Global Roadmap of Action Toward Sustainable Mobility

PAPER 4 | Efficiency

SUSTAINABLE mobility FOR ALL™

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GLOBAL ROADMAP OF ACTION

Toward Sustainable Mobility

EFFICIENCY

TABLE OF CONTENTS

List of Figures

List of Tables

LIST OF ACRONYMS

ACARE	Advisory Council for Aeronautics Research in Europe
ADB	Asian Development Bank
ADR	European Agreement concerning the International Carriage of Dangerous Goods by Road
AFD	Agence Française de Développement
ASYCUDA	UNCTAD Automated System for Customs Data
ATAG	Air Transport Action Group
ATP	Agreement on the International Carriage of Perish¬able Foodstuffs
AWB	Airway Bill
BEV	Battery Electric Vehicles
BMZ	German Federal Ministry for Economic Cooperation and Development
CMR	Convention on the Contract for the Interna¬tional Carriage of Goods by Road
CO2	Carbon dioxide
CORSIA	Carbon Offset and Reduction Scheme for International Aviation
COTS	Commercial Off-The Shelf Technologies
DFID	United Kingdom's Department for International Development
EEDI	Energy Efficiency Design Index
EEOI	Energy Efficiency Operation Indicator
EIRR	Economic Internal Rate of Return
EPD	Environment Product Declarations
ESWs	Electric Single Windows
EU	European Union
GANP	Global Air Navigation Plan
GDP	Gross Domestic Product
GMR	Global Mobility Report
GRA	Global Roadmap of Action
HOV	High Occupancy Vehicles
HSWIM	High Speed Weigh-In Motion
ICAO	International Civil Aviation Organization
ICCIMA	Iran Chamber of Commerce, Industries, Mines and Agriculture

ICT	Information and Communication Technology
IMO	International Maritime Organization
IRF	International Road Federation
IRU	International Road Transport Union
ITC	Inland Transport Committee
LAQ	Local Air Quality
LDCs	Least Developed Countries
LLDCs	Landlocked Developing Countries
LPI	Logistics Performance Index
MPI	Mobility Performance Index
NCTTA	Northern Corridor Transit and Transport Agreement
NCTTCA	Northern Corridor Transit and Transport Coordination Authority
NGOs	Non-Government Organizations
PIARC	World Road Association (Permanent International Association of Road Congresses)
PPPs	Public Private Partnership
R&D	Research and Development
RAMS	Reliability, Availability, Maintainability and Safety
RTS	Real- Times Safe
SAFE	ICAO Safety Fund
SAMOA	State Accelerated Modalities of Action
SDGs	Sustainable Development Goals
SEEMP	Ship Energy Efficiency Management Plan
SGR	Standard Gauge Railway
SIDS	Small Island Development States
SMEs	Small and Medium Enterprises
SuM4All	Sustainable Mobility for All
TAH	Trans African Highways
TDM	Travel Demand Management
TFA	Trade Facilitation Agreement
TIR	International Road Transport
TNCs	Transport Networking Companies
TOD	Transit Oriented Development
UIC	International Union of Railways
UN	United Nations
UN OHRLLS	United Nations Office of The High Representative for Least Developed Countries, Landlocked Developing Countries and Small Island Developing States

UNACTAD	United Nations Conference on Trade and Development
UNECA	United Nations Economic Commission for Africa
UNECE	United Nations Economic Commission for Europe
UNESCAP	The United Nations Economic and Social Commission for Asia And the Pacific
UNESCWA	United Nations Economic and Social Commission for Western Africa
UPC	Universitat Politècnica de Catalunya
VTPI	Victoria Transport Policy Institute
WB	World Bank
WBCSD	World Business Council for Sustainable Development
WCO	World Customs Organization
WTO	World Trade Organization

FOREWORD

Sustainable Mobility for All (SuM4All) is an umbrella platform that brings together 55 public and private organizations and companies with a shared ambition to transform the future of mobility. Its unique value lies in bringing key influential actors to work together. It serves as the principal platform for international cooperation on sustainable mobility, a center of excellence, and a repository of policy, knowledge and resource on sustainable mobility. Its mission is to play a leading role in the ongoing transformation of the global mobility system, and support countries in their transition towards sustainable mobility.

