number of people transported (individual-mass), frequency (irregular-regular), public accessibility (private-public), transport distance (local-regional-long-distance), location of the trip origin and trip destination in relation to geographical units (interurban-interstate-intercontinental), and spatial relation of the origin and destination of the analysed area. (inner-outer-transit) (Dostál & Adamec, 2011)

1.3. Global Trend in Transport

According to the projection of the International Transport Forum of the Organisation for Economic Co-operation and Development (ITF, 2019), based on the current demand pathway, overall global demand for transport of both freight and passengers will triple by 2050 compared to 2015 as a result of population growth and economic development. In business-as-usual scenarios, demand for passenger transport worldwide will rise three-fold between 2015 and 2050, from 44 trillion to 122 trillion passenger-kilometres, which is dominated by urban and non-urban road transport (Figure 1.1). The movement

Figure 1.1 Demand for passenger transport by mode

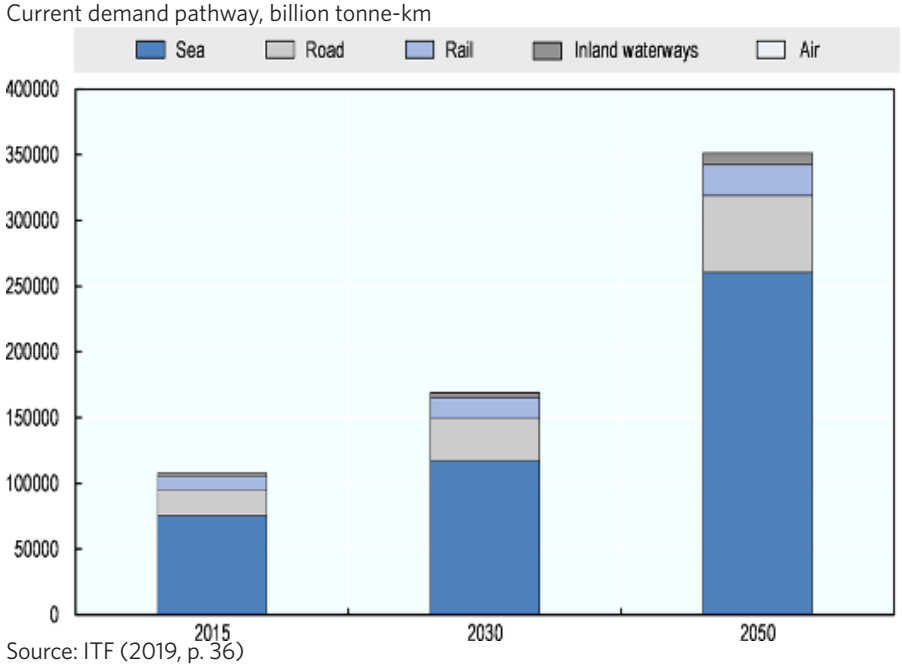
Current demand pathway, billion passenger-kilometres



Source: ITF (2019, p. 27)

Figure 1.2 Projected freight transport demand by mode

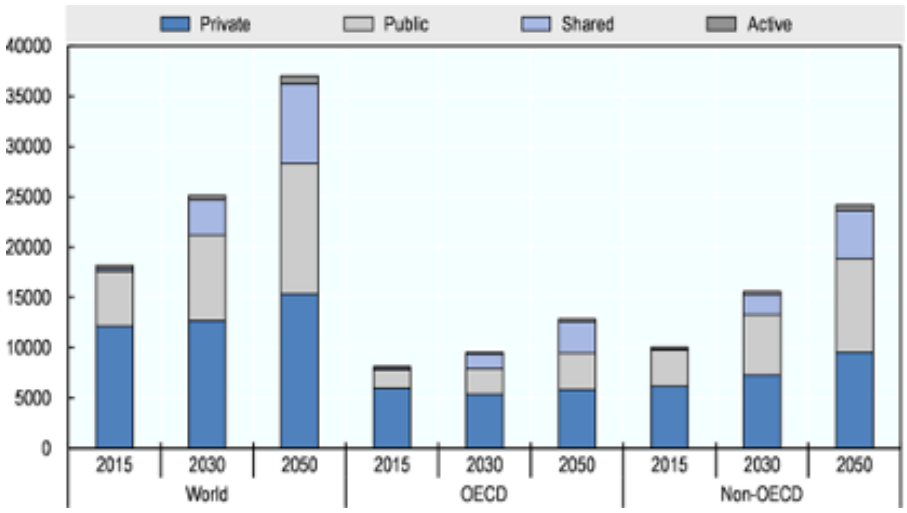
Current demand pathway, billion tonne-km



Source: ITF (2019, p. 36)

Figure 1.3 Urban travel by mode group

Current demand pathway, billion passenger-kilometres



Source: ITF (2019, p.28)

of goods will also grow three-fold between 2015 and 2050, from 108 trillion to 351 trillion tonne-kilometres, with sea freight playing a leading role in freight transport activity (Figure 1.2).

In light of urban mobility pattern analysis, the ITF study (2019) identifies that the preferred travel mode in urban areas worldwide is private vehicle, with a growing trend towards public transport and shared mobility (shared bikes, scooters, cars, taxis and buses) in the coming years to 2050. Evidence reveals that the proportion of shared mobility in urban areas will reach one fifth of global urban travel activity by 2050, while the difference between demand for shared mobility in OECD and non-OECD countries will be minimal, accounting for 24% compared to 20% respectively. Furthermore, global public transport utilised by urban inhabitants is projected to reach 35% by 2025. The significant growth of public transport is expected to be found

in non-OECD countries due to the limitation of existing road networks to serve the growth in travel demand and the development of public transport infrastructure, such as rail and metro.

The increase in travel demand and the development of transport infrastructure and systems in urban areas are two sides of the same coin. A well-established transport system can enhance the quality of life of many people and their environment. On the contrary, poor transport networks may lead to many social and economic issues as well as environmental degradation. Therefore, the way forward for the urban mobility of people and goods needs to be sustainable and requires more ambitious and coherent action from the national to the local level from all stakeholders, while leaving no one leave behind.

1.4, Definition of Sustainable Transport

Although the term 'sustainable transport' is widely used, there is no strong consensus on its definition for the reason that 'the contributions of transport to sustainable development are diverse, complex, dynamic and context-dependent' (United Nations Economic and Social Commission for Asia and the Pacific [UNESCAP] 2017, pp. 3)

Thus, the definition of sustainable transport given by various organisations depends on what views or aspects of sustainable transport one wants to emphasise. Some examples of definitions of sustainable transport are shown below.

Table 1.1 Definition of sustainable transport given by different organisations

Organisations	Definition
United Nations Secretary-General's High-Level Advisory Group on Sustainable Transport (2016, p.10)	'The provision of services and infrastructure for the mobility of people and goods – advancing economic and social development to benefit today's and future generations – in a manner that is safe, affordable, accessible, efficient and resilient, while minimising carbon and other emissions and environmental impacts.'
Clean Air Initiative for Asian Cities (CAI-Asia) (n.d. as cited in UNESCAP & CITYNET, 2012, p.3)	'...a set of transport activities together with relevant infrastructure that collectively does not leave problems or costs for future generations to solve or bear present builders and users of the system should pay such costs today. These costs are not limited to environmental externalities, but also include social and other economic impacts caused by transport.'
Former Centre for Sustainable Transport in Canada (n.d. as cited in U.S Department of Transport, [DOT] 2010, pp.III-3)	A sustainable transport system: Allows the basic access needs of individuals and societies to be met safely and in a manner consistent with human and ecosystem health, and with equity within and between generations. Is affordable, operates efficiently, offers choices of transport mode, and supports a vibrant economy. Limits emissions and waste within the planet's ability to absorb them, minimizes consumption of non-renewable resources, limits consumption of renewable resources to the sustainable yield level, reuses and recycles its components, and minimizes the use of land and the production of noise.
European Conference of Ministers of Transport (ECMT) (Organisation for Economic Co-operation and Development [OECD], 2005 as cited in Puri, 2017, p.55)	A sustainable transport system is one that is accessible, safe, environmentally friendly and affordable.'

According to Puri (2017, p.56), 'the broad agreement seems to be that the sustainable transport system is the one that is safe, environmentally cleaner, reliable, efficient, affordable, viable and adequate to serve the developmental requirements. Sustainable transport is, therefore, a system that creates economic, social and environmental benefits.'

The concept of sustainability, 'the triple bottom line', which encompasses three components - economic, environmental and societal, is considered to be the main principle for sustainable transport as well. The triple bottom line concept for sustainable transport refers to sustainable solutions focused on the surrounding natural environmental systems of the transport system, the transport systems' economic efficiency and the needs of the society (e.g., mobility, accessibility, safety and equity). These three concepts are commonly used since the transport planning and design process, which is a more comprehensive approach to sustainable transport than solely focusing on creating environmental-friendly transport infrastructure (e.g., green roads and green bridges) (DOT, 2010).

The table below shows the following characteristics for each triple bottom line component for a sustainable urban transport system.

Additionally, there is another framework, known as the 'four-policy goal framework' to assess sustainable mobility by achieving the four goals: universal access, efficiency, safety and green mobility at local, national and global levels. (Sustainable Mobility for All [SuM4All], 2019, pp.16)

1. Universal access (Ensure equitable access to economic and social opportunities by 2030 for all)
2. Efficiency (Increase the efficiency of transport systems by 2030)
3. Safety (Improve safety of mobility across transport modes)
4. Green mobility (Shift transport systems to a low-polluting (GHG/air/noise) and climate-resilient path)

To reflect and assess the progress towards the four goals that define sustainable mobility – universal access, efficiency, safety and green mobility – country

Table 1. 2 Characteristics of the triple bottom line of sustainable urban transport

Environmental Aspect	Social Aspect	Economic Aspect
▪ Limit emissions and waste (that pollute air, soil and water) within the urban area's ability to absorb/recycle/cleanse. ▪ Provide power to vehicles from renewable or inexhaustible energy sources. This implies solar power over the long term; and ▪ Recycle natural resources used in vehicles and infrastructure (such as steel, plastic, etc.)	▪ Provide equity of access for people and their goods, for this and all future generations ▪ Enhance human health ▪ Help support the highest quality of life compatible with available wealth ▪ Facilitate urban development on a human scale ▪ Limit noise intrusion below levels accepted by communities ▪ Be safe for people and their property	▪ Be financially affordable for each generation ▪ Be designed and operated to maximise economic efficiency and minimise economic costs ▪ Help support a strong, vibrant and diverse economy

Source: Data from Puri (2007, p. 56)

Figure 1.4 Concept of the four-policy goal framework

Source: Sustainable Mobility for All (2019, p.16)

mobility dashboards have been developed by SuM4All. These enable countries to know where they stand, where they need to be and how to get there in order to advance transport development.

SuM4All's country mobility dashboards[1] are the framework that aims to track and benchmark country performances on the four goals. The framework is based on indicators and country-level data. Global progress reflects the sum of performances across all countries.

The dashboards compile the transport profiles of 183 countries, using 40 standard transport indicators and countries' sustainable mobility index scores. The objective of this report is two-fold: to establish sustainable mobility and its four global goals as a useful, operational tool for policy action; and to support national debates on prioritisation and the formulation of transport and mobility implementation strategies (SuM4All, 2020). The indicators and indices of the dashboard are a useful source of audit criterion or benchmarking for auditors as well as potentially being secondary data in performing audits.

1.5. Impact of Transport

Transport systems are the activities that have both positive and negative environmental, economic and social impacts. Transport affects the environment in many ways in terms of transport modes, their energy supply system, their emissions, and the infrastructures in which they operate (Rodrigue, 2020). The key impacts on the environment are air pollution, water pollution, release of toxic/hazardous substances. Transport systems also contribute to socioeconomic changes. Economic opportunities are likely to arise where transport infrastructures can ensure access to markets and resources. Although transport has positive impacts on socioeconomic systems, there are also negative consequences such as congestion, accidents and mobility gaps. Nevertheless, transport systems also have an impact on society in many forms. The mere presence of transport infrastructures may affect the quality of the physical environment, such

1 For more details about country mobility dashboards, please see 'Mobility Performance at a Glance: Country Dashboards 2020' available at: https://www.sum4all.org/gra-tool/country-performance/snapshot

Table 1.3 Overview of some of the sustainability-related impacts of transport

Environmental Impacts	Social Impacts	Economic Impacts
▪ Air pollution ▪ Consumption of land/urban sprawl ▪ Depletion of ozone layer ▪ Disruption of ecosystems and habitats ▪ Global climate change ▪ Hydrological impacts ▪ Light pollution ▪ Noise pollution ▪ Release of toxic/hazardous substances ▪ Solid wastes ▪ Vibration pollution ▪ Visual intrusion and aesthetics ▪ Water pollution	▪ Accidents ▪ Declining community liveability/ community partitioning ▪ Human (psychological and physiological) health impacts. Inequalities associated with negative environmental and health impacts ▪ Mobility barriers/inequalities for the disadvantaged ▪ Time wastage ▪ Visual pollution	▪ Cost of transport to customers/ consumers ▪ Cost related to accidents ▪ Depletion of non-renewable resources and energy supplies (also and environmental and intergenerational equity concern) ▪ Traffic congestion ▪ Transport facility costs ▪ Transport-related health costs

Source: UNESCAP (2017, p.6)

as visual quality, light pollution, and people's perceptions of the immediate environment. The movement of vehicles affects the safety of travellers and has an effect on their health. UNESCAP's summary of the key impacts associated with sustainable transport are presented in Table 1.3.

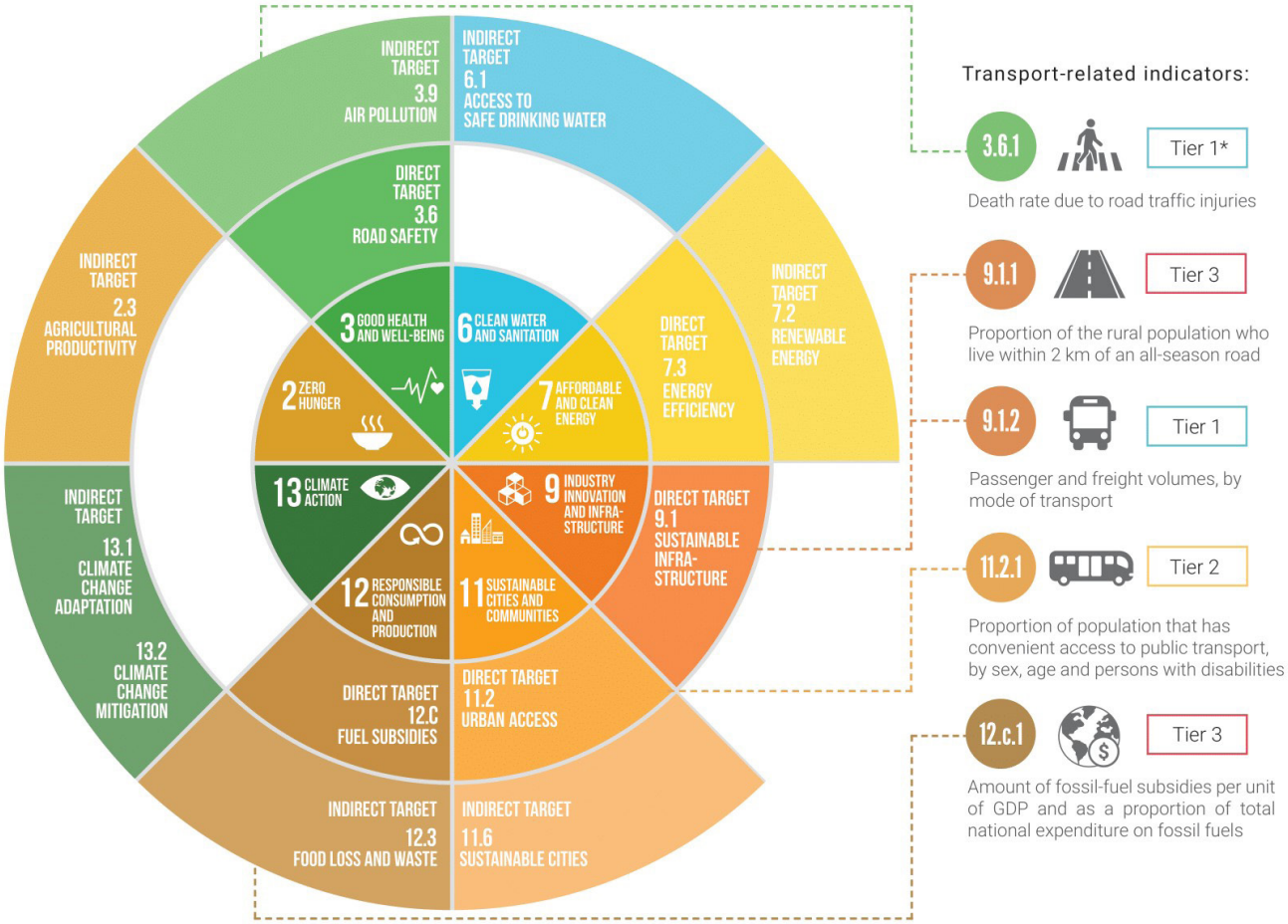
1.6. Sustainable Transport and the SDGs

In 2015, the United Nations announced the Sustainable Development Goals (SDGs) as a framework for UN member states to develop their countries in terms of the balance of economic, social and environment development under the concept of 'leave no one behind', with the commitment of achieving all the goals by 2030.

Even though sustainable transport is explicitly stated in target 11.2, there is no specific goal solely dedicated to the achievement of sustainable transport in the 2030 Agenda. Transport is considered as a cross-cutting issue, relevant to the majority of all goals as well as playing a vital role in achieving many of the SDGs, and several of the 169 specific SDG targets relate and address transport directly or indirectly.

Figure 1.5 illustrates that achieving sustainable transport would mean at least eight goals or 13 targets of the SDGs in either direct or indirect ways could be achieved. In fact, sustainable transport contributes directly to five SDG indicators on road safety (Target 3.6); energy efficiency (Target 7.3); sustainable infrastructure (Target 9.1), urban access (Target 11.2), and fossil fuel subsidies (Target 12.c) and indirectly to eight SDG targets on agricultural productivity (Target 2.3), air pollution (Target 3.9), access to safe drinking water (Target 6.1), renewable energy (Target 7.2), sustainable cities (Target 11.6), reduction of food loss (Target 12.3), climate change adaptation (Target 13.1) and climate change mitigation (Target 13.2). Therefore, it is clear that sustainable transport plays an important role in achieving the SDG goals in almost all areas. In addition to the general benefits of sustainable transport that result in sustainable social development, having sustainable transport

Figure 1.5 Direct and indirect transport targets and indicators



Sources: SLoCaT (2019, p.11)

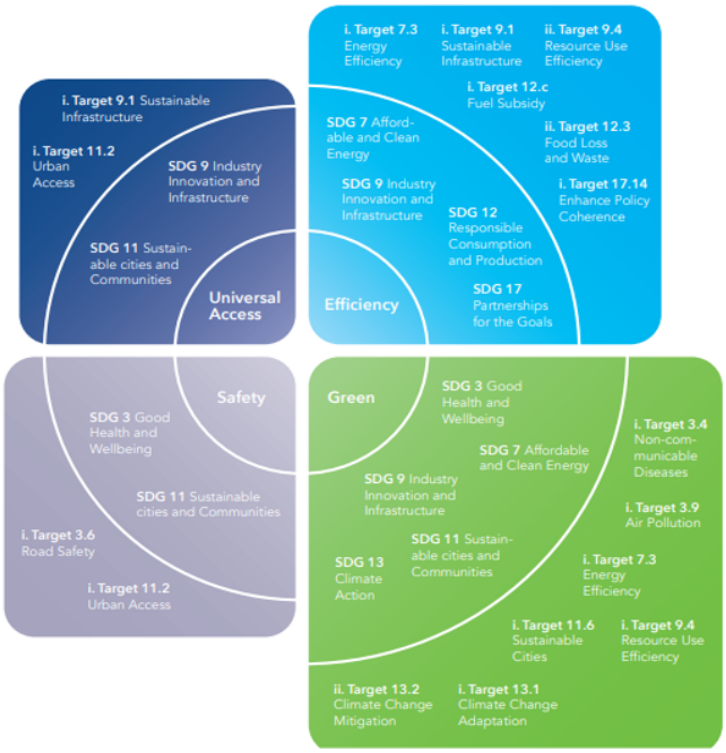
helps reduce the impact of pollution from transport and contributes to achieving the targets addressing climate change as well.