Established in 2017, SuM4All's first task at hand was to find common ground on what countries wanted to achieve. We all agreed that transport was a key contributor to economic development and core to people's quality of life. We also agreed that the transport that we have is not the transport that we want—congestion in cities, segregation among rural and urban communities, carbon emissions, air and noise pollution, and traffic mishaps that are symptomatic of a systemic problem with mobility. We set our ambition high for the mobility of the future: we need an equitable, efficient, safe and green mobility.

The consensus on what sustainable mobility meant set us on our next task to establish the imperative for action. The Global Mobility Report 2017 benchmarked countries' performances on mobility relative to four policy goals. The findings of that report were alarming: not a single country in the world—developed or developing—has achieved sustainable mobility.

With evidence at hand, SuM4All embarked on a major drive in 2018 to develop a comprehensive policy framework to assist decision makers in cities and countries as well as practitioners at development banks to identify gaps, necessary steps, and appropriate instruments to attain the Sustainable Development Goals, and improve the sustainability of their transport sector.

We are pleased to share the outcomes of these efforts that embody the collective knowledge of all its members and more than 180 experts, and feedback from more than 50 public decision makers and 25 large private corporations. The Global Roadmap of Action builds on six policy papers, including this Efficiency paper, whose content is made accessible and usable to all in a web-based tool for decision making.

Sustainable Mobility for All Steering Committee
(On behalf of our 55 Member organizations)
July 2019, Washington, D.C.

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EXECUTIVE SUMMARY

The growing global demand for mobility and trends in development, economic integration, and urbanization all point to the need for better utilization of resources to meet these demands while reducing our footprint.

This paper uniquely views overall efficiency as the sum of two activities.

- Resources expended in making the transport system available for use
- Resources expended by users in consuming transport services.

To be efficient is to use minimum resources to achieve maximum output. Inefficiency arises when users of services do not get the quality of service they expect –for example, with slow, unreliable, or unpredictable transport–which leads to waste of time, materials, and users' opportunities.

Two types of efficiency contribute to the analysis:

- Productive efficiency in the optimal way of producing goods and services
- Allocative efficiency in the optimal way of matching demand and supply and thus the distribution/ allocation of resources in society.

The priority areas of action for the efficiency policy goal are also clustered in two ways. The issue of allocative efficiency, "doing the right things", is largely covered by a set of policy measures in the economics and finance toolbox. The issue of productive efficiency, "doing things the right way", is largely covered by policy measures in the Regulatory & Institutional and the Engineering & Technology toolboxes.

This paper finds that:

- Efficiency can be assessed across various elements of the transport systems, but comparable data limits evaluating efficiency across countries. These limitations lead to focusing on only on one principle indicator, the Logistics Performance Index (LPI)[1], and a set of country attributes that are strongly correlated with it. In future work, a second summary indicator dealing with passenger transport–a mobility performance index (MPI)– needs to be developed to complete evaluation of transport efficiency.
- Existing transport technologies and practices are tightly integrated into most economic and social activity. Our personal behavior, social habits, and business practices are conditioned by the transport sector. This means transport can influence and promote change in areas across the whole economy and society.
- Tension exists between the long-run benefit of demonstrated and integrated productive innovation and the shorter-run cost of disruptive innovation. While the productive aspects of the innovation are proven, broader systems adapt to integrate the innovation. No single model is available to move from disruptive to productive innovation. The greatest challenges for efficient sustainable transport are public opinion and political will.

The multimodal, interconnected, and interactive nature of transport's sub-sectors indicates that transport has always faced complexities in delivering efficient mobility. The existing mechanisms, institutions, arrangements and patterns however provide a starting point to improve upon. We are not starting from zero.

ENDNOTES

1 The LPI is a comprehensive measure of the efficiency of international supply chains; the organization of the movement of goods through a network of activities and services operating at global, regional, and local scale. Efficient logistics connects people and firms to markets and opportunities and helps achieve higher levels of productivity and welfare.

1. THE GOAL OF EFFICIENCY

Efficiency is generally defined as the ratio of output to input, where outputs—benefits and utility—are maximized, and inputs—cost factors such as capital, land, energy resources, institutions, technology, and labor—are optimized.

Since efficiency in transport cuts across multiple dimensions, the Global Mobility Report defines the boundary for this objective from a strictly "macroeconomic" perspective: the optimization of resources—energy, technology, space, institutions, and regulations—to generate an efficient transport system or network. (Global Mobility Report 2017), while minimizing transport's global environmental footprint including climate change.