Sustainable transport contributes to mitigating climate change through reducing carbon emissions. For example, the Partnership on Sustainable, Low-Carbon Transport (SLoCat)[2] aims to promote the integration of sustainable, low-carbon transport in global policies on sustainable development and climate change, and leverage action in support of the implementation of global policies.

2 The SLOCAT Partnership on Sustainable Transport is a multi-stakeholder partnership of over 90 organisations (representing UN organisations, multilateral and bilateral development organisations, NGOs and foundations, academia and the business sector).

The four-policy goal framework presented by Sustainable Mobility for All (SuM4All), includes universal access, efficiency, safety and green mobility, all of which contribute to the achievement of sustainable transport and mobility (SuM4All, 2019). Each policy goal demonstrates the linkages between its goal and the SDG targets and indicators given in Figure 1.6.

Figure 1.6 The four-policy goal framework



The ultimate goal of universal access is the desire to connect all people regardless of the needs of different groups, and communities to economic and social opportunities across geographical locations, and includes SDG targets and indicators mainly on SDG 9 (Industry Innovation and infrastructure), SDG 11 (Sustainable Cities and Communities), SDG target 9.1 (Sustainable infrastructure) and SDG target 11.2 (Urban access).

The Efficiency policy goal aims for transport systems to be predictable, reliable, timely and cost-effective. Different performances are considered for efficiency consisting of energy (SDG target 7.3 Energy Efficiency, SDG Target 12.c Fuel Subsidy), resource use (SDG Targets 9.4 Resource Use Efficiency), infrastructure (SDG target 9.1 Sustainable Infrastructure), responsible consumption, (SDG Target 12.3 Food loss and waste) and policy coherence (SDG target 17.14 Enhance Policy Coherence).

The safety policy goal aims to reduce transport accidents that cause fatalities, injuries and crashes across different modes of transport, therefore minimising public health risks, and social and economic losses related to unsafe mobility. Safety includes SDG targets and indicators mainly on SDG 3 (Good Health and Wellbeing) and SDG 11 (Sustainable Cities and Communities).

The Green mobility policy goal is to minimise the environmental impact of mobility in terms of greenhouse gas (GHG) emissions, air pollution and noise. The objective of this goal is in accordance with the Paris Agreement, a legally binding international treaty on climate change, and SDG 3 (Good Health and Wellbeing), SDG 7 (Affordable and Clean Energy), SDG 9 (Industry Innovation and Infrastructure), SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action).

1.7. Challenges of Sustainable Transport

The studies of ITF (2021), Rodrigue (2020), Sun4All (2017) and the United Nations Secretary-General's High-Level Advisory Group on Sustainable Transport (2016) illustrate challenges in implementing and achieving sustainable transport, as presented below.

Urbanisation and urban-rural integration

- By 2050, the world's urban population is expected to have grown by 2.5 billion people, reaching 66% of the total global population. Economic mass will continue to shift from mature economies toward emerging markets.
- In 2015, there were 29 megacities of over 10 million people. By 2030 there will be an additional 12, with ten of them in Africa and Asia. In addition, the recent decades have

seen the rise of polycentric metropolitan regions consisting of a number of connected large urban areas, which present a new set of challenges for transport planning.
- The COVID-19 pandemic may have an impact on urbanisation trends. There are indications that the pandemic has encouraged people to relocate out of cities to areas with more space. However, it is too early to know whether this will become an established trend. To a large extent, this will depend on how long the pandemic lasts and the degree to which practices like teleworking will prevail after restrictions are lifted.

Demographic changes

In some parts of the world, the population is shrinking and ageing, while in other parts, it is growing rapidly and getting younger. Demographic trends at both ends of the spectrum have consequences for transport. Broadly speaking, issues of accessibility and proximity are crucial, particularly for elderly people, while younger generations are driving new trends, including the 'sharing economy' and other approaches dependent on smartphone connectivity. However, these trends vary according to the region and level of development, and all policy decisions must take specific contexts into account.

Global supply chains and trade routes

- The transport of goods and people is becoming an increasingly global activity, with research and development, raw material sourcing, design, production and marketing potentially each located in a different country, or in several different countries.
- National governments and private-sector entities are preparing for the challenges and opportunities arising from more globalised supply chains, including through trade facilitation via regional integration, and the creation of transport corridors. In Asia and Africa, governments are allocating more resources to long-distance transit corridors, using high-capacity transport systems and simplified border crossings. In all regions, ports and airports are vital hubs enabling international freight transport.
- When considering the transport landscape in any part of the globe, special attention must be paid to the 'last mile'. Transporting goods via rail, lorry, ship or aircraft can be efficient and cost effective. However, when goods arrive at a high-capacity freight station or port, they must then be transported to their final destination. This last leg of the supply chain is often less efficient, comprising a significant portion of the total cost of moving goods. Also, given its strong environmental impact, the 'last mile' is almost always done via road transport. This has become known as the 'last-mile' logistics challenge. The 'last mile' is also a conundrum for passenger transport, one that will need to be addressed to achieve sustainable transport.
- The pandemic has spurred a more direct route.
- The pandemic is accelerating the growth and popularity of e-commerce and online retailing, which could also underline last-mile logistics, congestion, emissions, and decreasing consolidation and average loads.

Development of greener, more efficient propulsion technology

- As the international community confronts the climate crisis, and cities around the world face unprecedented levels of pollution, there are signs of a widespread shift – slow though it may be – away from a fossil fuel-based transport system.
- Congestion and pollution – with the accompanying twin health crises of traffic fatalities and health impacts of poor air quality together with the climate imperative – are major drivers towards clean, green and smart transport technology. Effective technological innovation always needs to be linked to sustainable transport policies.
- Alternative fuels mainly concern existing modes, but the sources of fuel, or engine

technology, are modified. For instance, hybrid vehicles involve the use of two types of motor technologies, commonly an internal combustion engine and an electric motor.

- Global transport emissions grew at an average annual rate of 2 per cent from 1990–2012, and transport remains among the fastest growing sectors of CO2 emissions from fuel combustion. Road-based transport – passenger and freight transport – is responsible for more than 80 per cent of the sector's CO2 emissions. Optimising the contributions of the transport sector will be essential to achieving the mitigations target.
- The pandemic has spurred fuel efficiency and more direct routes in air travel, while the rise of e-commerce and online retailing could also increase freight emissions.
- Decarburisation has been challenged during the pandemic. Due to health concerns, public transport and shared mobility ridership have reduced and have shifted to higher usage of private vehicles, leading to a reduction of cleaner 'shared' modes (bus, rail).
- Financial recovery after COVID-19 can support the transition to cleaner transport. Governments could consider this recovery as an opportunity to encourage investment in low-carbon alternatives for transport infrastructure. Carbon pricing can be used for that purpose.
- 'Build back better' stimulus packages will accelerate transport decarbonisation. Such packages can include investments in alternative fuel production, and distribution and supply infrastructure, while also improving the competitiveness and availability of multimodal solutions. Incentives and regulatory changes to encourage decarburisation can be rolled out.
- Support must be carefully designed to aid a transition to more sustainable non-urban travel rather than returning to business as usual. Economic stimuli provide an opportunity to invest in research, and the development of cleaner aircraft, road vehicles and fuels.
- Greater emphasis on the resilience of the transport system, with less carbon-intensive modes (rail and inland waterways as well as favouring cargo consolidation, higher average loads and multimodal solution, offers opportunities for decarburisation.
- The COVID-19 pandemic should be taken as an opportunity to accelerate a transition to sustainable transport systems and solutions in support of the implementation of the 2030 Agenda and the Paris Agreement on climate change, with long-term policies and strategies built around the objectives of universal (affordable) access, safety (including sanitary measures, such as more stringent cleaning and disinfection services), efficiency and green mobility.

Digital connectivity

- The digital revolution, which is transforming all aspects of life, will have a major impact on mobility and transport in terms of demand and supply. In terms of demand, information and communication technology (ICT) is enabling telecommuting, and video- and audio-conferencing can replace longer-distance travel and make the sharing economy, e.g. making bike-sharing, car-sharing and transport-on-demand systems more viable and attractive. In terms of supply, ICT improves the efficiency of transport networks through passenger information systems, real-time traffic management centres, integrated electronic ticketing systems, automated control systems allowing vehicles and trackside or roadside equipment to communicate, and others.
- The development of a set of information and communication technologies (ICT) to improve the speed, efficiency, safety and reliability of mobility, is aiming at complete or partial automation (driving assistance) of vehicles and terminals (ports, airports, railway stations and distribution centres). These systems could involve the improvement of

existing modes such as automated highway systems, or the creation of new modes and new transhipment systems such as for automated vehicles, public transit and freight transport (automated terminals).
- The pandemic underlines the significant role of connectivity. Teleworking, teleconferencing and virtual meetings became the new norm during lockdown.
- Digitalisation, automation, virtualisation, e-commerce and home deliveries are picking up steam
- The pandemic is accelerating trends that affect freight transport. Digitalisation and e-commerce, trade regionalisation and decreased fossil fuel consumption are the most noticeable trends to emerge.

Socioeconomic inequalities
- The spread of COVID-19 has resulted in the loss of jobs in various sectors, livelihoods placed at risk, increased food insecurity, endangered supply of medicines and other essentials, thus endangering progress across multiple SDGs. These impacts contribute to, and are exacerbated by, economic recessions and inequalities in countries.

Changes in travel behaviour
- Many cities were starting to favour active modes of transport, such as walking and cycling, as a way of healthy living and sustainability for people and the planet, accompanied by urban changes, such as new cycle lanes. Different actors, including civil society, were pushing for enhanced safety measures, including those related to public transport.
- The pandemic may be prompting longer-term changes in both demand and supply for transport services and changes in the way we use and develop transport systems, based on new kinds of safety needs and changed user behaviour (e.g. increases in alternative modes, such as teleworking, teleconferences, remote learning. walking, cycling).
- Long-distance leisure tourism could shift to more travel closer to home.

1.8. Transport and COVID-19 Pandemic

The COVID-19 pandemic has had a substantial impact on a global scale in various areas, including the transport sector. Whereas the long-term effects are difficult to predict, the short-term impacts can be observed.

Each transport sector, namely urban passenger transport, non-urban passenger transport and freight transport, in the short term, are affected across all modes to varying degrees, disrupting tourism, trade, global supply chains and the movement of labour.

Urban passenger transport, especially public transport and shared mobility, faced some of the most significant challenges due to a dramatic drop in the number of users; reducing service frequencies, suspended routes and the need to adapt to social distancing rules and sanitation requirements, notably due to personal quarantine and a record number of people working from home. Private vehicle use and active travel; walking, cycling and micromobility has become a preference option, and recovered considerably in many cities worldwide between containment measures while public transport did not (ITF, 2021).

Non-urban passenger transport fell dramatically during the pandemic. Long-distance travel such as international and inter-city air travel, as well as bus and rail, was particularly hard-hit. Compared with pre-pandemic projections of non-urban passenger demand in 2020, ITF projections show a significant decline in travel of around 40% (measured in passenger-kilometres) (ITF, 2021, p.131). Air travel dropped by 94% worldwide in April 2020 compared to April 2019 (IATA, 2020) due to strict international travel restrictions, border closure and stay-at-home orders. Rail travel was affected disproportionately. The demand for inter-city bus travel has seen a large drop, with bus activity falling by 36% according to ITF (2021) estimates.

The pandemic has underlined the vital role played by freight transport. While the lockdown and mobility

restriction introduced to contain the pandemic has had a more direct impact on the movement of people than goods, home deliveries and e-commerce are actually on the rise. Freight volumes in the second quarter of 2020 were lower than during the peak of the 2008 financial crisis. The ITF estimates that global freight transport dropped by 4% in 2020 on the previous year.

Efforts to achieve the 2030 Agenda for Sustainable Development and the Paris Agreement on climate change are impacting at different scales and developing countries have been particularly affected. The temporary reduction of GHG emissions was having a positive impact on climate change, while the travel reductions and consequent job reductions or losses and supply chain interruptions were negatively affecting economic development and livelihoods. At the same time, the pandemic was seen as a chance to bring forward different perspectives, behaviour change and new national priorities to possibly accelerate progress in the recovery period.

It is uncertain how the pandemic will ultimately change the mobility of people and the transport of goods. However, it is apparently that COVID-19 will have an effect on our transport networks and systems in the long run as a result of changing behaviour and business models, as well as government intervention. Some concrete examples of the potential effects of COVID-19 to the future of transport, at this point of time, are as follows.

Teleworking/Remote working

COVID-19 has accelerated the digitalisation of working and social interactions. During the pandemic's peak, social distancing, health measures and global lockdowns forced not only firms but also public sector organisations to perform a wide range of daily functions through virtual means, and, in turn, have accelerated the uptake and acceptance of remote working, which will likely remain in place after the pandemic (OECD, 2021a). Remote working is proving effective to reinforce social distancing and mitigate the economic impact of the crisis (OECD, 2021c).

United Kingdom – Teleworking in April 2020 was 1.8 times the level before the pandemic.

Japan – A nationwide lockdown was not instituted in 2020, but teleworking rates increased markedly from 10% in December 2019 to almost 28% in May 2020.

Italy – Teleworking rates in the second quarter of 2020 were over four times the level before the pandemic, increasing by 15 percentage points on an annual basis.

(OECD, 2021b)

Digitalisation of public services

Confinement measures have also catalysed the digitalisation of public services to better manage and respond to citizens' needs and the continuation of services, and to broaden the range of services provided online including online administrative services, online education and e-health (OECD 2021c).

Online education

During the crisis, the movement of people, travel, gathering and activities have been limited or have ceased altogether. However, the delivery of education at all levels is needed. With schools, universities or even educational institutions being closed, the use of digital tools to continue classes has been promoted. At the same time, the COVID-19 crisis led to a massive shift towards e-education and online courses after March 2020.

(UNESCO, 2020 as cited in OECD 2021c)

Germany – The city of Bamberg established an online platform with exercises and working materials for students. These serve a dual function, as they also relate to Bamberg's cultural heritage. Düsseldorf is also

turning to the internet and telephone for education support, as well as having developed a hotline for the elderly and other high-risk populations to get help and advice (Eurocities, 2020 as cited in OECD 2021c, p. 63).

Italy – Bologna's Institution for Education and Schools (IES) has been offering online educational resources to families with children aged 0–6, to help keep them entertained, educated and active without having to leave the house (OECD 2021c, p. 63).

E-health services

E-health services, such as e-prescriptions and telemedicine, offer important benefits to citizens in need and for patients to receive healthcare services in the context of COVID-19. The use of e-health services has increased significantly since March 2020 (OECD, 2021c).

Thailand – Many public hospitals offer medical or consultancy services, particularly for follow-up cases, by using digital means to connect with patients regarding their health information, treatment, laboratory results, medication, online appointments, emergency calls and online payment (Tortermvasana, 2019, Koh, 2020).

China – E-health users in China can access various services, such as online registration, online payment, and medical and health consultations. E-health played a unique and distinctive role in residents' healthcare during the COVID-19 pandemic (Wang et al., 2021).

Estonia – Estonia also had a variety of telemedicine providers in the market at the start of the COVID-19 crisis, among them MinuDoc and Viveo Health, for synchronous patient-to-doctor video telemedicine; and Dermtest, for asynchronous doctor-to-doctor telemedicine and care management for dermatological conditions (e-Estonia, 2022).

Active travel and micromobility

Travel restrictions and health measures imposed by governments resulted in individual behaviour change in transport modes, therefore, active travel, comprising walking and cycling, and micromobility, such as the use of personal e-scooters, electric bikes and other small-scale and portable modes of transport, are significantly increasing (McKinsey & Company, 2020).

To meet the rise in active traveling, transport authorities across cities have improved transport infrastructure such as extending cycling networks, improving walking facilities and made way for micromobility options (Habib & Anik, 2021)

Milan has announced that 35 kilometres of streets previously used by cars will be transitioned to walking and cycling lanes after the lockdown is lifted.

Paris will convert 50 kilometres of lanes usually reserved for cars to cycle lanes. It also plans to invest $325 million to update its bicycle network.

Seattle permanently closed 30 kilometres of streets to most vehicles, providing more space for people to walk and cycle following the lockdown.

Montreal announced the creation of more than 320 kilometres of new pedestrian and cycle paths across the city.

(McKinsey & Company, 2020)

Preventive measures and public transport regulations

To facilitate the safe and efficient movement of people and contain the spread of COVID-19, government and public transport authorities have issued preventive measures and public transport regulations for transport operators and users. Transport operators are responsible for ensuring adherence to government regulations and making sure that public health and social measures are followed through specific actions, such as thorough cleaning of vehicles, disseminating information and making necessary adjustments in providing services to the public. Meanwhile, the responsibility for ensuring COVID-19 measures also lies with users, who are expected and recommended to keep physical distancing, appropriately use face masks, maintain meticulous hand hygiene while they are on board, and to avoid travelling and seek medical care if they are feeling unwell or develop symptoms consistent with COVID-19 (World Health Organization [WHO], 2020).

Europe – COVID-19 railway protocol – Recommendations for safe resumption of railway services in Europe, dated 21 July 2020, outlined the operational guidelines for the resumption of railway operations in Europe. This protocol reflects the current status of knowledge about the COVID-19 disease and its pandemic effect. It summarises preventive and operational measures in places at all times for passengers and staff, consisting of health promotion messages, strategies to reduce overcrowding, facilitation of hand hygiene, enhancing the cleaning of public areas, and this complements measures taken by the European Commission to support Member States in relaunching mobility and tourism across Europe (European Union Agency for Railways & European Centre for Disease Prevention and Control, 2020).

China – China has implemented preventive measures by upgrading facial recognition cameras nationwide to scan crowds with infrared for fever and identify individuals without masks. In addition, subway travellers are required to scan a QR code placed in each subway car as a ticket (WSP Global Inc., n.d.).

1.9. Role of SAIs and Sustainable Transport

Supreme Audit Institutions (SAIs) are national institutions that ensure the sound use of public resources. The role of SAIs goes beyond oversight of the public budget and government accounts and extends into the evaluation of public policies and programmes, including the management of environmental assets.

Transport investments are often large and long-term in nature. With transport planning and investments, the public sector 'locks in' the infrastructure for a long time and can thus either create preconditions for sustainable systems or hamper them. Here, SAIs have a key role in assessing the sustainability and the economy, and the efficiency and effectiveness of the implementation of transport policies and funding. SAIs could strengthen the implementation of the 2030 Agenda for Sustainable Development by evaluating public policies throughout the entire policy process, considering the interrelations between policies, assessing their results, and enhancing the level of transparency and accountability on how governments implement international commitments on sustainable development (United Nations, n.d.). In terms of Sustainable Transport, likewise, SAIs can undertake individual and cooperative audits to monitor and follow up on the implementation of SDG 11.

Within the SAI mandate, SAI can contribute to the achievement of sustainable transport targets through their audit work. Sustainable transport-related projects can be audited in financial audits to ensure the financial reporting of the project, in compliance audits to ensure that the activities under the project comply with their

criteria, or by conducting performance audits to assess the project. Moreover, SAIs may conduct performance audits of the implementation of SDGs.[3]

In additional to the oversight function, SAIs can have an advisory function in the form of non-audit products, which include position papers, best practice and documentation, which promote better understanding of technical issues (INTOSAI Journal, 2019). Non-audit products can enhance good governance while maintaining the integrity, objectivity and independence that are so vital to SAI work.

3 More information about the audit of SDGs implementation. Please see IDI's SDGs Audit Model (ISAM) available at: https://www.idi.no/work-streams/relevant-sais/auditing-sdgs/audit-sdgs-implementation/isam

2. Understanding Governmental Responses to Achieving Sustainable Transport

This chapter provides an overview of governmental responses to achieving sustainable transport, specifically international agreements and treaties as well as policies and programmes. It also focuses on instruments of policies and programmes to achieve sustainable transport in each respective country. The purpose of this chapter is to provide potential sources of criteria to the auditors and to describe how the government manages transport to become environmentally sound and socially equitable while maintaining economic feasibility.

There have been several major international responses to the rising challenge of and increased pressure on sustainable transport. Even though some of the international agreements and treaties do not specifically address sustainable transport issues, the auditor can refer to parts of the provision that concern the area of sustainable transport, which are relevant to the audit. One place for auditors to start looking at government responses could be to study the relevant SDGs and map their country's commitment to implementing these, and the relevant targets that contribute to its achievement. When looking at governmental responses, the SAI also needs to identify national objectives and gain an overview of the responses to achieve these objectives.

Some of the important international agreements and treaties as well as policies/programmes and their instruments on sustainable transport in a national/domestic context are introduced in the following sub-chapter.

2.1. International Agreements

In recent years, various efforts have been made by global civil society to implement international mechanisms, which allow every country to develop its own sustainable transport action plans or to formulate a more sustainable transport policy. In general, there are two main international mechanisms, namely legally binding and non-binding instruments, with the characteristics shown in Figure 2.1

Figure 2.1 Characteristics of legally binding and non-binding instruments

Legally Binding Instruments

- Include UN Conventions, Agreements and Regulations, EU Directives and Regulations
- Serve as benchmarks for normative or regulatory frameworks
- Facilitate international coordination and cooperation

Non-Binding Instruments

- Reflect the vision of sustainable mobility of groups of countries, agencies, entities
- Provide policy recommendations
- Include action plans, statements, declarations

Source: Sustainable Mobility for All (2018, p.4).

All types of international instruments, in distinct ways, play an important role in assisting countries on the path towards sustainable transport. Each agreement covers different modes of transport or issues related to sustainable transport. Some agreements cover all modes of transport and sustainable

transport issues, such as the Ashgabat Statement. Others aim at specific modes of transport, such as the UNECE Agreement, which aims at managing inland transport in Europe, the provisions of the International Maritime Organization (IMO), which regulates marine transport, and the International Civil Aviation Organization (ICAO), which specifically addresses civil aviation. Each instrument can focus on single or various goals, depending on its purposes. The policies and programmes that address the issues of sustainable transport may vary between international communities. The choice of policies and programmes as well as the instruments used are mainly influenced by economic potential, political division, demography, geographical condition and international obligation. International agreements and treaties related to sustainable transport that are adopted and implemented by countries include:

1. The 2030 Agenda for Sustainable Development
The agenda was declared on 25–27 September 2015 and established 17 SDGs and 169 targets which focus on people, the planet and prosperity. In the agenda, targets 11.2 and 3.6 specifically address transport issues. Due to the integrated and interlinked nature of the SDGs, engaging in a target could also impact other relevant targets. For example, when a country is working on achieving a sustainable transport (target 11.2), it also helps the country to achieve other SDG targets, inter alia, target 3.6, target 3.9, target 7.3, target 9.1, target 11.6, target 13.1 and target 13.2.

   Available at: https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf

2. The Paris Agreement on Climate Change
The Paris Agreement is a legally binding international treaty on climate change, which was adopted by 196 parties at COP 21 in Paris on 12 December 2015 and entered into force on 4 November 2016. The goal is to limit global warming to 1.5 to 2 degrees Celsius, compared to pre-industrial levels. Global peaking of greenhouse gas emissions should be reached as soon as possible to achieve a climate-neutral world by mid-century in order to achieve this long-term temperature goal. Implementation of the Paris Agreement requires economic and social transformation, based on the best available science. Every five years, countries submit their plans for climate action known as nationally determined contributions (NDCs).

   Available at: https://unfccc.int/sites/default/files/english_paris_agreement.pdf

3. Ashgabat Statement on Commitments and Policy Recommendations of the Global Sustainable Transport Conference The UN Secretary-General initiated the first-ever Global Sustainable Transport Conference on 26-27 November 2016, in Ashgabat, Turkmenistan, as a main component of the United Nations' commitment and strategy to advancing sustainable development and tackling climate change. The global commitment is aimed at enhancing the role of sustainable transport in connecting people and communities to jobs, schools and health care and in the delivery of goods and services to rural and urban communities, thus providing all with equal opportunities and leaving no one behind.

   Available at: https://sustainabledevelopment.un.org/content/documents/11987Ashgabatstatement.pdf

Several international agreements and treaties related to sustainable transport that can be used as a source of criteria in conducting audit on sustainable transport are presented in Appendix 1.

2.2. Policies/Programmes and Their Instruments on Sustainable Transport

Policies and programmes on sustainable transport are very important in establishing priorities and objectives of the transport sector in a country. To achieve sustainable transport, countries must plan and implement a sound and integrated transport policy and strategy. Identifying the policies and programmes is also a cru-

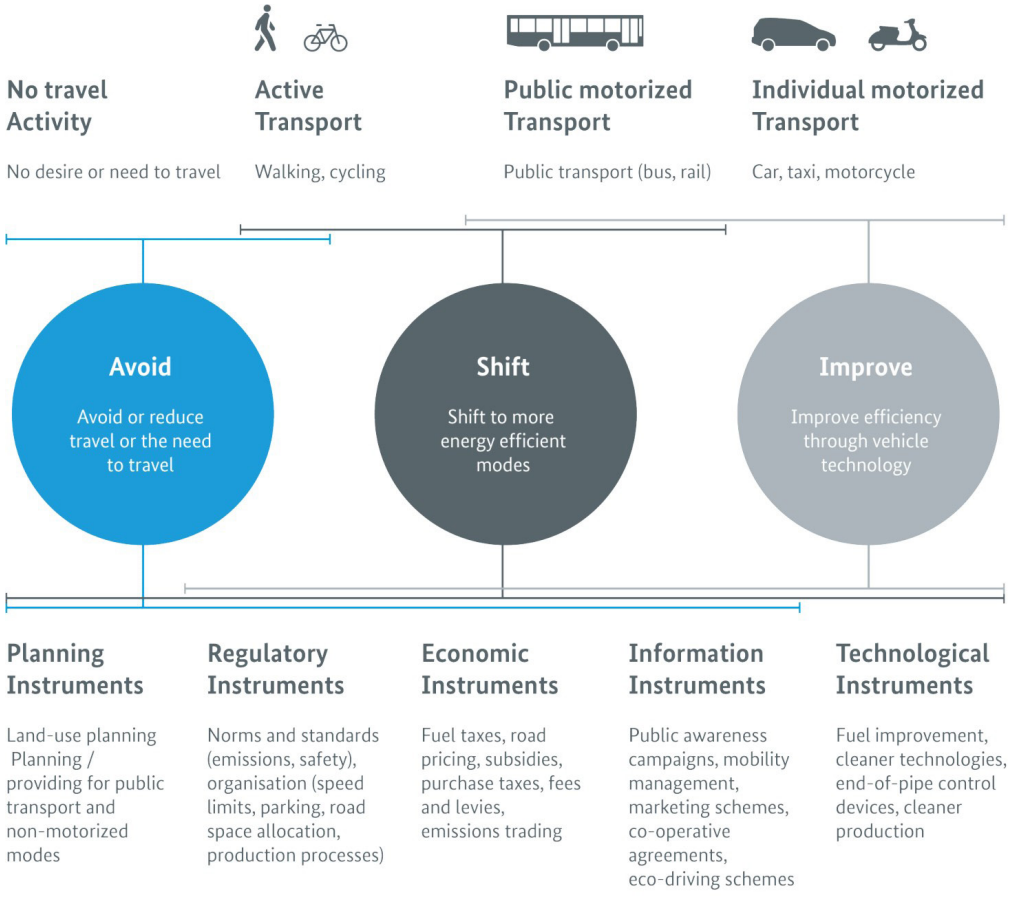
cial step in conducting audits related to sustainable transport, as the auditor could assess the economy, efficiency and effectiveness of the mentioned policies and programmes. The policies, programmes and instruments that support the achievement of sustainable transport are discussed below.

2.2.1 The Avoid-Shift-Improve Approach

The traditional approach to meeting demand in the transport sector is by increasing supply with the provision of additional infrastructure. This approach has not been considered sustainable, especially in countries where the availability of infrastructure is considered adequate to support inter-regional connectivity. As an alternative, a concept known as the 'Avoid-Shift-Improve' (ASI) approach is developed. It is a concept that builds on the principles of sustainability to satisfy mobility demand while creating less congestion as well as reducing energy consumption and greenhouse gases emissions, which was initially developed to address climate change mitigation and other environmental issues in the transport sector. Bongardt (2019) referred to the pillars of the ASI approach as follows:

- Avoid/Reduce: Improving the efficiency of the overall transport system through compact and transport-oriented development of cities, so that the need for motorised travel and trip lengths can be reduced.
- Shift/Maintain: Improving individual trip efficiency by shifting from more polluting and energy-consuming towards environmental-friendly modes of transport.
- Improve: Focuses on efficiency of vehicle and fuel as well as operational efficiency of public transport.

Figure 2.2 Avoid-Shift-Improve instruments



Source: GIZ, 2019

The GIZ also introduces 10 principles of sustainable urban transport with the ASI instruments, as follows:

1. Planning dense and human-scale cities. The initiatives taken to support this principle include designing mixed-use city quarters and supporting projects to create affordable housing in city centres and small urban fabric.

2. Developing transit-oriented cities to enhance urban connectivity and reduce detours, and to ensure land value capture around transit simultaneously. Approaches using this principle include creating high-density apartments around transit stations and adding shopping facilities to major transit stations.

3. Optimising the road network and use.

4. Encouraging walking and cycling. This could include introducing a public bike-sharing system.

5. Implementing transit improvements with easy access and intermodal integrations.

6. Controlling vehicle use. Options include the provision of high-performance public transport networks, for example BRT or rail systems with comfortable interchange facilities and distance-based pricing ('pay as you ride').

7. Managing parking. Approaches include limiting the allowed parking durations or the establishment of parking fees and clear marking of on-street parking.

8. Promoting clean vehicles. This could include vehicle scrapping or retrofit schemes for old vehicles.

9. Communicating solutions for a sustainable urban transport system comprehensively. Options include introducing awards to highlight bike-friendly behaviour and doing marketing campaigns for better public transport and cycling.

10. Approaching the challenges comprehensively by involving related stakeholders, including citizens.

Furthermore, the ASI approach does not dictate that there must be 'avoidance,' 'shifting' or 'improvement' in any particular instance. Rather, each should be considered and advanced as a means to enhance sustainability. Additionally, the concept of enabling is a critical addition to the framework. Essentially, sound policy and governance structures and basic technical and financial capacities at all levels must be in place as a prerequisite to effectively employ the framework (UN Secretary-General's HLAG on Sustainable Transport, 2016).

In addition, there are two perspectives on sustainable development that are not generally taken into account when discussing ASI: transition theory (a strong relationship between elements that meet community needs such as transport, markets, infrastructure and science) and sustainable lifestyles could be considered. Bakker et al. (2014) suggest a modified approach by incorporating Access into ASI (to become A-ASI). This approach is expected to enable a more long-term sustainability-oriented view of transport, development and climate change mitigation. However, institutional constraints that hinder an integrated and comprehensive implementation of the ASI approach are also relevant for A-ASI.

2.2.2 Transport Strategic Plan and Funding

Transport planning is a process that encompass future policies, objectives, resources inflow and design to fulfil the needs of mobility of people and goods. It provides developers, landowners and urban planners with a comprehension of how to integrate transport with spatial planning and development of relevant sectors. The study by Steiner (2009) defined transport planning using the following characteristics:

- Long-term prediction
- Comprehensiveness
- Manageability at the network level
- Applicability of all transport modes
- Efficiency of the entire system

Strategic planning of transport sector development must be in harmony with the overall economic development of the country. It also has to be dynamically adapted to investment opportunities of the public sector. It is also advisable that strategic planning is based on learnings from past projects, evaluations of past policies and analysis of relevant data.

The strategic planning should include indicators to evaluate progress towards goals and objectives that have been set. When selecting indicators, it must be ensured that the selected indicators provide useful information and cover various goals and objectives (Littman, 2011). For example, the planning process will cover the impact of air pollution. It may involve setting air pollution indicators (describing how air pollution will be measured), goals (the percentage of desired air pollution reduction), objectives (shifts in travel mode and energy sources) and targets (feasible changes in air pollution impact), and thresholds (levels beyond which the amount of air pollution is intolerable).

The UN Secretary-General's HLAG on Sustainable Transport (2016) points out that funding sources to attain goals that have been set should also be identified and the strategy to mobilise them should have been internalised. In order to achieve global sustainable transport, the annual investment needs are estimated at between US$1.4 and US$2.1 trillion. Innovative financing for sustainable transport is highly recommended to encourage policy-makers and financial institutions to build an advantageous investment climate. Aligning different sources of financing and incorporating them into the strategic plan will be a key factor for the accomplishment of the strategic plan's implementation. Aside from government funding, innovative financing for the transport sector is as follows:

A Private Sector Engagement
Partnership with the private sector to mobilise financial resources for sustainable development is one of the highlights in the Addis Ababa Action Agenda of the Third International Conference on Financing for Development. In the transport sector, private-sector engagement can be in the form of full private investment (for projects with a high internal rate of return, such as a toll road) or involving government intervention (public-private partnership). In a public-private partnership, the risk is allocated between parties that are best able to manage them at the lowest cost. In other words, the party that is best able to understand a risk, take charge of the possibility of its occurrence, and/or reduce the impact of the risk will be responsible for handling that risk (Hoyy, 2015).

The National Transport Strategy – Malta

Following its establishment in 2010 under Chapter 499 of the laws of Malta (Authority for Transport in Malta Act (Act XV of 2009)), the Authority for Transport in Malta embarked on preparations to establish a strategic approach to transport, which would integrate the planning of the different transport sectors.

These preparations laid the ground for the development of an integrated National Transport Strategy (NTS) with a time horizon of 2050 together with a Transport Master Plan (TMP) with a time horizon of 2025. The NTS consists of a vision outlining where Malta wants to be in the long term, the strategic goals, the strategic direction on how to get there and the indicators necessary to measure the progress of this strategy.

The UN Secretary-General's HLAG on Sustainable Transport (2016) points out that funding sources to attain goals that have been set should also be identified and the strategy to mobilise them should have been internalised. In order to achieve global sustainable transport, the annual investment needs are estimated at between US$1.4 and US$2.1 trillion. Innovative financing for sustainable transport is highly recommended to encourage policy-makers and financial institutions to build an advantageous investment climate. Aligning different sources of financing and incorporating them into the strategic plan will be a key factor for the accomplishment of the strategic plan's implementation. Aside from government funding, innovative financing for the transport sector is as follows:

A Private Sector Engagement

Partnership with the private sector to mobilise financial resources for sustainable development is one of the highlights in the Addis Ababa Action Agenda of the Third International Conference on Financing for Development. In the transport sector, private-sector engagement can be in the form of full private investment (for projects with a high internal rate of return, such as a toll road) or involving government intervention (public-private partnership). In a public-private partnership, the risk is allocated between parties that are best able to manage them at the lowest cost. In other words, the party that is best able to understand a risk, take charge of the possibility of its occurrence, and/or reduce the impact of the risk will be responsible for handling that risk (Hoyy, 2015)

National Agenda for Competitiveness and Innovation – Colombia

Under the National Agenda for Competitiveness and Innovation (2014–2019), new project management tools and institutional frameworks were introduced to enhance public-private collaboration that will help the country close the gaps in 11 priority areas: Institutional Framework, Regional Development; Science, Technology and Innovation; Agricultural Transformation; Industrial Transformation, Infrastructure, Transport and Logistics; Legality and Corruption; Justice and Rule of Law; Health, Education and Employment, with a focus on labour formality; macroeconomic stability and good practices in international trade and antitrust.

For the transport sector, the agenda aimed to enhance territorial integration and boost economic productivity by reducing travel times between production centres and ports by 30% and reducing vehicle operating costs by 20%.

B Fiscal- and market-based measures

In conjunction with the 'Avoid' and 'Shift' pillars in the Avoid-Shift-Improve approach, fiscal- and market-based measures can be both control instruments and sources of revenue. By utilising fiscal- and market-based incentives and disincentives, the public can be encouraged to avoid private motorised vehicles and shift to public transport and/or green vehicles. Fiscal- and market-based instruments in the transport sector include fuel taxes, carbon pricing, congestion pricing, parking management and fees, and vehicle registration and ownership charges.

Federal and State Taxes and Legislation – USA

In the USA, motor fuel taxes are taxes levied on petrol, diesel, and gasohol (a mixture of ethanol and unleaded petrol). In most states, levy per unit taxes are based on the amount of petrol purchased by a consumer. However, some states tie at least a portion of the motor fuel tax rate to a variable such as the price of petrol, inflation, and population growth.

Increasing motor fuel and other related taxes and fees could balance revenues with spending from the Highway Trust Fund. Congress and the administration need to agree on a long-term plan for funding surface transport. Increasing state taxes would provide states with additional revenue to maintain state transport assets.

C International Financial Institutions

Multilateral and bilateral financial institutions play an important role in sustainable transport development, especially in developing countries with limited access to investment finance. Aside from financial assistance, international financial institutions can also provide technical assistance to national or local governments in developing high-quality sustainable transport plans. Examples of multilateral and bilateral financial institutions are the African Development Bank (AfDB), Asian Development Bank (ADB), CAF-Development Bank of Latin America (CAF), European Bank for Reconstruction and Development (EBRD), European Investment Bank (EIB), Inter-American Development Bank (IADB), Islamic Development Bank (ISDB) and the World Bank.

D Climate Funds

Climate funds are the financial resources used to finance measures related to climate change impact mitigation and adaptation, which include low-carbon and green transport development. The main source of funds is the provision of financial resources pledged by developed countries under the UNFCCC. International funding mechanisms to support the achievement of sustainable transport include the Clean Technology Fund, Green Climate Fund and Global Environment Trust Fund.

2.2.3 Smart Cities

Referred to in the previous INTOSAI WGEA research, a smart city is defined as a city with intelligent 'smart (intelligent) physical, social, institutional and economic infrastructure while ensuring the centrality of citizens

in a sustainable environment' (INTOSAI WGEA, 2019). One of the distinct features of the smart city is 'smart mobility', where the strategic use of new technologies and innovative approaches enhance the efficiency of transport system. Smart mobility services include an autonomous transport system, intelligent traffic management and public transport with real-time timetabling and route optimisation, seamless travel and digital ticketing.

National Smart Cities Mission – India

The National Smart Cities Mission is an urban renewal and retrofitting programme by the Government of India, with the mission to develop smart cities across the country, making them citizen friendly and sustainable. The mission initially included 100 cities, situated in 36 provinces/union territories of India, with the deadline for completion of the projects set between 2019 and 2023. Typical features of comprehensive development in Smart Cities that related to transport development includes:

a) Promoting mixed land use in area-based developments – to make land use more efficient.
b) Improving pedestrian and cyclist networks. Necessary administrative services are also offered within walking or cycling distance;
c) Transit-oriented development (TOD), public transport and last mile para-transport connectivity; and
d) Applying smart solutions to infrastructure and services in area-based development in order to make them better, including smart parking and intelligent traffic management.