This suggests that Efficiency in transport is its operational performance and should be assessed from the perspective of producers and suppliers of transport infrastructure and services, as well as the users, whether from the freight or passenger transport sub-sectors.

Overall efficiency in transport is the sum of two activities. First, resources are expended in making the transport system available for use. To be efficient is to use the minimum resource to achieve the maximum output. Second, resources are also expended by users in consuming transport services. Here inefficiency arises when users of services do not get the quality of service they had expected - for example, with slow, unreliable, or unpredictable transport - and so time, materials, and opportunities of the users themselves are wasted.

Borrowing from the concept of Efficient Air Transport as defined by ACARE,[2] efficient transport systems can be defined as: "The movement of transport vehicles, of all types, and their passengers and cargo, through terminals and transport infrastructure worldwide, along various trajectories/routes, either under one mode of transport or a combination of modes, in a timely and least-costly manner to transport providers and users and without undue constraints arising from unreliable and unpredictable operating, administrative, documentary, legal, regulatory and institutional frameworks."

Promoting efficient transport systems requires that the factors that drive up costs, delays, transit and travel times, and undermine predictability and reliability are controlled. This means addressing the limitations and inadequacies affecting the physical assets (infrastructure creation, maintenance, and operations), the vehicles and equipment, the services (cargo handling and passenger travel), the operations and management practices, and the overall underlying domestic and cross-border administrative, legal, and institutional frameworks that govern passenger and freight transport as well as trade and logistics (such as visa requirements, technical standards, customs, trade policy and market access, traffic rights, non-tariff barriers, and vehicle licensing). Strengthening governance—with good planning, budgeting, transparency, accountability, and regulation—is a prerequisite. In this context, the relevant parameters that measure efficiency in transport include cost, time, reliability, and predictability.

Two types of efficiency are used in this analysis, productive efficiency and allocative efficiency.

Productive efficiency is concerned with the optimal way of producing goods and services, sometimes called "doing things the right way." It ensures the greatest technically possible output allowed by a given set of resources, production factors, and initial conditions. This creates the largest "production possibility frontier," a supply-side concept relevant to producers of transport activity. Productive efficiency

focuses on the delivery of transport services and takes into account physical infrastructure requirements and movable assets such as equipment and vehicles, as input costs of providing the services. Broadly speaking, resources include: time—personal and paid; energy; technology; land; capital; labor; institutions; and regulations used as economic inputs or initial conditions.

Allocative efficiency is concerned with the optimal way of matching demand and supply, and thus the distribution or allocation of resources in society. It is about "doing the right things." This is to make allocation choices along the "production possibility frontier" to account for user's needs and preferences. In this paper we accept that two things are what most distinguish different points along the transport production possibility frontier. First is the infrastructure network: the extent and spatial distribution of the network, spatial allocation to different modes, and modal and intermodal linkages and connections. Second are the costs: the price, time, and other non-price costs faced by travelers and shippers when choosing if and how to travel. Other resource combinations play a role here, but act more through productive efficiency. Allocative efficiency is thus focused on the infrastructure network, and it incorporates the user demand that is relevant to the consumers of transport services.

This paper will explore issues of efficiency, develop measures to support efficiency outcomes, and suggest efficiency actions for the Global Roadmap of Action.

The efficiency objective will be considered along with other objectives of the SuM4All initiative—access, safe, green, and gender. To provide a consistent framework across all the objectives, the GMR defines the efficiency objective in "macroeconomic" or "macro-conditions" terms.

ENDNOTES

2 Advisory Council for Aeronautics Research in Europe.

2. THE STATE OF PLAY

Efficiency can be assessed for multiple aspects of transport systems. In evaluating efficiency across countries, there are limitations of comparable data. These limitations lead to focusing on only one principle indicator–the Logistics Performance Index (LPI)–and a set of country attributes that are strongly correlated with it (see Table 2.1). This comparative evaluation allows a classification of countries in four groups, and the recommendations of actions to be deployed (Chapter 6) are presented by country group.

A second summary indicator dealing with passenger transport needs to be developed to complete the evaluation of transport efficiency.