2.2.4 Transit-Oriented Development

Transit-oriented development (TOD) is a form of urban development that focuses the development of residential, commercial and leisure areas within walking distance of public transport. Typically, TOD includes a central transport hub that is surrounded by a high-density mixed-use area. It is also designed to be more walkable by using smaller block sizes and reducing the land area for motorised transport. Residents of TODs tend to make more trips by public transport compared to automobiles. They also tend to travel shorter distances for their activities (Zamir et al., 2014). TOD brings together elements of urban design, land use planning, transport planning, urban regeneration, real estate development, land value capture, and infrastructure implementation to achieve sustainable development.

Melbourne 2030-Australia

The Metropolitan Strategy Melbourne 2030 is the strategic planning policy framework of Victorian Government for the metropolitan area of Greater Melbourne for the 2001–2030 period. Within this period, the population of the area is projected to increase to over 7 million. The main elements of the policy are based on planning principles for Transit-Oriented Development, as follows:

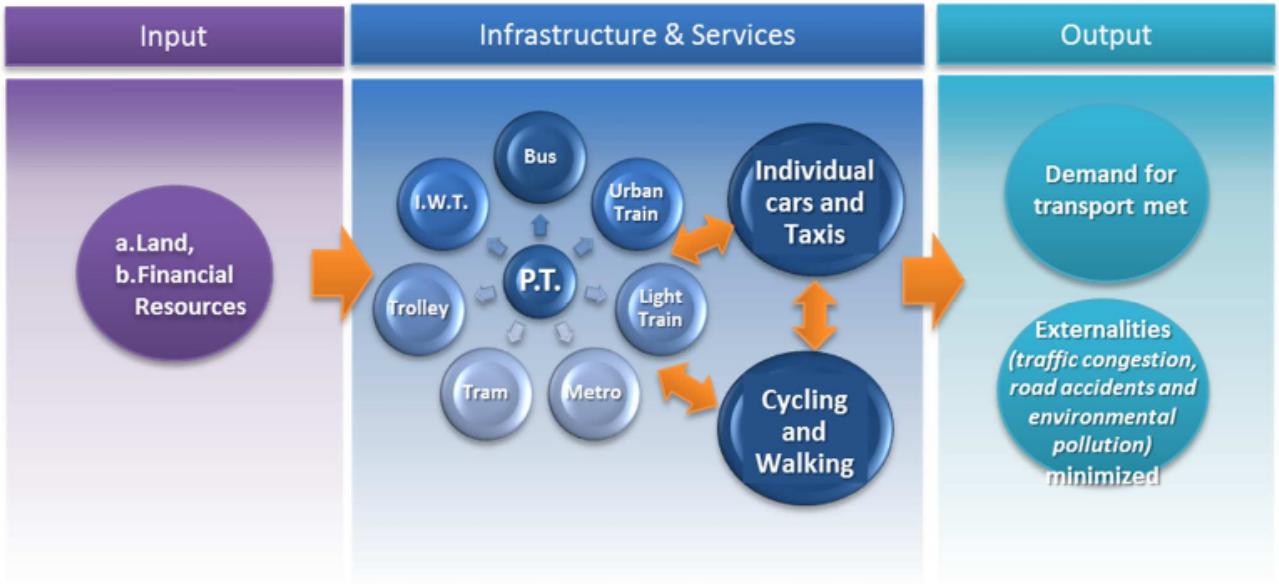
a) redirecting new development to allocated areas of inner and middle-ring suburbs;
b) concentrating development within designated activity centres close to transport nodes;
c) establishing legislated urban growth boundaries, with the aim of containing urban development.

2.2.5 Public Transport Development

Sustainable transport systems should be able to reduce the negative externalities while still providing their main service, which is improved mobility. One of the efforts to decrease the negative externalities from the transport sector is by shifting from private to public or mass transport. By using public transport, negative externalities such as emissions and congestion are greatly reduced. Public transport can also improve quality of life by reducing the travelling time of commuters and increasing fitness levels (citizens that use public transport walk more). Examples of public urban transport include city buses, trams, rapid transit, commuter trains and water taxis. Moreover, public transport between cities includes airlines, coaches, inter-city rail and ferries.

In relation to the 'shift' and 'improve' pillars of ASI approach, building an effective and efficient public transport system requires governments to convert available land and financial investments into relevant transport infrastructure and networks as well as maintaining the proper combination between public and private transport modes (United Nations Economic Commission, 2015). The cost-effectiveness of public transport should also be taken into account as it should be arranged with reasonable and optimised costs.

Figure 2.3 Sustainable urban transport system (UNECE, 2015)



A Public Transport Infrastructure

All public transport needs infrastructure in the form of roads, railways, airports and ports. The infrastructure can be dedicated to a specific mode of transport, such as mass rapid transit, or shared with other modes and private transport, such as roads. Investments in infrastructure make up a larger part of the total costs in a public transport network project.

Transport Infrastructure Development Strategy – Thailand

The strategy is consistent with the transport strategic plan, serving as a framework for integrating the development of the country's transport infrastructure in order to build the foundations of economic, social and environmental stability in the country. The strategy holds more details according to the road map for the development of transport systems in various modes, including the development of the intercity train network, the development of public transport networks to solve traffic problems in Bangkok and its vicinity, increasing highway capacity to bridge the country's vital production bases and to connect with neighbouring countries, development of the water transport network, and increasing the capacity of air transport services.

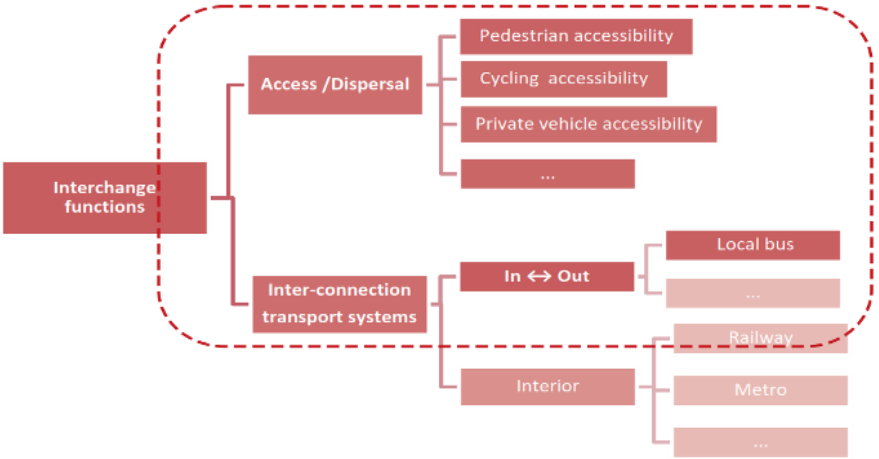
The Ministry of Transport is the main unit operating in terms of transport, transport development, transport business, traffic planning and the development of transport infrastructure, including coordination and integration with other agencies and stakeholders to achieve the said strategic plan.

B Interchanges

A transport interchange or transport hub is a place where passengers or cargo are exchanged between vehicles or transport modes (intermodality). Intermodal/mixed-mode commuting is mainly based on the concept of getting people onto the train network (or other main method for commuting) and then off the train network to their final destination.

Therefore, transport interchanges should also take into account access or dispersal through different modes of private mobility (walking, cycling, private vehicle, taxi, etc.) and in-out links (local bus, tram stops, etc.) (Dauden et al., 2014). Integrated ticketing is also encouraged to promote the use of public transport by simplifying the exchange between transport modes and eventually increasing the efficiency of the services.

Figure 2.4 Interchange functions (Dauden et al., 2014)



Jaklingko System – Indonesia

Jaklingko is a programme that integrates public transport's payment and physical connection between transport modes in Jakarta. The integration includes commuter trains, airport trains, mass rapid transit, bus rapid transit, common city buses, and public vans. The programme allows passengers to pay only IDR 5,000 (USD 0.35) in order to use several modes of transport with three hours. This programme is also expected to lower people's spending on infrastructure by 30 per cent.

Key players are local government, mass transport operators (municipally owned corporations), the association of city bus companies, and the public van owners' association. Local government acts as the regulator and implementer, while others act as the public transport operator.

B Accessibility

Public transport improves accessibility in terms of providing mobility to individuals that have no access to a private vehicle, such as the elderly, children that are too young to drive, and economically deprived individuals. For example, the design of public transport nowadays also accommodates the disabled in mobility, such as kneeling buses and low-floor access boarding on buses and light rail. Several subsidy schemes are also implemented in order to increase the affordability of public transport.

Public Transport Accessibility – Latvia

In Latvia, people with disabilities, orphans and other vulnerable groups are entitled to free public transport services. Families with three or more children are entitled to a 25% discount on public transport costs. Studies have shown that the public transport subsidy scheme has contributed to lowering the risk of poverty for families with three or more children (19.8% in 2016).

Moreover, most trams and buses in Riga have low floors or are equipped with special ramps for passengers with disabilities. Seats designated for people with disabilities are also available. Some taxi companies also offer services to passengers with disabilities.

2.2.6 Transport Demand Management

Transport demand management plays an important role in achieving the objective in the 'Avoid' pillar. It is the implementation of policies and strategies to reduce or redistribute the demand for travel in space and/or time. A demand management approach in the transport sector can potentially reduce congestion and air pollution, improve public health and leverage economic development. Transport demand management measures include promoting active transport and congestion pricing.

A Active Transport Infrastructure

Active transport, such as walking and cycling, is the main idea of the 'Avoid' pillar in the Avoid-Shift-Improve approach. Active transport or active mobility improves the health of the citizen by decreasing air pollution from motorised vehicles and reducing negative health problems that arise from physical inactivity and sedentary lifestyles. In order to encourage people to walk and cycle more, the government should develop cities that are compact and transport-oriented, and that

provide a safe and convenient active transport infrastructure. Centers for Disease Control and Prevention (2011) mentions strategies to develop active transport infrastructure, which include:

- Designing 'complete streets', which include pavements, cycle lanes and share-the-road signs to provide safe and convenient travel for all road users
- Improving infrastructure near public transport stations and interchanges, including bicycle parking
- Providing safe and convenient pedestrian and bicycle lane connections to public parks and recreation areas
- Providing safe road crossing infrastructure and traffic signs to direct pedestrians and cyclists to the safest and most direct routes
- Educating pedestrians and cyclist on laws and regulations as well as safe practices.

National Cycle Network – UK

The National Cycle Network (NCN) is the national cycling route network in the United Kingdom that was created by the charity Sustrans. It is built to encourage cycling and walking throughout the UK as well as for bicycle touring purposes. The network includes shared use paths, disused railways, minor roads, canal towpaths, and traffic-calmed routes in towns and cities.

There are nine principles to be met when designing the network, namely traffic-free or a quiet road, wide enough to accommodate all users, design that minimises maintenance, clearly and consistently signed, a smooth, well-drained surface, fully accessible to all legitimate users, avoiding places that are enclosed or not overlooked, step-free and safe road crossings, and attractive and interesting.

National Active Transport Strategy – Canada

The National Active Transport Strategy 2021–2026 is the Canada's first strategy to promote the construction and use of pathways, trails and cycle lanes. The strategy is guided by the ACTIVE/ACTIF framework, which is adaptable to the varied and shifting needs of Canadians, while prioritising key elements that will be crucial for the strategy's success: Awareness, Coordination, Targets, Investments, Value and Experience. The strategy is supported by the deployment of the Active Transport Fund, the first dedicated fund supporting the expansion and enhancement of active transport infrastructure across Canada.

A Congestion Pricing

Congestion is considered a negative externality and congestion pricing is a strategy to address the externality by using price mechanisms to charge users of public goods (a road, for example). Congestion pricing benefits society by reducing emissions and fuel consumption, making land use more efficient, reducing housing market distortions, expanding opportunities for civic participation, and providing additional revenues for transport development (US Department of Transport, n.d.). However, when such schemes have a cross-border impact, policies need to be coordinated to avoid distortions (e.g. longer routes undertaken to avoid paying congestion pricing).

Electronic Road Pricing – Singapore

The Electronic Road Pricing (ERP) is a system initiated by the Land Transport Authority (LTA), in which toll charges are levied on vehicles based on levels of congestion and time. This system allows a motorist to decide the time, route and destination of their journey in order to avoid congested roads. The LTA would also be able to increase charges on a heavily congested highway with the aim of reducing traffic.

Radio communication equipment, sensors and cameras are installed in the designated areas. Every vehicle is also fitted with an in-vehicle unit (IU), which is detected when the vehicle approaches ERP zones. The charges are deducted automatically from a smart card that is slotted into the IU.

Low-Emission Zone – European Union

A low-emission zone (LEZ) is a designated area where there is a restricted or deterred access for some high-emission vehicles with the aim of improving air quality. Consequently, certain alternative fuel vehicles, hybrid electric vehicles, plug-in hybrids and all-electric vehicles are allowed to enter the area. In many LEZs, vehicles that do not meet the emission standards set by the LEZ are fined if they enter the zone. A fine is not issued if entering the LEZ with a vehicle that does not meet the emission standards, when a fee has been paid.

2.2.7 Clean Fuels and Green Vehicle

A green vehicle is a motorised road vehicle that emits fewer emissions and are more environmentally friendly (not considering the life-cycle assessment). The 'Improve' pillar focuses on fuel and vehicle efficiency, which is closely incorporated with transport sector energy sources. Renewable and low-emission fuels have become the backbone of green vehicle development. Some examples of green vehicles are electric vehicles, hybrid vehicles, natural gas vehicles, biofuel vehicles and fuel cell-powered vehicles.

A Electric and Hybrid Vehicles

Electric vehicles are considered among the cleanest vehicles because they have practically no exhaust emissions. They run on one or more electric motors powered by rechargeable batteries. Compared to conventional internal combustion engine cars, electric cars have fewer overall emissions (considering the life-cycle assessment) (US Department of Energy, n.d). However, the indirect emissions of electric cars depend on the electricity mix of a country. A hybrid vehicle usually combines two energy sources, such as electric and petroleum, to power the vehicle. To encourage the shift from internal combustion engine to electric cars, the policy instruments to promote electric vehicles include tax (registration and ownership, which include greenhouse gases emissions in the tax calculation), infrastructure measures, financial incentives for purchasing, and research and development (Cansion et al., 2018).

National Car Fleet Renewal – North Macedonia

The objective of the programme is to use more advanced technologies in order to slow down the growing energy consumption in the transport sector, which is complex and has limited capabilities for energy use reduction. The measures include: reduction of VAT from 18% to 5% for hybrid and electric vehicles; direct subsidising of hybrid vehicles; and gradually equalling excise duties of diesel fuel and petrol.

The entities that are responsible for implementing the programme are the Ministry of Transport and Communications, the Ministry of the Economy, the Energy Agency, and end-users. The Ministry of the Economy, the Energy Agency and the Ministry of the Interior are responsible for monitoring the progress of the implementation.

B Natural Gas Vehicles

There are two types of natural gas that are utilised as energy sources in the transport sector: compressed natural gas (CNG) and liquefied natural gas (LNG). A natural gas vehicle is considered cleaner than one that runs on petrol and diesel fuel because it can reduce life cycle greenhouse gas emissions by 15% (84% if running on renewable natural gas) (US Department of Energy, n.d). Three types of natural gas vehicles are available, namely dedicated (run on only natural gas), bi-fuel (can be run on petrol or natural gas) and dual fuel (run on natural gas but use diesel fuel for ignition assistance). Existing petrol-powered vehicles can be converted to dedicated or bi-fuel natural gas vehicles. However, policy instruments to promote natural gas vehicles should be in place and implemented.

National Action Plan for Clean Mobility – Czech Republic

The global goal of the National Action Plan for Clean Mobility is to create a sufficient environment for the wider application of selected alternative fuels and propulsion in the transport sector in the Czech Republic, and to achieve conditions comparable in this area with other developed countries of the European Union. Electromobility was perceived as a standard technology and natural gas as a standard fuel, with hydrogen technology which has been being developed to implement certain basic measures for the development of this technology in the medium and long term.

C Biofuel

Biofuel is derived from biomass; therefore it is a renewable source of energy. The two most common types of biofuel are bioethanol and biodiesel. Bioethanol is mainly produced by the fermentation of sugarcane, corn and sweet sorghum. Bioethanol can be used as a fuel in its pure form (E100), but it is usually utilised as additives to improve performance and reduce emissions. Biodiesel is produced from transesterification of oils and fats and can also be used as a fuel in its pure form (B100). Because of performance issues, biodiesel is usually mixed with diesel fuel to reduce emission levels.

Bioethanol – South Africa

South Africa grows maize and sugar crops in excess of local needs, so is well positioned to produce bioethanol. Bioethanol can replace petrol from imported crude oil and save on valuable foreign exchange, contribute to the local economy, generate or save jobs and enhance energy security. The South African approach is based on a proposed 10% blend of ethanol into the petrol pool of about 11 billion litres.

The technology pathways that were considered for bioethanol to supply transport energy services were as follows:

a. Conventional petrol and hybrid engines fuelled by a blend of petrol and between 2% bioethanol (E2) and 10% bioethanol (E10) as per R671 for passenger and light freight vehicles; and
b. So-called flex-fuel internal combustion technology, fuelled by a blend of petrol and 85% bioethanol (E85). These vehicles can operate on conventional petrol and a range of ethanol/petrol blends, but were assumed to use E85 exclusively.

D Other Green Vehicles

Other clean energy sources in the transport sector include hydrogen, fuel cell and clean diesel. However, compared to electric vehicles, only some policies address specific issues related to hydrogen and fuel cell electric vehicles (FCEV). The lack of policies provides obstacles for the advancement of FCEV-related technologies that may otherwise be successful and competitive in the attempt to create a cleaner planet (Asif et al., n.d.)

The Strategic Road Map for Hydrogen and Fuel Cells – Japan

As a leader in hydrogen technology, and since the enactment of the Paris agreement, the Japanese Ministry of Economy, Trade and Industry published a strategic roadmap for hydrogen and fuel cells. This strategic roadmap is divided into three sections: hydrogen use in mobility, hydrogen supply chain, and other applications for a global hydrogen society. In spite of all the challenges in hydrogen use in mobility, Japan will continue to promote regulatory reform, technological development, and joint, strategic hydrogen station development within the public and private sectors.

The Roadmap for the Development of Hydrogen Energy – China

Chinese National Development and Reform Commission and the National Energy Administration jointly released a plan in March, 2022 on the development of hydrogen energy for the 2021-2035 period. By 2035, the proportion of hydrogen produced from renewable energy in terminal energy consumption will increase significantly, which will play an important supporting role in the country's green energy transformation.

The Hydrogen Strategies - European Countries

In 2020, ten governments adopted hydrogen strategies: Canada, Chile, France, Germany, the Netherlands, Norway, Portugal, Russia, Spain and the European Union (France had already adopted a Plan for Deploying Hydrogen for the Energy Transition in 2018). As of September 2021, four more strategies had been adopted (by the Czech Republic, Colombia, Hungary and the United Kingdom) and Norway released a roadmap to complete its strategy adopted in 2020. In addition, Poland and Italy have released strategies for public consultation and more than 20 other countries have announced they are actively developing theirs. (International Energy Agency Hydrogen Tracking Report – Nov 2021)

It is also worth noting that the public awareness about sustainable transport is also vital in order to generate a vision of an alternative future and pressure for action on transport. Public awareness activities can help to set the public agenda, policies and programmes on sustainable transport and influence what is discussed amongst national and local authorities, in the media, and in the community. There are many ways of approaching the issues of raising public awareness on sustainable transport, especially through campaign. A public awareness campaign on sustainable transport could cover many concerns about transport, such as clean air, congestion, safety, public transport, and condition for cyclists and pedestrians. Through the campaign, it is also hoped that people can feel that a change they make, like choosing more ecological and more sustainable type of transport such as the switch from driving to cycling, really has a positive impact for their environment.

2.3. Key Players and Roles in Sustainable Transport Management

In policy formulation and implementation on public transport management, various players and stakeholders have significant roles depending on the relevant national context; however, it basically consists of:

- National authorities related to transport and environmental subjects
- Territorial organisations and bodies of public territorial authorities/local government
- State companies/enterprises or private companies with (inter)national importance
- Independent research or advisory groups with national political influence
- Private organisations dealing with transport and environmental questions/NGOs
- National active groups (industrial, civil and environmental bodies)
- Media/press

(Vagland, A. and Viehauser, M.,1999)

National authorities and governments of various countries play a key role in promoting the sustainable

development of transport. Therefore, while SAIs understand the major means of transport and the challenges of sustainable development faced by the countries, they need to know what measures the governments are taking in terms of prevention or mitigation (such as what programmes have been carried out, what policy tools have been used and how effective are they), and government officials at all levels that are held accountable. With this information, SAIs may design key audit factors, such as audit objectives, audit objects, audit methods and audit effectiveness.

As mentioned previously, governments of various countries have taken actions to realise sustainable transport while coping with the challenges in this regard. For example, public policy tools, such as international protocols, domestic laws, policies or financial subsidies and market-based economic tools, may be used to authorise, fund and implement these actions. Below is a description of the common public policy tools and the above-mentioned issues

A International protocols and treaties

As a global topic, sustainable transport means there is a significant impact on countries all over the world, hence coordinated action is called upon by governments of various countries. In order to realise the goal of sustainable development of transport, governments have signed international protocols at global, bilateral, multilateral and regional levels. SAIs should see to the practice of these protocols and speed up the fulfilment of obligations by governments, and understand the conclusion and performance of protocols related to sustainable transport from relevant domestic institutions.

B Domestic laws

Governments of various countries have legal mandates to deal with issues and activities related to sustainable transport, including laws (acts of parliament or congress), regulations, rules and articles. Regarding sustainable transport, governments of various countries play various roles and undertake different duties. Therefore, there may be differences in the laws formulated and implemented.

Generally, the entry into force of international protocols on a country should take into account the domestic laws of the mentioned country. For example, if a country has signed an international protocol, the SAI should understand whether there is corresponding legislation and what the law enforcement is like. Certainly, in other cases, national laws may not be directly related to international protocols, and their primary purpose is to satisfy domestic needs. For example, the formulation and implementation of laws may be related to urban rail transit, urban trails, cycle lanes and road pollution control. As for most SAIs, the perfection of domestic laws is a prerequisite for compliance auditing.

C Policies/plans and fund subsidies

Governments of various countries generally lay down national policies or plans related to sustainable transport and provide subsidies as appropriate. Countries that pursue high-quality development, in particular, have incorporated sustainable transport into national development strategies. Policies allow for clear orientation and may include specific action plans and programmes. For example, the US Environmental Protection Agency (EPA), the Department of Transport (DOT) and the Department of Housing and Urban Development (HUD) launched a joint plan in 2010, covering a range of tasks related to sustainable transport planning, including traffic passage programmes, a bus-oriented urban development plan and overall downtown planning. Specifically, the HUD will allocate USD 40 million to put into practice a local urban planning programme that integrates support of urban low-income groups, job opportunities and public transport development; and the DOT will allocate USD 28 million to support programmes that promote transport, housing and economic development.

Governments of various countries have also promoted research programmes related to sustainable transport, which are generally linked to monitoring and evaluation databases as a way to evaluate whether the policies and funds invested have made positive changes.

The realisation of sustainable transport objectives is inseparable from financial support. The governments should encourage policy-makers, financial institutions and the private sector to establish an enabling investment environment and see that the funds are put into key strategies. For example, the eight multilateral development banks[4] (MDBs) are funding the development of sustainable transport in developing countries, and they issue annual reports detailing the progress of the supported sustainable transport work.

D Market-based economic tools

Guided by the principle of market operation, the economic tools applied by governments to practice sustainable transport policies generally derive from the market. These tools include financial subsidies, tax incentives and user charge reductions. For example, in Latvia, people with disabilities, orphans and other vulnerable groups are entitled to free public transport services; Singapore adopts a congestion charge policy in order to alleviate traffic congestion, performs rational allocation by using electronic toll collection systems, provides public transport, pedestrian and parking management systems that alleviate congestion by economic means, and it also imposes high taxes on vehicle purchases to control private car ownership.

4 African Development Bank (AfDB), Asian Development Bank (ADB), CAF-Development Bank of Latin America (CAF), European Bank for Reconstruction and Development (EBRD), European Investment Bank (EIB), Inter-American Development Bank (IADB), Islamic Development Bank (ISDB) and the World Bank.

3. Selection and Design of Sustainable Transport Auditing

This chapter guides the selection and design of sustainable transport auditing for the Supreme Audit Institutions (SAIs) and their auditors. As the topic of sustainable transport entails a broad range of aspects, audit institutions are facing tremendous challenges in selecting the appropriate scope of audit and designing targeted audit priorities, and even have no idea about where to start. In this regard, a systematic selection and design method in audit planning would be helpful for audit institutions to focus on their priorities. In this context, this chapter prepares three basic steps for the selection and design of sustainable transport auditing with a view to offering effective guidance and the application of future audit practices of SAIs across countries.

This chapter incorporates three basic steps as follows:

- **Step 1:** To understand the situation and challenges of sustainable transport
- **Step 2:** To select the audit topics and evaluate each priority
- **Step 3:** To set the objectives, audit question, techniques and methods of auditing sustainable transport.

These steps serve as general recommendations, and specific applications shall be adapted and adjusted according to the realities and needs of SAIs. The steps may be used to define the objectives, scope and criteria of an audit assignment, or to develop a long-term, risk-based work plan for a series of audits. SAIs that have selected the audit topic may skip these early steps, and move directly to Chapter 4 for targeted guidance on auditing sustainable transport. Similar to environmental auditing, sustainable transport auditing may check over issues related to finance and compliance, and evaluate performance based on the tasks and objectives set by the SAI. As sustainable transport often involves professional technical issues, many SAIs cooperate with external experts to gain a better understanding of specific issues or a clarification of viewpoints. SAIs may refer to the INTOSAI WGEA (2007) paper Evolution and Trends of Environmental Auditing for Better Application of Expert Recommendations.

3.1. Step 1: To Understand the Status and Challenges of Sustainable Transport

Chapter 1 provides the general background of sustainable transport and describes the global challenges and issues of common concern. Chapter 2 analyses the government strategies of achieving sustainable transport from a global perspective. However, as the relevance and urgency of certain issues may be particular to certain countries, this gives rise to a focus on sustainable transport. For the sake of formulating a feasible plan for auditing sustainable transport, SAIs must fully understand their domestic context and challenges in this regard.

3.1.1 Key question 1: What are the major modes of transport in the country?

While answering this question, auditors may consider the following matters:

Characteristics of the main transport system. For example, does the transport rely on a single mode of transport, such as waterway, road, air, or on multiple modes? And as land transport is further subdivided into high-speed rail, expressway, subway, light rail, railway or road, which of these constitute the land transport system in your country?

Transport-related authorities and activities. For example, which authorities are related to transport? What are their main activities? In a country with a well-developed public transport system, which authorities manage or control the fares, amount, coverage and frequency of buses or subways?

Sustainability of the transport system. For example, which transport systems are sustainable? If there is no sustainable transport system, how could one be built? What is the focus of this system? What is the relationship between transport and socioeconomic development? For example, which infrastructures may have major impacts on transport and trade? How can these infrastructures be planned and deployed? Are there enough funds and technologies to support the investment and operation? What is the status of the rural traffic network and is it safe? Has urban-rural connectivity been realised?

The relationship between transport and the ecological environment. For example, what modes of transport cause more pollution: roads, waterways or railways? With regard to air pollution (i.e. CO2, NOx, PM, SOx, O3) and noise pollution caused by traffic, have the environment authorities established traffic pollution evaluation criteria and conducted monitoring and control? How about the validity of obtained data? How were they obtained and stored?

3.1.2 Key question 2: What are the major challenges to sustainable transport?

This set of questions focuses on challenges in transport. Chapter 1 introduced the major challenges facing sustainable transport around the world. The auditors of SAIs should first understand the challenges in their countries and the threats to socioeconomic development and environmental quality improvement. In order to identify possible challenges, SAIs may obtain information from government bodies responsible for the sustainable development of transport, and other external partners such as universities, international organisations, local stakeholders, legal experts and media.

While identifying the challenges in the sustainable development of transport, auditors should bear in mind that, apart from direct driving factors such as urbanisation, population ageing and the globalisation of economic development, indirect driving factors such as social policy, culture, religion, climate, science and technology may also affect the development of sustainable transport. For example, as high temperatures and heavy rainfall mean walking or cycling cannot become the main mode of mobility, climate has been a particular challenge faced by Singapore in terms of the sustainable development of transport. In some cases, governments of various countries may fail to fully evaluate the challenges facing sustainable transport, the auditors may need to consult universities, social organisations or any agencies that have done such evaluation, or hire professional consultant SAIs. Generally, SAIs provide governments with the identified questions and recommendations in audit reports, which, however, mostly indicate the challenges and threats of sustainable transport that the government has not yet evaluated.

3.1.3 Key question 3: Who are the key stakeholders? What roles and duties do they hold?

The auditors need to determine the main stakeholders of sustainable transport. However, due to the large number of stakeholders (institutions or individuals), their interests may be consistent or contrary. In defining the key players involved, it is important to understand the overall system of sustainable transport management. There are analysis tools such as stakeholder analysis and responsible, accountable, consulted and informed (RACI) analysis.

Governments of various countries have different approaches to realising sustainable transport. In some countries, the government is responsible for the development of transport at the national level, including:

- laying down urban or regional plans
- developing a sustainable infrastructure policy
- defining public transport services
- monitoring and regulating environmental pollution on roads
- takine measures that are conducive to traffic safety.

Some countries delegate the specific duties of sustainable development of transport to lower-level governments. The mandates, roles and duties of governments at multiple levels are dramatically different. For example, central government usually lays down policies, while lower-level governments implement them. It is crucial for the auditors to understand what levels of government are relevant, and what roles and duties these levels carry. In addition, state-owned companies, private companies, communities, academic institutions and media should not be ignored.

3.2. Step 2: To Select the Audit Topics and Evaluate Each Priority

There are multiple factors that affect the sustainable development of transport. Nevertheless, it is difficult to carry out audits that are well-considered in every aspect as the time and resources of SAIs are rather limited. Therefore, it is necessary to choose the proper topic and determine the priority of sustainable transport auditing. SAIs may choose a macro topic according to its own capacity and needs, such as a full-scale traffic construction fund audit, or select a topic from the field, such as an audit of traffic safety or traffic pollution. Chapter 4 of this Guidance includes the following detailed information (including possible audit criteria, audit objects and questions) of the optional audit topics.

- Audit of sustainable transport planning
- Audit of sustainable transport fund
- Audit of sustainable transport safety
- Audit of environmental impact of sustainable transport
- Audit of new energy and the application of new technology to sustainable transport
- Other related audits of sustainable transport.

While choosing the audit topic and determining the priority, SAIs may consider the following four key questions:

3.2.1 Key question 1: What is the highest risk affecting sustainable transport?

SAIs need to carry out a risk analysis based on the domestic conditions of sustainable development of transport, and also to identify the most effective approach for the audit. Generally speaking, the key to evaluating the risks of sustainable transport lies in economic, social and environmental risks.

Economic risks. As for the transport sector with prominent public attributes, the level of fund expenditure and the structure of its sources are the primary factors affecting sustainable development of transport. SAIs should pay special attention to the sustainability of the construction and management funds of the transport sector, including whether the fund structure is balanced, the source is sustainable and profitability is practical. From a theoretical perspective, the sources of transport investment funds include:

a. assistance funds from international organisations such as the World Bank
b. public financial funds designated for transport specified by the laws and regulations of each country
c. national transport construction funds set out by the national development strategies and action plans of central government
d. local supporting funds invested by local governments in transport
e. private investment funds allowed to enter the field of transport
f. profits from transport projects.

Generally speaking, public finance funds are the main funding source of transport development. However, with the rise of investment models such as Public Private Partnership (PPP) and Build-Operate-Transfer (BOT), more and more private investments are stepping into the field of transport construction.

In addition, the adverse impact of transport development on regional economic growth, such as excessive financial deficits that may hinder local economic growth, the outflow of talents and the transfer of factors in underdeveloped regions, should also be given attention.

Social risks. As a remarkable achievement in human civilisation, transport is positioned to provide ser-

vices for human exchanges and social development. Hence, social services are the basic functions of the transport system. The social risks affecting the sustainable development of transport that SAIs should give priority mainly cover three aspects: safety, availability and equity

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a. Safety risks, including lack or absence of facilities such as expressway signs, emergency passages, brake failure buffers, temporary parking bays, damage to or insufficient brightness of street lights on both sides of the road.

b. Availability issues, including the pricing of transport tools such as aeroplanes, high-speed railways, ships, trains, subways, buses and taxis, and the degree to which all social classes are considered, especially low-income groups;

c. Equity issues, including urban and rural transport network connections, road construction and maintenance in rural areas (or mountainous areas, regions inhabited by ethnic groups, slum areas, etc.), planning, construction, and subsidies for urban and rural bus routes.

Environmental risks. SAIs should focus on resource utilisation, environmental pollution, and ecological damage in sustainable transport audits.

a. Resource utilisation, including the occupation of natural resources such as cultivated land, rivers, lakes and forests, and renewable energy development related to new-energy vehicles.

b. Environmental pollution, including road traffic pollutant emission control, limited issuance of urban private car licences, and low-emission/zero-emission replacement of buses and taxis.

c. Ecological damage, including the threats and impacts of transport modes such as aeroplanes, high-speed railways and ships on the surrounding ecosystems. For example, will they lead to degradation of biological habitats? The auditors must consider the severity of the impact and, if necessary, consult professional experts.

3.2.2 Key question 2: What added value will the audit bring about?

SAIs should evaluate the effectiveness of the government's measures to promote sustainable development of transport, and the auditors may consider the following questions:

- What are the interests of the main users of the audit report?
- What is the effect of auditing on government behaviour? Will it effectively promote economic development?
- What social impact might auditing exert? Will it mean the concept of sustainable development infiltrates people's minds?
- To what extent is auditing conducive to the coordinated development of transport and environmental protection?
- Has this topic been audited before?

3.2.3 Key question 3: Is the topic auditable?

- Has the government signed relevant international protocols on sustainable transport?
- Does the government obtain external funds from international organisations, such as the Global Environment Fund (GEF) or the World Bank?
- Has the government drawn up relevant domestic laws?
- Has the government drawn up targeted development plans?
- Are there funding plans related to sustainable transport incorporated in the government's public budget?
- Is the selected topic equipped with sufficient data and information?
- Are there enough auditors?
- Are the auditors qualified with requisite techniques?

3.2.4 Key question 4: Are SAIs entrusted with the mandate to audit the participants?

Upon clarifying the participants of sustainable transport in the second step above, SAIs should further confirm the scope of their jurisdiction. It is generally believed that direct or related users of public funds, state-owned assets and state-owned resources

should be incorporated in the scope of audit. The key audit objects should be government authorities directly involved in the sustainable development of transport, considering the global impact of their activities. In addition, some state-owned enterprises, private companies or social organisations may also be incorporated into the scope of the audit and become audit objects. As for all the audit objectives, auditors must be clear on their roles, so that the government may regulate their behaviours based on the audit report.

Based on SAIs' consideration of the four questions above, a risk-based topic priority evaluation model for auditing sustainable transport is developed, as shown in Figure 3.1. This simple tool is used to quantify the audit priority of various topics related to sustainable transport in the country. Specifically, for each potential audit topic (including but not limited to those provided in Chapter 4), a qualitative evaluation is carried out from four dimensions, i.e. risk level R, audit added value V, audit difficulty D and audit authority A, followed by assignment and quantification correspondingly (R is assigned 0−−5, V is assigned 0–4, D is assigned 0–3, A is assigned 0–2). The four dimensions are multiplied to obtain the priority score P, and its value ranges from 0–120.

Of particular note is that if any of the four dimensions (risk level, audit added value, audit difficulty, audit authority) takes a value of 0, then the priority score P of the audit topic will be 0, and the necessity and feasibility of the audit topic that represents a priority must be examined from four dimensions simultaneously. With regard to the criteria for qualitative evaluation of the four dimensions, SAIs do not need to and may not be in full accord. They may factor into consideration their domestic realities and practical needs and ensure that the same evaluation criteria are applied for all the potential audit topics. Therefore, the priority of each audit topic may be evaluated one by one according to the table below, and the priority score is sorted out and classified accordingly. The right-most column in the table divides the priority levels of audit topics into critical, imperative, urgent and pressing from top to bottom. Certainly, this is for reference only, and SAIs may adjust the specific classification criteria as per practical needs

Figure 3.1 Priority evaluation model of the topic of sustainable transport audit

Risk level R	Audit added value V	Audit difficulty D	Audit authority A	Priority P
Extremely high risk=5	Very high added value=4	Easy to audit=3	Directly audited=2	Score P=R*V*D*A
Very high risk=4	High added value=3	Can be audited=2	Audit extension=1	80~120 Critical
Moderate risk=3	Moderate added value=2	Difficult to audit=1	No audit authority=0	40~79 Imperitive
Low risk=2	Very low added value=1	Cannot be audited=0		20~39 Urgent
Very low risk=1	No added value=0			0~19 Pressing
No risk=0				

3.3. Step 3: To Lay Down the Objectives, Audit Questions, Techniques and Methods of Auditing Sustainable Transport

3.3.1 Key question 1: What are the main objectives of this audit?

From the perspective of the International Standard of Auditing (ISA 100), the types of audits generally include financial auditing, compliance auditing and performance auditing. On this basis, we form the following three objectives of potential sustainable transport audit in the aspects of information, behaviour, results and rules.

- Information authenticity (financial auditing): To audit the authenticity, quantity and distribution of key information related to the financial income and expenditure of financial funds and contracts signed by the main participants.
- Legality of behaviour (compliance auditing): To examine the compliance of the behaviour of the main participants with national laws and regulations, plans or signed international conventions.
- Effectiveness of results (performance auditing): To evaluate the performance of special funds and engineering projects in effectively improving sustainable transport.

3.3.2 Key question 2: What are the audit questions of this audit?

1 Main audit questions of financial auditing of sustainable transport

- Are there sufficient financial funds to support the development and construction of sustainable transport?
- Have the funds been used for sustainable transport construction been effectively managed?
- What are the evaluation criteria of the allocation of funds?
- Is the payment and use of funds subject to effective oversight?
- Have the funds been delayed in payment, left idle, or misappropriated for other purposes?

2 Main audit questions of compliance auditing of sustainable transport

- Do the main participants of sustainable transport comply with the international conventions or protocols signed by their country?
- Do the main participants of sustainable transport comply with the relevant laws drawn up by their government?
- Have the main participants of sustainable transport practised the policies, plans and programmes related to sustainable transport drawn up by their government?
- Do the main participants of sustainable transport exhibit behaviours that run counter to sustainable development?

3 Main audit questions of performance auditing of sustainable transport

- Have the relevant institutions defined the expected results of their programmes?
- Have they drawn up specific indicators and measures for these results, and are they effectively monitored and tracked throughout the process?
- Is the data for measuring performance reliable?
- Have the policies, plans and programmes of sustainable transport achieved their objectives and expected results?
- What are the reasons for not achieving the objectives and expected results, and how should these reasons be queried?