Table 2.1. Principal Efficiency Indicators

1. Logistics Performance Index (LPI)–for freight transport	
2. Mobility Performance Index (MPI)–for passenger transport, to be developed	
Attributes Evaluated	
1. Distance to "regulatory frontier"	This is based on the Doing Business initiative of the World Bank. This measure is a quantitative indicator of business regulations and the protection of property rights. The distance to frontier score captures the gap between an economy's performance and a measure of best practice across the entire sample of 41 indicators for 10 Doing Business topics. These topics are: starting a business, dealing with construction permits, getting electricity, registering property, getting credit, protecting minority investors, paying taxes, trading across borders, enforcing contracts, and resolving insolvency. An economy's distance to frontier score is indicated on a scale from 0 to 100, where 0 represents the worst performance and 100 the frontier.
2. Electricity carbon intensity	This is the International Energy Agency composite electricity/ heat factor ($kgCO_2$/kWh).
3. GDP per capita	Gross Domestic Product measured by Purchasing Power Parity per population of the country.
4. Government effectiveness	This is a component of the Worldwide Governance Indicators (WGI) project of the World Bank. It includes indicators for six dimensions of governance: Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption.
5. Land area	This is measures per 10 sq. km.
6. Motorization rate	Vehicles per 1000 inhabitants.
7. Smartphone penetration rate	Based on top 50 countries or markets in terms of smartphone users in 2018; available at https://newzoo.com/insights/rankings/top-50-countries-by-smartphone-penetration-and-users/.
8. Terrain ruggedness	This is measured in terms of the average difference in elevation (measured in hundreds of meters of elevation) for points 30 arcseconds apart (that is, 926 meters on the equator or any meridian) not covered by water.

9. Time to export	This is also based on the Doing Business initiative of the World Bank. Measured in days.
10. Trade openness	Is defined as the sum of imports plus exports as share of Gross Domestic Product (GDP).
11. Transport infrastructure index	This is the Transport Infrastructure component in the World Economic Forum, Global Competitiveness Index. This measure combines: quality of overall infrastructure, quality of roads, quality of railroad infrastructure, quality of port infrastructure, quality of air transport infrastructure, and available airline seat kilometres. It highlights the importance of infrastructure coverage and quality.
12. Urban population	This is urban population (percent of total).

Source: Authors

2.1. PRINCIPAL EFFICIENCY INDICATORS

The principal indicator for freight transport is the **Logistics Performance Index (LPI)** developed by the World Bank. The LPI takes on values from 0 (least efficient freight transport) to 5 (most efficient freight transport). It is a comprehensive measure of the efficiency of international supply chains. This means the organization of the movement of goods through a network of activities and services operating at global, regional, and local scale. Efficient logistics connects people and firms to markets and opportunities and helps achieve higher levels of productivity and welfare.[3]

The LPI is based on six components, covering: efficiency of customs and border management clearance (speed, simplicity, and predictability of formalities); quality of trade and transport infrastructure (ports, railroads, roads, and information technology); competence and quality of logistics services (transport operators, and customs brokers); ease of arranging competitively priced shipments; ability to track and trace consignments; and frequency with which shipments reach consignees within scheduled or expected delivery times. The first three components measure inputs to the logistics process and offer areas for policy regulation. The last three components measure service delivery performance outcomes (time, cost, reliability).

Figure 2.1: Logistics Performance Index (LPI) by Region

Source: Own calculations based on World Bank (2018)

The LPI indicates the relative ease and efficiency with which products can be moved into, out of, and within a country.

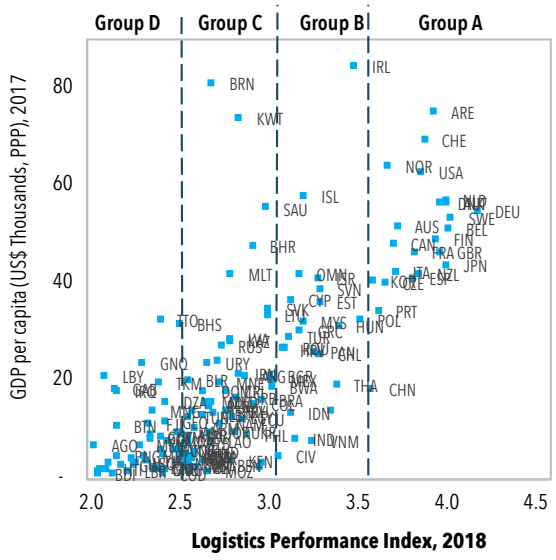
Figure 2.1 shows the distribution of Logistics Performance Index in developed and developing countries, and in six regions of the world for developing countries only. The line in the box shows the median of the variable. The width of the box on either side of the median shows the "spread" of one quartile of the observations. The "Whiskers" show where the more spread out observations lie (two quartiles). Individual dots show observations which are outlying extreme values beyond the quartiles. For example, the median for South Asia is about 2.5. The values within one quartile range from about 2.3 to 2.6 (the Box) and the broader values range from about 1.9 to 3.2 (the Whiskers).