3.3.3 Key question 3: What techniques and methods can be used for this audit?

Upon confirming the audit topic, audit objective and investigative orientation, we need to further consider the specific techniques and methods for implementing audits. In the practice of traditional environmental auditing, the most commonly used approaches are review, observation, questionnaire, conference, interview, statistics, comparison, etc., which may still be applied to any topic, objective and orientation of sustainable transport audit.

With the advance of science and technology and the development of theory, recent years have witnessed the rise of new audit techniques and methods, such as big data audit, 3S (GIS/GPS/RS) audit, visual audit and composite evaluation audit. As shown in Figure 3.1 this Guidance presents these emerging audit methods under different audit topics and audit objectives. It should be clarified that they only serve as recommendations for the practice of auditing sustainable transport. In practice, SAIs may choose audit techniques and methods as per their domestic capacity and concrete needs.

Table 3.1. Optional techniques and methods for auditing sustainable transport

Audit topic	Audit objectives, optional techniques and methods		
	Financial management	**Compliance auditing**	**Performance auditing**
Audit of transport planning	✔ Big data method[5] ✔ Visual complex analysis[6]	✔ Visual complex analysis ✔ 3S (GIS/GPS/RS) method[7]	✔ Visual complex analysis ✔ 3S method ✔ Composite evaluation[8]
Audit of transport fund	✔ Big data method ✔ 3S method	✔ 3S method	✔ Visual complex analysis ✔ 3S method ✔ Composite evaluation
Audit of traffic safety	✔ Big data method ✔ Composite evaluation	✔ Big data method ✔ Composite evaluation	✔ Big data method ✔ Visual complex analysis ✔ Composite evaluation
Audit of intelligent transport	✔ Big data method ✔ Composite evaluation	✔ Big data method	✔ Big data method ✔ Composite evaluation
Audit of environmental impact of transport	✔ Big data method ✔ Composite evaluation	✔ Big data method ✔ Composite evaluation	✔ Big data method ✔ Visual complex analysis ✔ Composite evaluation
Audit of new energy and circular economy in transport	✔ Big data method	✔ Composite evaluation	✔ Big data method ✔ Composite evaluation

5 Big data method: Using a large amount of economic and social data with scattered sources and diverse formats to carry out in-depth mining and analysis across levels, across regions, across systems, across departments and across businesses, so as to better find problems, conduct macro analysis and evaluation in the audit process.

6 Visual complex analysis: Using computer image processing technology, massive scientific data is transformed into intuitive physical phenomena or physical quantities expressed in graphics and images, which change with time and space, so that auditors can more easily observe and find hidden problems.

7 3S (GIS/GPS/RS) method: Includes remote sensing (RS), geographic information systems (GIS) and global positioning systems (GPS). It is a modern information technology that combines space technology, sensor technology, satellite positioning and navigation technology, computer technology and communication technology, and highly integrates multiple disciplines to collect, process, manage, analyse, express, disseminate and apply spatial information. It has greatly expanded the source of audit data.

8 Composite evaluation converts a large number of indicators/variables into one indicator/variable that can reflect the comprehensive situation to evaluate the audit object, mainly including the multi-level analysis method, principal component analysis method, data envelopment analysis method, fuzzy evaluation method, and so on.

Implementation and Cases of Sustainable Transport Auditing

This chapter is devoted to the cases on sustainable transport auditing from SAIs all over the world. In these cases, key information about audit objectives, criteria, scope, findings and recommendations will be covered as much as possible.

This chapter is divided into the following five parts, covering the main topics of sustainable transport auditing described in Chapter 3:

- Audit of sustainable transport planning
- Audit of sustainable transport funding
- Audit of sustainable transport safety
- Audit of environmental impact of sustainable transport
- Audit of new energy and new technology application to sustainable transport

Each part consists of:

- A brief introduction to case background
- Audit criteria derived from international conventions or agreements, laws, policies, plans and programmes in line with the principle of international generality
- The main players in line with the principle of international generality
- Research questions in line with generality
- Several typical cases.

The main sources of the audit cases in this chapter:

- The questionnaire on sustainable transport auditing sent to SAIs around the world
- The information about sustainable transport auditing provided by SAIs around the world
- The websites of the United Nations
- The website of INTOSAI WGEA
- The websites of SAIs.

Table 4.1. Cases of sustainable transport auditing

Sustainable transport planning	SAI China	2021	Sustainable transport auditing of the Changsha-Zhuzhou-Xiangtan Region
Sustainable transport funding	European Court of Auditors	2020	An Audit Project of the Implementation of the Sustainable Urban Mobility Plan
	SAI China	2014-2019	An Audit of the Grant Project of the Global Environment Fund
	SAI Czech	2019-2021	Audits in support of public urban and regional transport; on funds earmarked for the modernisation of a transit railway corridor and on construction, maintenance and repairs of cycling infrastructure
Sustainable transport safety	SAI Canada	2011, 2015 and 2020	Real-time Audit of Dangerous Goods Transport
Environmental impact of sustainable transport	SAI India	2017	A Compliance Audit of Vehicular Emissions by State Transport Undertakings in the Province of West Bengal
	SAI Korea	2007	Environmental Audit of Air Quality Improvement Project: Control of Diesel Emission Plan
New energy and new technology application to sustainable transport	SAI UK	2017	An Audit Project of the Environmental Committee Recommendation on Meeting Decarbonisation and Renewable Energy Targets
	SAI Czech	2010	An Audit Project of Intelligent Transport on Road Infrastructure

4.1. Audit of Sustainable Transport Planning

Background

Transport is the basic, lead and strategic industry, and also an important service industry, in national economies, giving great support to sustainable development. The aim of sustainable transport planning is to optimise the utilisation of limited temporal and spatial resources. The following principles shall be adhered to generally: priority is given to serving people rather than vehicles, and great emphasis is placed on low-cost transport such as walking and cycling; policies aimed to facilitate the development of urban transport shall be emphasised; the mode of land utilisation with high accessibility and low transport demand is emphasised, and a reasonable transport structure and the analysis of transport capacity shall be highlighted; an environmental impact assessment shall be carried out actively to minimise the transport environment costs and negative social impacts; the smooth transition between various modes of transport shall be realised, and the transformation towards the means of transport with lower carbon emissions and higher efficiency shall be promoted, such as the transformation from road transport to high-speed railway transport; and the role of modern transport management technologies in urban transport systems shall be emphasised, such as smart cities and intelligent driving.

Urban sustainable transport planning can be divided into three levels.

A Strategic planning focuses on the long-term development strategies for urban transport. According to land use planning, ecological environment capacity, population development and distribution, and economic development planning, it aims to research the future needs of urban transport, with a planned research period of 20–50 years.

B Medium and long-term planning aims at the positioning and scale of various lines and facilities in the whole transport network, as well as the construction of relevant projects. With the aim of meeting transport demand, optimising resource utilisation and improving environmental quality, it deepens and refines strategic planning for the sustainable development of urban transport, with a planned research period of 5–20 years.

C Short-term planning focuses on proposing the measures that need to be taken in the next 1–5 years based on the analysis and evaluation of the current sustainable development of urban transport. It mainly includes the evaluation of the current sustainable development of urban transport, the planning of transport networks, the design of road transport construction, and the effect analysis of major projects and implementation support.

Audit criteria

- Targets of SDGs and international agreements
- National overall plan for transport development
- National special plan for transport development
- Implementation programme or plan for transport development released by local governments
- Other related transport plans, such as a special plan for urban public transport.

Players

- **The national planning department** represents the overall interests of the country and is responsible for proposing the prospects and blueprints of national transport planning under the background of national space planning.
- **The transport department** is responsible for implementing the national transport plan, determining the scale and direction of transport investment, and submitting construction programmes/plans to government/congress, or reviewing and approving the transport investment projects under national plans within the authority.
- **The project construction department** is responsible for the construction of transport investment projects, such as railways, highways or bridges.
- **The project operation department** is responsible for the operation and maintenance of transport projects after completion, including railways, civil aviation or expressway operation.
- Transport users mainly include the users of land transport, water transport and air transport.

Research questions

- **Whether plan-related data is available.** For example, the Audit Bureau of Jordan found that the lack of audit data in the planning department has an adverse effect on the extraction of necessary data; the Office of the Auditor General of Thailand found that the lack of unified data collection systems between departments leads to low quality of the data collected and the data cannot be analysed.
- **Whether the plan is based on actual condition.** Planning is not based on the actual condition of some countries. For example, there is a large gap in investment in transport infrastructure in many developing countries with large populations. Some developed countries are faced with a low public transport utilisation rate. The fundamental reason is that the actual needs of road users are not considered in the plan, which leads to the shortage or excess of transport investment.
- **Whether the plan considers stakeholders.** The

participation of major stakeholders may not be emphasised enough. For example, the relative ministry or agency does not enable local communities and residents to fully participate in the preparations for road infrastructure, which may affect communities on a larger scale and compromise the transparency of sustainable development goals.

- **Whether the plan is scientific and reasonable.** Poor planning will lead to low transport construction efficiency. For example, the completion of a transport construction project in India has been delayed by 2,899 days due to early planning flaws such as the slow procedure of land expropriation and the unavailability of barrier-free venues. Another project, which aims to alleviate traffic congestion, has not been completed 10 years after approval due to poor planning and the lack of a comprehensive investigation.
- **Whether the planning process meets the requirement of compliance.** For example, an audit project for a smart grid and smart city in Australia discovered that regular and honest assessment and selection regarding the allocation of funds will help ensure transparency and clear responsibility, but there are still many flaws in the process. As shown by relevant department records, the independent assessment team has evaluated the performance of each applicant and ranked them based on the assessment results. However, this assessment evidence has not been retained.
- **Whether the plan is under effective monitoring and evaluation.** It is especially important to monitor and evaluate the plan to ensure that it is scientific and effective. For example, an audit project on the effectiveness of a space planning project implemented by the space planning authority in Indonesia found that the government has not yet formulated the standards and procedures for monitoring and assessing space planning, and there is no government department responsible for relevant work.

Audit case studies

Case 1: SAI China: sustainable transport auditing of Changsha-Zhuzhou-Xiangtan Region

In 2021, SAI China conducted a performance audit entitled 'The sustainable transport status in Changsha-Zhuzhou-Xiangtan Region'

Audit Objectives

To audit the development of sustainable transport in Changsha-Zhuzhou-Xiangtan Region

Audit Scope:

- The transport planning and design of Changsha-Zhuzhou-Xiangtan Region
- The public fund investment in urban transport and project implementation
- The development of urban green transport and intelligent transport

Audit Criteria

- China's National Plan on the Implementation of the 2030 Agenda for Sustainable Development
- Sustainable Development of Transport in China (White Paper)
- Outline of the Integration of Changsha-Zhuzhou-Xiangtan Region
- Five-year Action Plan for the Integration of Changsha-Zhuzhou-Xiangtan Region

Findings

- The scientific planning and implementation of transport network construction is far from satisfactory. The goal of urban transport micro-circulation and rapid transport has not been achieved. A collaborative and efficient transport junction system has not yet been formed. The development potential of transport structure adjustment has not been fully realised.
- The factors supporting the sustainable development of transport are still inadequate. The funds devoted to transport development are under pressure. The contradiction between transport development and resource factor is increasingly prominent.

- The development of intelligent transport and green transport needs to be further accelerated. There are some limitations in the development of new-energy vehicles. The control over the environmental pollution caused by fossil fuel vehicles must be strengthened. The construction and management of car parks needs to be improved

.

Recommendation

- The high-level and comprehensive planning of the integration of Changsha, Zhuzhou and Xiangtan should be carried out at a faster pace.
  - The transport interconnection structure should be optimised.
  - System connection and efficient transfer between multiple transport structures should be enhanced.
  - Capabilities of transport should be improved to serve the economic development of the city agglomeration. Great emphasis should be placed on the cross-city connection of public transport
  - The role of transport in promoting the integration of Changsha-Zhuzhou-Xiangtan Region should be brought into full play.
- Strengthen the scientific layout and advance the implementation of transport network construction. Further efforts should be made to improve the efficiency of urban transport micro-circulation, improve and transform the branch road network, further mitigate traffic congestion, propose the concept of a rapid transport system, build a collaborative and efficient transport junction system, tap the potential for transport structure adjustment, and exert the unique advantage of water transport channels.
- Strengthen the support for increasing the capability of sustainable transport.
  - Fund channels for transport development should be diversified.
  - Transport investment pressure of local governments should be reduced.
  - Income potential of existing transport affiliated resources should be released.
  - Contradiction between transport development and resource constraint should be well handled.
  - Resources should be reserved for the sustainable development of transport in a forward-looking, comprehensive and long-term manner.
- Advance the development of intelligent transport and green transport.
  - Greater emphasis should be placed on the development of new energy-source vehicles, and increasing the construction of affiliated facilities.
  - Strengthen the control over environmental pollution caused by fossil fuel vehicles.
  - Eliminate the blind zones for control over emissions from non-road mobile machinery.
  - Enhance the standardisation and intelligence of urban car park management and systemically improve urban parking management capabilities.

4.2. Audit of Sustainable Transport Funding

Background

The investment in transport infrastructure requires a large quantity of funds. It is estimated that the global investment in transport in the next 15 years will reach USD 1 to 2 trillion per year. The global source of funds for sustainable transport mainly includes:

- **International development assistance.** Some smaller countries still rely on development assistance. For example, the sustainable urban development project of Malaysia utilises a fund of USD 3 million from the Global Environment Fund (GEF) and mutual aid of USD 18 million to solve the needs of energy, transport and architecture in Malacca. The comprehensive sustainable urban planning and management project for Abidjan, Côte d'Ivoire, aims to improve mobility planning, transport infrastructure and urban air quality, with a fund of USD 6 million from the GEF and mutual aid of USD 21 million.

- **Public financial funds.** In most countries, the government is the major investor in the transport sector and can increase investment in various ways. Transport is given priority in the public budget, especially for sustainable transport. For example, the London Green Bus Fund initiated by the EU devoted USD 150 million to reduce traffic carbon emissions. In addition, the government can take measures to limit expenditure that do not meet the requirements of sustainable development, such as fossil fuel subsidies, slower update of new energy technologies, and the extended service life of fossil fuel vehicles.
- **Private investment.** In the case of insufficient public finance and limited financing modes, private investment has been playing an increasingly important role in transport infrastructure. The mode of PPP (Public-Private Partnership) has been adopted for financing by many countries. A supportive policy and a. legal and regulatory framework should be established at the government level, and there should be sufficient market interests to attract private investment.
- **Capital market.** In some developing countries, the capital market has become one of the sources of funding, such as government bonds, municipal bonds and project bonds. Moreover, multilateral development banks can help countries expand financing for the transport sector, formulate relevant policies to release transport financing, support the development of the capital market and build a public-private partnership framework. For example, the African Development Bank Group adopted comprehensive measures to address the challenges facing rural transport in the Sirari Corridor Accessibility and Road Safety Improvement Project in Kenya. The project cost reached USD 280 million, 25% (USD 69 million) of which was dedicated to building rural branch roads and related social infrastructure.

Although the funds for sustainable transport can be acquired through various channels, raising sufficient funds is still a major challenge facing the 2030 Agenda for Sustainable Development. Inland developing countries and those countries in special situations are facing greater challenges in attracting international investment and thus require more support to bridge the gap in terms of economics, geography and infrastructure and attract investment. According to Sustainable Urban Mobility in the EU: No Substantial Improvement Is Possible Without Member States' Commitment, more than 60% of the official development funds for economic infrastructure and service sectors are acquired in the form of loans, and are mostly devoted to to transport and energy sectors. According to the Report of the Secretary-General on Progress Towards the Sustainable Development Goals delivered at the United Nations High-level Political Forum on Sustainable Development, foreign direct investment flows have been reduced by 40% compared with 2019 due to the COVID-19 pandemic.

Against this backdrop, it is highly important for many countries to formulate and implement a comprehensive financing framework so as to support and fund the strategies for sustainable transport. For example, the international co-operation framework of the Belt and Road Initiative proposed by China can help to solve the above financing issues faced by developing countries to some extent. Relevant research shows that projects under this initiative have led to the construction of several important railways and ports in the countries along the route of the Belt and Road Initiative, such as the Mombasa–Nairobi Standard Gauge Railway in Kenya, the Addis Ababa–Djibouti Railway across Ethiopia and Djibouti, the Abuja-Kaduna Railway in Nigeria, the Ankara-Istanbul High-speed Railway in Turkey, the Benguela Railway in Angola, Piraeus Port in Greece, Gwadar Port in Pakistan, Hambantota Port in Sri Lanka and Kyaukpyu Port in Myanmar. This initiative also contributed to the completion of 30,000 kilometres of roads and more than 6,000 kilometres railways in Africa. Recent research from the World Bank shows that the Belt and Road Initiative will reduce global trade costs by 1.1% to 2.2%, decrease trade costs in the China/Central Asia/West Asia Economic Corridor by 10.2%, and will greatly promote economic

development. Therefore, the auditing of such financing and funds for sustainable transport has become a popular topic of many SAIs.

(Please view the Report of the First United Nations Global Sustainable Transport Conference, Financing for Sustainable Development Report 2019, and the web page https://baijiahao.baidu.com/s?id=1646879002380285065&wfr=spider&for=pc for more information)

Audit criteria

- **Sustainable development goals.** According to Target 11.2 of Goal 11 of Sustainable Cities and Communities in the United Nations Sustainable Development Goals 2030, '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.' Being affordable can be used as an audit criterion for the use of sustainable transport funds.
- **International conventions or agreements.** For example, at the 2012 United Nations Conference on Sustainable Development (Rio+20 Summit), some multilateral development banks made commitments to raise USD 17.5 million. The international conventions or national plans above can be used as the audit criteria for financing commitments and planning implementation by relevant departments.
- **Laws, policies and plans.** The laws, policies and plans related to sustainable transport mainly involve fund source, management, use and performance evaluation, all of which are important sources of audit criteria for sustainable transport funds.

For some objectives or projects, some governments and international organisations will lay out special plans or establish special funds, which can also be used as an important source of audit criteria. For example, the EU allocated a special financial fund for sustainable transport projects and relevant research for the Sustainable Urban Mobility Plans released in 2013. The Global Environment Fund provided grants for environmentally friendly projects in developing countries.

Players

- **Transport management department.** Responsible for the proposal, scale and direction of transport infrastructure investment plans, approving construction projects in accordance with national regulations; submitting financial policies on transport investment to government or congress, and supervising the implementation of projects.
- **Project construction department.** Responsible for the construction of transport projects.
- **Project operation department.** Responsible for operation and maintenance after the completion of transport projects.
- **Investment department.** Responsible for the funding for transport projects, including international assistance agencies such as the Global Environment Fund, financial departments, financial institutions, foreign investors and private sectors.

Audit questions

- Whether there are sufficient funds to ensure the construction of sustainable transport.
- Whether a financing plan is in place and the rationality, compliance, feasibility, sustainability and anticipated risks of financing models have been evaluated.
- Whether the financing plan for sustainable transport has been implemented effectively.
- Whether the allocation, management and use of public funds for sustainable transport projects are authentic, legal and efficient.
- Whether the management and use of the operational income of sustainable transport projects are authentic and legal.
- Whether the mechanism of PPP projects, such as investment return mechanism and risk sharing mechanism, are completed; whether the exit mechanism and performance evaluation indicators are established.

Audit Case 2: An Audit Project of the Implementation of Sustainable Urban Mobility Plan by the EuropeanCourt of Auditors (2020)

The EU is investing substantial amounts to help cities improve their mobility and make it more sustainable. In 2018, the European Court of Auditors conducted an audit to examine the extent to which EU support was effective in contributing to improving urban mobility in a sustainable way.

Audit Objective

Assess whether cities followed EU guidelines and targeted EU funding to achieve more sustainable urban mobility.

Audit Scope

- Availability and content of the sustainable urban mobility plans.
- Traffic congestion fee and the potential of cycling in Copenhagen and Stockholm.
- Other relevant strategies and plans.

Audit Criteria

- Relevant polices and documents released by the European Commission.

Audit Methodology

- Document review, field visit, project assessment, questionnaire, big data analysis and expert opinion.

Findings

- In the absence of legislative compulsion, there was limited take-up of the Commission's guidance on the part of many member states and cities – notably in terms of preparing 'Sustainable Urban Mobility Plans'. Neither is there a requirement for access to EU funding to be conditional on having these plans in place.
- Some member states and cities did not complement EU funds effectively with appropriate resources to ensure the adequate operation and maintenance of their public transport network; costs can also rise because lines are not always technically interoperable.
- The examined projects in receipt of EU funding were not as effective as intended, because of weaknesses in project design and implementation.

Recommendation

- Build on its previous experiences to publish better data on urban mobility and the extent to which the EU's most important cities have sustainable urban mobility plans in place.
- Link access to EU funding to sustainable urban mobility plans.

Source: https://op.europa.eu/webpub/eca/special-reports/urban-mobility-6-2020/en/
https://www.eca.europa.eu/Lists/ECADocuments/SR20_06/SR_Sustainable_Urban_Mobility_EN.pdf

Audit Case 3: An Audit of the Grant Project of the Global Environment Facility by SAI China

From 2014 to 2019, SAI China conducted a series of audits for the Large-City Congestion and Carbon Reduction Projects and City Cluster Eco-Transport Projects granted by the Global Environment Facility (GEF). These audits aimed to examine the use of granted funds, compliance with applicable provisions of state laws and regulations and the grant agreement of the relevant entities, its internal financial control, project management and project performance during the project implementation process.

The below is a summary of the audits:

Audit Objective

- To offer audit opinions on financial statements, evaluate the adequacy of the accounting policies selected and the rationality of accounting estimates.
- To evaluate the overall presentation of financial statements.

Audit Scope

- The special purpose financial statements and

Notes to the Financial Statements.
- The fund withdrawal application and relevant materials submitted to the World Bank within the period.
- Compliance with applicable provisions of state laws and regulations and the grant agreement of the relevant entities, its internal financial control, project management and project performance during the project implementation process.

Audit Criteria
- The accounting standards and accounting systems in China.
- The grant agreement.
- The National Auditing Standards of China.
- The International Standards of Auditing (ISA).

Audit Methodology
- The assessment of major misstatement risks.

Findings
- Some local transport departments retained the supporting funds from central government.
- Some consultation agencies made up expert rewards to increase contract quotes.
- The cost of some conferences had exceeded the acceptable level.

Recommendation
- Relevant local transport authorities should allocate the retained project funds, and calculate and return the interest generated during the retention of the funds.
- Further measures should be taken to recall the false contract price, recover the loss of grants in a timely manner, strengthen project procurement and implementation supervision, and prevent similar problems from happening again.
- The relevant departments should be urged to strictly enforce the standards for conference costs.

Audit Case 4: Audits on support for public urban and regional transport; on funds earmarked for modernisation of transit railway corridor, and on construction, maintenance and repairs of cycling infrastructure

From 2019 to 2021, a number of sustainable transport auditing projects were carried out in the Czech Republic. The audit projects focused on whether the financial support for sustainable transport projects has achieved the expected results, whether fund budgets are clarified, as well as the use and benefits of funds.

Audit Objective
- Examine the financial support for public urban transport, which was distributed between 2014 and 2018 by the Ministry of Regional Development (MoRD).

Audit Scope
- More than 12.5 billion CZK (Czech Crowns) from EU Funds.

Findings
- Only one fifth of newly purchased vehicles served to expand the vehicle fleet and to diversify the services provided.
- Only 21% of the vehicles acquired by beneficiaries served to expand the fleet and thus to increase the number of connections. Most of the funds were used to replace old cars with new ones.
- The beneficiaries reported unrealistic data on how the number of transported persons increased as a result of the project. In fact, the MoRD failed to set up a mechanism for data verification and error prevention.
- The subsidy beneficiaries bought some electric buses with independent oil-fire heating, which was not consistent the financial support aimed to make public transport more environmentally friendly. Very few bidders came forward in the tender for suppliers of cleaner vehicles, limiting the competition to a certain extent.
- The MoRD had failed to unequivocally prohibit beneficiaries who acquired a subsidy to purchase

new, cleaner vehicles, continue to use their old, less environment friendly vehicles to transport passengers.

Recommendation

- Devote support to strategic projects that are interlinked with other measures.

Case source: https://www.nku.cz/scripts/detail.php?id=11094
Other audit projects undertaken: A. SAI Czech (2020): Construction, maintenance and repairs of cycling infrastructure (Audit No. 20/11).
B. SAI Czech (2014): Funds earmarked for modernisation of III. and IV. transit railway corridor (Audit No. 15/14).
Case source: https://www.nku.cz/scripts/rka-en/detail.asp?-cisloakce=15/14&rok=0&sestava=0

4.3. Audit of Sustainable Transport Safety

Background

As many as 1.25 million people die in road traffic accidents every year. Ninety percent of these accidents occur in developing countries, with 20 to 50 million people getting seriously injured in road traffic accidents. As noted in the Agenda 2030 for Sustainable Development adopted in September 2015, road safety must become a top priority for transport. The United Nations encourages its member states to use and implement the norms, standards and conventions that support the development of sustainable transport. It was pointed out at the first United Nations Global Sustainable Transport Conference in November 2016 that sustainable development would not be possible without traffic safety. The United Nations General Assembly organised three global ministerial meetings with the theme of road safety. The international community must adopt more measures to reduce traffic accidents, and strive for the sustainable development goal of reducing the number of casualties from road traffic accidents by 50% by 2030. The European Union has invested 170 million euros in road safety in line with the Sixth Framework Programme, Seventh Framework Programme and Horizon 2020. In April 2019, the European Commission and the European Investment Bank jointly launched a 'safer traffic' platform; the European Investment Bank is paying more attention to road safety issues worldwide and is providing financial and technical assistance in the sectors of infrastructure, research and development for projects conducted by public and private sectors. China has included sustainable transport into the '13th Five-Year Plan', and set the goals of reducing carbon emissions from transport by 7% and reducing traffic accidents by 50%; Japan has enforced traffic safety measures such as seat belts and helmets to reduce road mortality; Thailand has launched a 20-year transport strategy plan, covering efficient, green and safe transport as well as inclusive and technological innovation; bus rapid transit systems have been successfully implemented in India and Colombia; and the EU has greatly reduced deaths and injuries from road traffic accidents by upgrading the infrastructure safety, and building the knowledge base for reliable road safety measures.

The harm from traffic accidents can be prevented. Effective interventions mainly include joining and implementing the United Nations Convention on Road Traffic, and considering road safety factors in land use, urban planning and transport planning; implementing relevant United Nations conventions about traffic rules and signs, vehicle management, inspection and dangerous goods transport; strengthening education on road safety, introducing technical measures to control hazardous driving; making necessary investment in road safety, emphasising engineering design and road enforcement, ensuring that safety should be taken into account in all investment in transport infrastructure, setting up road signs and marks, improving road infrastructure, installing cameras and safety checkpoints for monitoring road transport, and releasing regulations on vehicle safety.

Audit criteria

- The Midpoint of the Decade of Action for Road Safety 2011–2020

  In March 2010, the United Nations announced that 2011–2020 was the decade of action for

road safety and called on its member states to work on 'road safety management, road and motor vehicle safety, vehicle safety, road user safety, and response to traffic accidents', so as to reduce the number of casualties from road traffic accidents. In August 2020, the United Nations announced that 2021–2030 will be the second decade of action for road safety, with the goal of reducing the number of casualties from road traffic accidents by at least 50% in 2030.

- The targets of 2030 Agenda for Sustainable Development (A / RES / 70/1) related to road safety. According to Target 3.6 of the 17 Sustainable Development Goals, the number of deaths and injuries from road traffic accidents worldwide will be halved in 2020 compared with the baseline estimate in 2010. This target has further strengthened the overall goal of the action for the decade.
- As noted in Target 11.2 of the 17 Sustainable Development Goals, safe, affordable, accessible and sustainable transport systems will be provided for all, road safety will improve and public transport will be expanded by 2030.
- The United Nations resolutions on improving global road safety include:
  - Resolution 70/260 adopted on 15 April 2016
  - Resolution 72/271 adopted on 12 April 2018
  - Resolution 74/299 adopted on 31 August 2020.
- The United Nations legal instruments related to road safety include:
  - Vienna Convention on Road Traffic adopted in 1949 and 1968
  - Convention on Road Signs and Signals adopted in 1968
  - European Agreement Concerning the Work of Crews of Vehicles Engaged in International Road Transport adopted in 1970, European Agreement on Main International Traffic Arteries adopted in 1975 and Intergovernmental Agreement on the Asian Highway Network adopted in 2004
  - Twelve global road safety performance indicators (Table 4.2) in The Midpoint of the Decade of Action for Road Safety 2021-2030.

Table 4.2. Global road safety performance indicators

Indicator	Target
1	By 2030, all countries will have formulated a comprehensive multi-sectoral national road safety action plan, with a definite timeline.
2	By 2030, all countries will have joined one or more core United Nations legal documents related to road safety.
3	By 2030, all newly built roads will meet the technical standards that take into account all road users, or are rated at three-star or above.
4	By 2030, more than 75% of travel routes on existing roads will meet the technical standards that take into account the road safety of all road users.
5	By 2030, 100% of new products (production, sales or imports) and used cars will conform to high-quality safety standards, such as the recommended regulations of the United Nations, global technical regulations, or national performance requirements at the same level.
6	By 2030, the proportion of vehicles exceeding the speed limit will be halved, and the deaths and injuries associated with speeding will be reduced.
7	By 2030, the proportion of motorcycle riders using helmets properly will be close to 100%.
8	By 2030, the proportion of motor vehicle passengers using seat belts or standard child restraint systems will be close to 100%.
9	By 2030, the number of deaths and injuries associated with drunk driving will be halved, and/or the number of road traffic casualties related to other psychoactive substances will be reduced.
10	By 2030, all countries will have passed laws to prevent or prohibit drivers from using mobile phones.
11	By 2030, all countries will have issued regulations that stipulate the driving time or rest time for professional drivers, and/or joined up the international/regional regulations in this field.
12	By 2030, all countries will have set and realised national goals to minimise the time interval between road traffic accidents and professional first aid.

Players

- National/governmental players: Congress and government, transport authorities, police authorities, emergency and rescue service sectors, environmental protection sectors, medical and health sectors, etc.
- Non-national/non-governmental players: Transport industry associations, transport service providers (freight, bus and taxi), non-governmental organisations and private organisations, insurance companies, etc.

All players should perform their duties and disclose relevant reports, which is vital to transparency and accountability. National/governmental players are obligated to formulate public policies and performance indicators, including those on deaths and injuries associated with road traffic accidents and other related data.

Research questions

1 Relevant actions

- National road safety governance framework.
- The suggestions of Land Transport Commission on enhancing national road safety systems.
- Speed management in the safety system: Global comprehensive research shows that the average number of deaths will be reduced by 4% if vehicle speed is reduced by 1%.
- The gender perspective in the road safety system and the impact on children: the risk of females getting injured seriously in car crashes is 47% higher than that of males in the world.
- The continuous cycle of road safety implementation, improvement and evaluation planning.
- Transfer of transport mode: Transport modality is shifting from mobility in private cars to cleaner, safer and more affordable mobility; road policies are aimed to promote the design of compact cities and give priority to pedestrians, cyclists and public transport users, and investment in public transport systems promoting the safe and efficient mobility of a large number of people.
- Collecting and reporting deaths from road traffic accidents: data accuracy, comparability, classification and accessibility.

2 Evaluation of road safety environment

- The structure, trends and laws regarding casualties from road traffic accidents: the number of deaths and injuries classified according to gender, age and administrative jurisdiction.
- Risk factors leading to the causalities of road traffic accidents in a country.
- The effectiveness of current measures and plans, including legislation and policy frameworks, activities across sectors, and the availability of road traffic casualty-related data.
- The efficiency of the authority responsible for road safety policies, including the coordination of financial resources and human resources available, the availability and use of the latest knowledge about road safety, and the participation of stakeholders.
- Existing challenges and opportunities, such as the link between the agenda for sustainable development goals and the improvement of road safety; the extent to which the goals can be achieved within the current capability.

3 Monitoring and assessment of progress and results in countries from the global perspective

- Monitoring: The Global Status Report on Road Safety will be adopted as the main monitoring mechanism during the decade. The data about the global status will come from surveys conducted by member states, the number of deaths and injuries from road traffic accidents provided by member states, traffic laws and law enforcement, and institutions responsible for road safety.

Assessment: According to the Resolution of the United Nations General Assembly (Resolution 74/299), the number of deaths and severe injuries from road traffic accidents shall decrease by at least 50% in the decade of action. The main results of the monitoring assessment, data source, and timeline are shown in Table 4.3. in the following page.

Table 4.3. Main results of the monitoring assessment, data source and timeline

Baseline year	2021	Statement of the Resolution of the United Nations General Assembly
Main achievement indicators	The number of deaths and severe injuries from road traffic accidents The number of deaths and injuries from road traffic accidents for every 100,000 people	A key road safety achievement
Other achievement indicators	The number of deaths for every 10,000 vehicles or the mileage of 100 million kilometres Years of life loss Years of disabled life	Other achievement indicators
Process indicators	Plan implementation: Formulation of national plans Allocation of resources Human resources and capabilities Coordination and participation of different departments and participants	The monitoring and assessment will be conducted in the middle of and at the end of the action plan for the decade, so as to gain insights into the implementation of the action plan. Relevant data will be collected and analysed by means of interview, survey, document review and case analysis.
Data source	The Global Status Report on Road Safety will be adopted as the main data source. Other sources include regional commissions of the United Nations, the Global Burden of Disease Study, the World Bank and regional observation stations.	The main data used in assessment of the action for the decade; still related to the new action plan for the decade
Timeline	2021: Baseline assessment 2025: Assessment in the middle of the decade 2030: Assessment at the end of the decade	Internal and external assessment

Audit case 5: Follow-up Audit on the Transportation of Dangerous Goods by SAI Canada

Audit Objective

- Determine the extent to which Transport Canada and the Canada Energy Regulator implemented the recommendations of 2011 and 2015 regarding their compliance and enforcement of relevant responsibilities to ensure that dangerous goods are transported safely.

Audit Scope

- **Whether Transport Canada had:**
  - put in place a national risk-based planning process that detailed how to consider risks, and how to priorities inspections
  - put in place guidance for inspectors on how to conduct and document compliance monitoring and follow-up activities
  - clarified roles and responsibilities for monitoring compliance with the Transportation of Dangerous Goods Act, 1992 and its regulations
  - implemented a performance measurement system that allowed the department to understand the rate of regulatory compliance
  - developed guidance for the review and approval of emergency response assistance plans, and completed reviews according to its time-line standards.

- **Whether Canada Energy Regulator had:**
  - assessed and addressed its information and data management requirements to ensure that they aligned with its critical business processes for regulatory compliance oversight
  - put in place the procedures and tools to systematically track and document compliance with pipeline approval conditions
  - put in place the procedures and tools to systematically verify that companies took corrective actions on violations within required time-line.

Audit Methodology

- Review the progress of the response of the two departments to the recommendations of previous audit reports.
- Evaluate the control measures taken.
- Using representative sampling inspection.

Audit Criteria

- Transportation of Dangerous Goods Act, 1992.
- Audit Reports from 2011.
- Plans for Audit Implementation Designed by Transport Canada and Canada Energy Regulator.
- Transportation of Dangerous Goods Inspector Manual, Transport Canada.
- Transportation of Dangerous Goods Inspector's Follow-up to Non-Compliance Standard, Transport Canada.
- Transportation of Dangerous Goods Policy on Inspection Prioritization, Planning and Reporting, Transport Canada.
- National Energy Board Act (replaced in 2019 by the Canadian Energy Regulator Act).
- National Energy Board Onshore Pipeline Regulations.
- Inspection Procedure, National Energy Board.
- Operations Project Management Procedure, National Energy Board.

Findings

- Transportation dangerous goods by rail, road, ship, and air:
  - Transport Canada still has shortcomings in its oversight of dangerous goods while improvements have been made in some aspects
  - Incomplete information for the risk-based planning of inspections
  - Inadequate follow-up on violations
  - Roles and responsibilities for compliance oversight were clarified
  - Incomplete performance measurement
  - Incomplete reviews of emergency response assistance plans
- Transporting dangerous goods by pipeline:
  - The Canada Energy Regulator improved its compliance oversight
  - Improved information management for compliance oversight
  - Incomplete documentation on the analysis of pipeline approval conditions
  - Improved follow-up on non-compliance

Recommendations

- Improve and update its tools and database.
- Systematically track and document its verification that companies have returned to compliance after violations are identified.
- Ensure that means of containment facilities with expired certificates are not conducting the activities for which the certificates were issued.
- Finalise its approval of the interim emergency response assistance plans by completing the necessary investigations and by developing national guidance and criteria for assessing firefighting capacity for plans related to flammable liquids.
- Strengthen its processes for collecting data from its partners.
- Finalise its approval of the interim emergency response assistance plans by completing the necessary investigations and by developing national guidance and criteria.

4.4. Audit of Environmental Impact of Sustainable Transport

Background

Air pollution is extremely harmful to human health, economic growth and food security. Traffic pollution will occur when the quantity, concentration and duration of the smoke, PM2.5, harmful gas and noise caused by the means of transport (by land, sea and air) exceed the purification capacity of the nature and acceptable standards, thus causing great harm to the environment and ecology. According to statistics, about one quarter of global greenhouse gas emissions are discharged from transport systems, and these emissions are expected to soar in the future, further worsening global warming. Severe environmental pollution poses great threats and challenges to economic and social development globally, urging governments to release traffic-related environmental protection policies and take effective measures to buck the trend. In 2018, the United Nations Environment Programme, Asia-Pacific Clean Air Partnership (APCAP) and Climate and Clean Air Coalition (CCAC) jointly released Air Pollution in Asia and the Pacific: Science-based Solutions at the first Global Conference on Air Pollution, pointing out that air pollution knows no borders. Governments at all levels must make concerted efforts to improve air quality. Countries need to work together to seek solutions to sustainable transport, more efficient production and more effective use of renewable energy, as well as waste management. For example, the EU plans to reduce carbon dioxide emissions from cars and lorries by 37.5% and 31% respectively by 2030 compared with 2021, which has achieved consensus between representatives of the European Union and the European Parliament. In late 2017, China released the China VI vehicle emission standards after referring to the relevant standards in Europe and the United States, which is also known as one of the most stringent emission standards in history. Moreover, the China VI (A) vehicle emission standards and China VI (B) vehicle emission standards will be implemented on 1 July 2023. In September 2020, China announced that it would take effective measures to peak in carbon emissions before 2030 and achieve carbon neutrality before 2060 at the General Debate of the 75th Session of the United Nations General Assembly.

Audit criteria

- United Nations Framework Convention on Climate Change.
- Paris Agreement.
- Vienna Convention for the Protection of the Ozone Layer.
- Target 11.6 of Goal 11 of the Sustainable Development Goals by 2030, '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'.
- Other international or regional agreements on environmental protection, such as the China-India Agreement on Environmental Co-operation and the China-South Korea Agreement on Environmental Co-operation.

Players

- National/governmental players: Government/congress, transport authority, environmental protection department and financial department;
- Non-national/non-governmental players: United Nations Environment Programme and other international agencies, non-governmental environmental protection organisations, automotive manufacturers, fuel companies, power companies, citizens, etc.