Developed countries were found to have a higher median LPI than developing countries. There were also clear differences between regions in the median of the LPI and in the variability (spread) of LPI among countries within a region. Ranked by median, the regions, from lowest to highest, would be: Sub-Saharan Africa, South Asia, Middle East & North Africa, Latin America & Caribbean, East Asia & Pacific and Europe & Central Asia.

In Figure 2.2, data on Logistics Performance Index is plotted against GDP per capita and used to compare countries on Efficiency. Countries are divided into four groups (A to D) based on distance to best performance (A). The figure displays a strong positive association between Logistics Performance Index and gross domestic product (GDP) per capita by country. Countries with the highest LPI are mostly those with high GDP per capita, and the average LPI rapidly declines as GDP per capita decreases.

The country categorization uses the LPI to measure the achievement of countries at the different stages of development. The bottom group, Group D, represents countries that have made the least progress toward developing an efficient freight transport system. The top group, Group A, includes those that have made the most progress. The rankings also show the achievement that is possible when a country moves from one group to another. The country groups will be used with the country attributes (in Table 2.2) to illustrate the achievement of a given attribute at a given stage of development.

Figure 2.2: Scatterplot of Logistics Performance Index vis-à-vis GDP per capita by country



Source: Own calculations based on World Bank (2018)

The second Principal Indicator would be a **Mobility Performance Index (MPI)**. The LPI is a summary indicator of freight logistics sector performance, combining data on six core performance components into a single aggregate measure. A similar summary indicator is needed for analysis and policy development for passenger transport. Like the LPI it would be used to improve research and analysis, enable cross-country comparisons over time, and support dialogue and discussion.

Some early ideas on developing an MPI suggest two measures would be of value: one for domestic travel and one for international travel. Possible considerations[4] include:

For domestic traveler and passenger mobility:

1. Percentage of population with at least twice daily public transport to the main city (regional capital)
2. Quality of infrastructure (territorial coverage, safety standards, capacity, comfort)

3. Cost of personal mobility (urban public transport monthly card, cost of 100 km train or bus ride, cost of gasoline)
4. Quality of and ease of access to information about public transport (urban, interurban)
5. Punctuality of public transport (urban within 5 minutes, interurban within 15 minutes)
6. Overall safety level in domestic transport (yearly fatalities per million inhabitants)

For international traveler and passenger mobility:

7. Border-crossing time (police, customs) for passengers on exit and on arrival
8. Quality of infrastructure at boarding stations for international connections (capacity, safety standards, comfort)
9. Cost of personal mobility (cost of transport to two most-demanded international destinations, in relation to cost of 100 km domestic transport by train or bus)
10. Quality of information available for international passengers (in advance, in real time)
11. Punctuality of international transport services (within 15 minutes)
12. Overall safety level (yearly fatalities per million passengers in international connections)

Similar to what happens with the LPI, some of these values might be based on hard data—actual measurements and subsequent statistics—and some others on opinion surveys.

2.2. ATTRIBUTES EVALUATED

About fifty variables were considered as potential attributes of countries that could help us understand the dimensions of transport efficiency in a country. Twelve of the attributes are presented in Table 2.2, based on having a high correlation with the LPI or representing a range of geographic, economic, or technological situations of possible interest.