Research questions

- Whether to abide by the international conventions /agreements, laws, policies and technical standards in the environmental field;
- Whether the design of the transport project is reasonable and can be made environment friendly as much as possible;
- The overall assessment of environmental impact of transport development, including atmospheric pollutants, noise, construction materials and indirect impacts on biodiversity protection;

- The technical assessment of environmental impact of the means of transport, including which type of transport or vehicle has the greatest impact on the environment, whether various environmental impact assessment indicators are properly used;
- Whether the fuel used by vehicles and other means of transport meet the emission requirements;
- Whether the automatic monitoring systems for road traffic emissions are all in place and at work;
- Transport promotes the development of circular economy, such as reuse of infrastructure materials, sharing of heavy industry machinery and recycling of waste resources including waste pavement asphalt, roadbed backfilling soil and construction waste.

Audit Case 6: A Compliance Audit of Vehicular Emission by State Transport Undertakings in the Province of West Bengal, India (2017)

Audit Objective

- Evaluate the environment plans and policies for mitigation of vehicular emissions by the State Transport Undertakings (STUs) and Environment Management System for reduction of emissions and the impact of vehicular emissions.

Audit Scope

- A Compliance Audit conducted by SAI India from April to June in 2017.

Audit Criteria

- The National Ambient Air Quality (NAAQ) Standards 2009 notified by the Central Pollution Control Board (CPCB).
- The provisions of various environmental protection acts and rules implemented by State Pollution Control Boards (SPCBs)/Pollution Control Committees (PCCs).

Findings

- The Transport Department had not prepared requisite action plans to (i) protect and safeguard the environment from pollution, and (ii) mitigate greenhouse gas emissions arising from vehicular emissions in operation of its STUs. Moreover, the government had also not laid out an overall air-quality management plan.
- Failure of infrastructure for supply of compressed natural gas (CNG)/coal-bed methane (CBM).
- CNG buses were not introduced. Out of all the buses with the five STUs, only 0.35 per cent of CNG buses were in operation despite availability of funds.
- Expansion of services of trams as environmentally friendly and energy-efficient transport system was not undertaken. There was a decline in the availability of tram services, which led to their substitution by road transport and higher vehicular emissions in Kolkata.

Recommendations

- Enforce vehicle emission norms.
- Monitor the issue of pollution under control (PUC) certificates.
- Improve fuel quality, e.g. using CNG and checking the quality of high-speed diesel (HSD).
- Phase out older vehicles and use vehicles with advanced emission control devices, e.g. operating more CNG buses.
- Issue 'certificates of fitness' (CF) for 'in-use' vehicles only after inspection and requisite maintenance, etc. Non-technical measures include building capacity for monitoring of vehicular emissions as well as ensuring environmental accounting and reporting.

Audit Case 7: Environmental Audit of Air Quality Improvement Project: Control of Diesel Emission Plan, Korea (2007)

Audit Objective

- Carry out an in-depth analysis of appropriateness of the master plan, performance and follow-up management for the diesel emission control plan, the certification for emission reduction devices and the prime cost accounting.

- Put forward possible solutions to improve air quality in the metropolitan area.

Audit Scope

- Special measures examination for air quality improvement in the metropolitan area from March to May 2007.

Audit Criteria

- The Special Measure for air quality improvement in Seoul metropolitan area in December 2002, adopted by the Ministry of Environment (MOE).
- The Special Act on Metropolitan Air Quality Improvement in December 2003, prepared by the MOE, to secure a clean environment and to provide the legal ground for the special measure.

Findings

- Inadequate expansion of control of diesel emission targets

The MOE spent the subsidies on diesel vehicle owners who merely applied for the devices, regardless of any emissions testing, when the actual installation of the devices was reported at only 4.4% of the established objectives of the plan.

- Inadequate management of construction machines emission

Approximately 116,527 construction machines had been reported to be operating in the metropolitan area, but on-site and closed emission tests were not being performed.

The deterioration rate of construction machines such as dumper trucks, cement mixers and concrete pump vehicles older than seven years was at 69%, higher than that of diesel vehicles (27%). In addition, they were emitting more exhaust gas than that of large freight vehicles.

Recommendations

- The MOE should adjust the scope of the plan for only those who failed the emissions testing based on the Special Act on Metropolitan Air Quality Improvement.
- The MOE should revise the subsidy scope of the diesel emission control plan to include construction machines such as cement mixers after consulting with the minister of the Ministry of Construction and Transportation.

4.5. Audit of New Energy and New Technology Application to Sustainable Transport

Background

Energy is the main factor leading to climate change, and about 60% of global greenhouse gas emissions are generated as a result of energy consumption. The development of new energy for transport is one of the strategic initiatives that aims to address climate change and promote green development. At the United Nations High-level Political Forum (HLPF) on Sustainable Development, sustainable transport was defined as 'delivering the services and infrastructure for the flow of personnel and goods in a safe, efficient, affordable, accessible and flexible manner while reducing the pollutants such as carbon and minimising environmental impacts, so as to promote economic and social development and benefit the world of the present and the future.' Electrification, intelligence and networking have represented the trend of the automobile industry. Empowered by new energy, new materials and revolutionary technologies such as the internet, big data and artificial intelligence, new-energy vehicles will push forward the optimisation of the energy consumption structure, transport systems and intelligent urban operation, which is of great significance to achieving sustainable development.

New-energy vehicles are powered by unconventional fuels, mainly in the form of electric vehicles (EV), hybrid electric vehicles (HEV), fuel cell electric vehicles (FCEV), gas vehicles (GV), biofuel vehicles (BFV) and hydrogen vehicles. In the short term, oil-electric hybrid electric vehicles and plug-in hybrid electric vehicles will serve as an important transition, representing the sustainable development of future means of transport. For example, 26 out of the 27 member

states of the EU have released stimulus policies to encourage the development of electric vehicles. Since 2020, European countries have further increased subsidies for new-energy vehicles. Germany issued an electric vehicle programme in the second half of 2009, attaching importance to the development of electric vehicles. Focusing on the development of pure electric vehicles, Germany unveiled the goals for industrialisation and marketisation in 2012, 2016 and 2020. As of March 2021, there were 5.51 million new-energy vehicles in China, 81.53% of which were electric vehicles (4.49 million vehicles.)

The ultimate aim of future transport is to create the 'urban traffic brain' and bring the idea of 'all for one, one for all' into full play. More specifically, data on all roads, vehicles and passengers will be connected with the systems, and operations such as collection, scheduling and management will be handled by the 'urban traffic brain'. To date, with the development of new-energy technologies such as high-performance power battery and 5G-based technologies such as smart transport and intelligent driving, the SAIs of many countries have carried out active explorations for the application of new energy and new technologies, have strived to effectively identify the problems in the sustainable development of transport systems nationwide, and offered targeted suggestions on improvement.

Audit criteria

- United Nations Framework Convention on Climate Change.
- Paris Agreement.
- Vienna Convention for the Protection of the
- Ozone Layer.
- Target 7.1 of Goal 11 of the Sustainable Development Goals by 2030, 'By 2030, ensure universal access to affordable, reliable and modern energy services'; Target 7.2, 'By 2030, increase substantially the share of renewable energy in the global energy mix'; Target 7.3, 'By 2030, double the global rate of improvement in energy efficiency'.
- Action Plan for the Deployment of Intelligent Transport Systems in Europe.
- New Urban Agenda in Resolution 70/197 of the United Nations General Assembly.
- Resolution 212 adopted at the 72nd General Assembly of the United Nations, 'Strengthening the Links between All Modes of Transport to Achieve the Sustainable Development Goals.'

Players

- National/governmental players: Government/congress, transport authority, information technology department, energy department, road infrastructure construction department and communication authority.
- Non-national/non-governmental players: International institutions such as International Energy Agency (IEA), automotive industry associations, artificial intelligence companies, automotive manufacturers, power companies, citizens, etc.

Research questions

- Whether the goal of promoting new-energy vehicles has been achieved. For example, as pointed out in the Energy Saving and New-Energy Vehicle Industry Development Plan (2012–2020), the accumulated sales of new-energy vehicles in China will exceed 5 million in 2020.
- The construction of new-energy infrastructure, including charging stations, hydrogen refuelling stations, preferential electricity prices, charging service platforms and related public financial funds.
- The policies aimed to promote the application and promotion of new technologies, such as the research and development of new-generation lithium batteries and hydrogen fuel batteries; the recycling of waste power batteries, and the application of 5G in the urban traffic network.
- Other economic policies, such as purchase subsidies for new-energy vehicles and preferential policies for parking and charging, 'paperless' mobility, the application of electronic toll collection (ETC) in intelligent transport, with attention paid to the use and administration of related funds.
- The development of smart cities and intelligent

transport, including public transport priority strategy, intelligent upgrading and transformation of transport systems, Maglev rail transit system and future-oriented innovation in intelligent transport technologies, such as the full integration of 'Internet +' modern information technology and transport management and services.

Audit Case 8: An Audit Project of the Environmental Committee Recommendation on Meeting Decarbonisation and Renewable Energy Targets, UK (2017)

Audit Objective

- Follow up the Department for Transport's (DfT) progress on the Committee's recommendations for improving its approach to sustainability.

Audit Scope

- National targets for renewable energy and greenhouse gas emissions.

Findings

- DfT had not established a separate target in UK law for 10% of renewable energy in transport in 2020.
- DfT had not taken measures to improve the way that transport appraisals factors air quality impacts.
- The rate at which individual sectors must seek decarbonisation is not specified. The Act did not specify the rate at which individual sectors must seek decarbonisation, but instead required the government to set legally binding 'carbon budgets' (which set restrictions on the amount of greenhouse gases the UK can emit over five-year periods) at an economy-wide level.

Recommendation

- Map out plans for tackling the shortfall against the cost-effective path for reducing transport carbon emissions.
- Retain the EU's renewable energy target in UK law and establish a transport sub-target.

Audit Case 9: Audit of the construction and operation of EU electric car charging infrastructures by the European Court of Auditors

- The European Court of Auditors audited the construction and operation of electric car charging infrastructures in the EU to improve the EU's deployment of charging infrastructures for electric cars and to enhance the service efficiency of such facilities.

Audit objective

- The objective is to determine the validity of the European Commission to support the EU to build public charging infrastructures for electric cars, improve the EU's deployment of charging infrastructures for electric cars, and enhance the service efficiency of such facilities.

Scope of audit

- What criteria and methods did the European Commission adopt to coordinate and support member states to deploy charging infrastructures?
- How did the European Commission manage the utilisation of the charging infrastructure funds in the 'Connecting Europe Facility' (CEF)?

Criteria of audit

- European Green Deal; Alternative Fuels Infrastructure Directive (AFID); Sustainable and Smart Mobility Strategy (2020)

Audit methodology

- The European Commission's procedures to assess charging infrastructure demands and provide funds for the project were analysed and the functions of the procedures were tested. Besides, on-site tests were conducted for the performance, universality and protocol consistency of the charging infrastructures financed by the EU.

Audit findings

- Explicit charging infrastructure construction objectives were absent within the EU.

- EU member states lacked consistent and coherent policies.
- The charging infrastructure deployments in the EU member states displayed remarkable differences.
- Universal EU charging standards should be used for the charging stations.
- Unified payment systems and basic information about charging stations required by users were absent.
- Overall analysis on infrastructure construction was absent to support the prioritised projects of CEF.
- Some projects failed to fully achieve the objectives.

Audit recommendations

- The minimum charging infrastructure requirements applicable to TENT-T networks shall be proposed.
- The EU electric car strategic roadmap shall be established.
- An analysis of infrastructures and financing gaps shall be performed.
- Project selection shall be enhanced.
- Project management shall be reinforced to improve the economic benefits of charging infrastructures.

Audit Case 10: An Audit Project of Intelligent Transport on Road Infrastructure, Czech Republic

Background

The Action Plan for the Deployment of Intelligent Transport Systems (ITS) in Europe was drawn up at the European Union (EU) level in 2008. The aim of the action plan was to accelerate and coordinate the deployment of ITS in road transport, including interfaces with other modes of transport. In 2010, the plan was followed by Directive 2010/40/EU (hereinafter referred to as the ITS Directive), which elaborated on the priority areas defined in the plan. The ITS Directive generally required the preparation of specifications for ITS with a view to achieving their coordinated implementation across the EU member states. In the Czech Republic, the ITS Directive had been transposed primarily into Section 39 of Act No 13/1997 Coll., on Roads. The ITS Directive was followed by EU regulations on the technical specifications of ITS systems.

Audit Objectives

- Verify whether the Ministry of Transport (MoT) managed and, together with the Road and Motorway Directorate (RMD) of the Czech Republic, implemented selected road ITS in a way that led to cost-effective and efficient spending of funds to achieve the objectives according to the Action Plan for the Development of Intelligent Transport Systems by 2020 (with an outlook to 2050) and other strategic documents.
- Improve the safety and flow of traffic to coordinate, synchronise and optimise passenger transport and consignment movements across the network of individual modes of transport.
- Further reduce environmental impacts.

Audit Scope

- The planning and implementation of intelligent transport projects.
- The financing and expenditure of intelligent transport projects.
- The economics and effects of the roads built for the goals.

Audit Criteria

- Action Plan for the Development of Intelligent Transport Systems in the Czech Republic by 2020.
- Action Plan for the Deployment of Intelligent Transport Systems in Europe.

Findings

- The MoT did not set the ITS Action Plan so that it could objectively monitor the progress of meeting its objectives over time, assess whether its implementation was progressing in the defined direction, define direct corrective measures and assess, at the end of its effectiveness, whether the set objectives or global objective in relation to the money spent had been achieved.

- The MoT and the RMD did not carry out performance evaluations of road ITS implemented through SD and PR projects under the ITS Implementation Plan, even in basic areas such as benefits in increasing road safety, reducing congestion or reducing road traffic violations.
- The MoT did not assess the appropriateness of including SD and PR project proposals in the ITS Implementation Plan in a transparent manner.
- The RMD did not have an overview of the total amount of money spent on road ITS until the end of the audit, as it did not monitor the money spent on the implementation of road ITS as part of road constructions separately.
- The MoT did not manage the implementation of high-speed weighing scales at a strategic level, although this is a tool for road safety and for combating road damage caused by overloaded vehicles.
- There is no authority at the national level to ensure the coordination of individual closures of the transport network between the individual institutions operating the road network.

Recommendations

- Set up and, in co-operation with the RMD, put into practice performance indicators to assess the benefits of road ITS deployment and operation for traffic flow and safety.
- Set default and target values of these indicators and anticipated milestones of meeting the target values.
- Perform periodic evaluations of the fulfilment of the objectives of the Action Plan according to these performance indicators and set milestones; and to take corrective measures in case they are not being fulfilled as expected.
- Prioritise areas for road ITS implementation and to set up a transparent system of evaluation and selection of project proposals in the ITS Implementation Plan.
- Set up a system for monitoring road ITS items within the budgets of constructed or reconstructed road structures and the costs associated with securing their life cycles.

Appendix

International Treaties with regard to sustainable transport

No	Name	Year	Remarks
1	United Nations Framework Convention on Climate Change	1992	The convention is an international environmental treaty addressing climate change, which was negotiated and signed by 154 states at the United Nations Conference on Environment and Development (UNCED). Transport sector addressed in Article 4. Available at: https://unfccc.int/resource/docs/convkp/conveng.pdf
2	Report on the Ninth Session – UN Commission on Sustainable Development	2001	The United Nations Commission on Sustainable Development (CSD) was established by the UN General Assembly to ensure effective follow-up of the UNCED. Transport sector addressed in: Decision 9/1: Energy for Sustainable Development and Decision 9/3: Transport. Available at: https://www.un.org/ga/search/view_doc.asp?symbol=E/CN.17/2001/19%20(SUPP)&Lang=E
3	Johannesburg Plan of Implementation of the World Summit on Sustainable Development	2002	The plan commits the nations of the world to sustainable development and includes substantial mention of multilateralism as the path forward. Transport sector addressed in Chapters 2, 3 and 4. Available at: https://www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/WSSD_PlanImpl.pdf
4	Intergovernmental Agreement on the Asian Highway Network	2004	The agreement provides minimum standards for the construction, improvement and maintenance of Asian highway routes, including terrain classification, design speed, cross-section, horizontal and vertical alignment, pavement, structure loading, vertical clearance, environment and road safety. Available at: https://treaties.un.org/doc/source/events/2004/English_text.pdf
5	Bogota Declaration – Sustainable Transport Objectives	2011	The declaration is aimed at promoting the integration of environmentally sustainable transport in general policies, and planning and development processes in the countries of Latin America. Available at: https://www.uncrd.or.jp/content/documents/201106_Bogota-Declaration_Eng.pdf

No	Name	Year	Remarks
6	The Future We Want – Outcome document of the United Nations Conference on Sustainable Development	2012	The declaration includes broad sustainability objectives within the themes of Poverty Eradication, Food Security and Sustainable Agriculture, Energy, Sustainable Transport, Sustainable Cities, Health and Population and Promoting Full and Productive Employment. Transport sector addressed in Paragraphs 132–133. Available at: https://sustainabledevelopment.un.org/content/documents/733FutureWeWant.pdf
7	UN Resolution: Role of transport and transit corridors in ensuring international co-operation for sustainable development	2014	The resolution is aimed at harmonising and improving transport and border-crossing infrastructure, facilities and services along international transport and transit corridors. Available at: https://unctad.org/system/files/official-document/ares69d213_en.pdf
8	Addis Ababa Action Agenda of the Third International Conference on Financing for Development (Addis Ababa Action Agenda)	2015	The Action Agenda provides a new global framework for financing sustainable development by aligning all financing flows and policies with economic, social and environmental priorities. Available at: https://www.un.org/esa/ffd/wp-content/uploads/2015/08/AAAA_Outcome.pdf
9	UN Resolution: Towards comprehensive co-operation among all modes of transport for promoting sustainable multimodal transit corridors	2015	The resolution is aimed at harmonising and improving transport and border-crossing infrastructure, facilities and services along international transport and transit corridors. Available at: https://digitallibrary.un.org/record/812642
10	ICAO Assembly Resolution on Aviation Contribution Towards the United Nations 2030 Agenda for Sustainable Development	2016	Presents the contributions enabled by states for safe, efficient, secure, economically viable and environmentally sound air transport systems towards the realisation of the SDGs. It also provides a report on activities undertaken by ICAO aimed at assisting its member states to enhance their air transport systems. Available at: https://www.icao.int/Meetings/a39/Documents/Resolutions/a39_res_prov_en.pdf
11	Regional Action Programme for Sustainable Transport Connectivity in Asia and the Pacific, Phase I (2017-2021)	2016	Sets the foundations for the development of a sustainable integrated international intermodal transport and logistics system. Available at: https://unece.org/fileadmin/DAM/trans/doc/2018/UNDA/RAP_2017-2021_VN.pdf

No	Name	Year	Remarks
12	UN Resolution: Strengthening the links between all modes of transport to achieve the SDGs	2017	The resolution is aimed at preserving natural and cultural heritage as well as promoting quality, reliable, sustainable and resilient infrastructure. Available at: https://digitallibrary.un.org/record/1467040
13	UNECE, Inland Transport Committee. Ministerial Resolution on Embracing the New Era for Sustainable Inland Transport and Mobility	2017	The resolution addresses the challenges of sustainable development of mobility and inland transport, especially in the context of the 2030 Sustainable Development Agenda and the SDGs. Available at: https://unece.org/fileadmin/DAM/trans/doc/2017/itc/Final_Resolution_ITC_70_years.pdf
14	European Commission. The European Green Deal	2019	The European Green Deal resets the Commission's commitment to tackling climate and environmental-related challenges that is this generation's defining task. It is also a framework to structure investments in sustainable transport. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1576150542719&uri=COM%3A2019%3A640%3AFIN

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