Table 2.2: Correlation between Freight Efficiency Indicator (LPI) and Attributes: For All Countries, Small Island Development States, and Landlocked Countries

	All Countries	non-SIDS	SIDS	not Landlocked	Landlocked
Distance to "regulatory frontier"	0.69	0.68	0.81	0.74	0.50
Electricity carbon intensity	-0.01	0.02	-0.21	-0.04	-0.07
GDP per capita	0.74	0.74	0.69	0.72	0.77
Government effectiveness index	0.85	0.86	0.79	0.85	0.85
Land area	-0.05	-0.09	-0.09	-0.02	-0.20
Motorization rate	0.64	0.65	0.42	0.60	0.85
Smartphone penetration rate	0.77	0.77	Not available	0.76	Not available
Terrain ruggedness	-0.17	-0.14	-0.46	-0.19	-0.00
Time to export	-0.57	-0.57	-0.67	-0.57	-0.55
Trade openness	0.16	0.16	0.45	0.11	0.52
Transport infrastructure Index	0.86	0.86	0.95	0.87	0.79
Urban population	0.53	0.54	0.48	0.49	0.58
	Attributes strongly correlated (>0.60) with LPI in all countries				
	Higher correlation (diff. >+0.10) than for all countries				
	Lower correlation (diff. >-0.10) than for all countries				

Source: Own Calculations (based on World Bank data, 2016)

The summary table shows the correlation between the country attributes and the LPI broken down three ways: first, for all countries; second, for non-SIDS and SIDs (Small Island Developing States); and third, for not- landlocked and landlocked countries. This includes all landlocked countries, not only Landlocked Developing Countries (LLDCs).

For all countries, six attributes stand out as having high positive correlations with the LPI. These are the transport infrastructure index, government effectiveness, smartphone penetration rate, GDP per capita, distance to "regulatory frontier," and motorization rate.

2.3. SMALL ISLAND DEVELOPING STATES AND LANDLOCKED COUNTRIES

Both small islands developing states (SIDS) and landlocked countries may be characterized as experiencing a higher degree of "isolation" than other countries. This is evident in the summary table, where the logistics performance of both is more highly correlated with trade openness than all countries. Both SIDS and landlocked countries share with all countries the high, positive, correlations with government effectiveness and GDP per capita. Countries in each of these groups have some common attributes; there is also significant variability for some attributes within each group, making some correlations difficult to interpret.

The two different country types—SIDS and landlocked countries—lead to differences in their relationship to motorization, terrain ruggedness, distance to the regulatory frontier, electricity carbon intensity, and land area. Not surprisingly, relatively small SIDS are much less correlated with motorization than all countries. Landlocked countries, with no maritime freight transport, depend relatively more on motorization. The small size of SIDS countries may mean that, when rugged terrain does occur, it has a large impact and leads to a higher negative correlation with freight efficiency than all countries. SIDS countries are more dependent on fossil fuel generation of electricity than countries overall.

It is not clear why the SIDS and landlocked countries should have such a strong difference compared, to all counties, with their correlation with the distance to the regulatory frontier attribute, –and in opposite directions—when they did not show a large difference in other summary attributes such as government effectiveness or the transportation infrastructure index.

Drawing on another example from the original set of variables, the cost-to-export attribute shows interesting information across global regions and between not-landlocked and landlocked countries.

2.4. ALL COUNTRIES

A scatterplot is presented for each of the six attributes with highest correlations with the Freight Efficiency Indicator (LPI): transport infrastructure index (figure 2.3); government effectiveness index (figure 2.4), smartphone penetration rate (figure 2.5), distance to regulatory frontier (figure 2.6); and motorization rate (figure 2.7).[5] It provides a visual representation of the correlation between the variables. Higher correlations have a higher degree of linear clustering of the observations.

The correlation value for the transport infrastructure index with the LPI is 0.86, the highest of the attributes compared against the LPI.

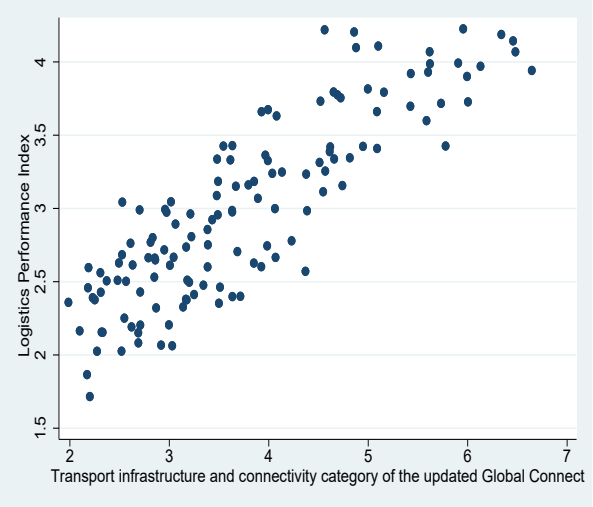
This attribute is associated with the efficiency theme of asset creation and, with its consideration of asset quality, the theme of asset management. The five efficiency themes will be explored in more detail in Section 4.

Government effectiveness is widely associated with efficiency across the transport sector, but in particular with the efficiency themes of service provision and public support and behavior.

The correlation value for the Smartphone Penetration Rate with the LPI is 0.77. Smartphone Penetration Rate is one of the few measures on hand that specifically relate to the adoption of technical innovation. Smartphone penetration is associated with the efficiency theme of innovation.

The correlation value for Distance to Regulatory Frontier with the LPI is 0.69. The Distance to Regulatory Frontier attribute is closely associated with the theme of asset management. Asset management, as a long-term activity with complex interactions and transactions, is more influenced by the ongoing regulatory

Figure 2.3. Transport Infrastructure Index

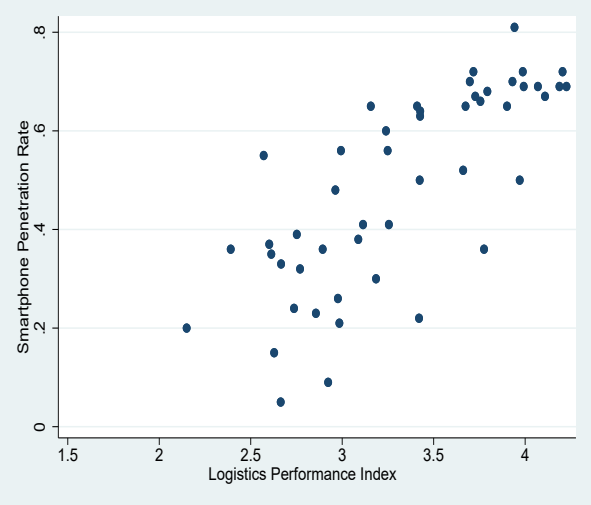


Source: Global Connectivity Index, Huawei

Figure 2.4. Government Effectiveness Index

Source: Worldwide Governance Indicators, World Bank

Figure 2.5. Smartphone Penetration Rate

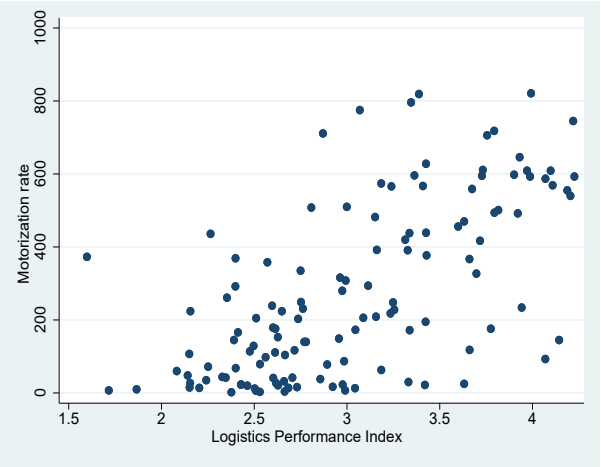


Source: Global Mobile Market Report, Newzoo

Figure 2.6. Distance to Regulatory Frontier

Source: Doing Business, World Bank

Figure 2.7. Motorization Rate



Source: World Road Statistics, International Road Federation

environment than asset creation, which is a succession of one-time activities, or service provision, where the transactions are more simple and visible.

The correlation value for the Motorization Rate with the LPI is 0.64. This is the last of the attributes tested that had a correlation above 0.60. Motorization, being influenced by the overall size and reach of the road network, is associated with the asset creation theme.

2.5. SUMMARY OF ATTRIBUTES BY COUNTRY GROUP

Based on the patterns seen above in the country categorization charts, Table 2.3 below summarizes in qualitative terms the level of each country group for the Principal Efficiency Indicator and six country attributes.

Table 2.3: Attributes by Country Group for Efficiency

	Group D Least Progress	Group C Less Progress	Group B More Progress	Group A Most Progress
Logistics Performance Index	Very Low	Low-Medium	Medium-High	High
Transport infrastructure	Low	Medium	High	Very High
Government effectiveness	Very Low	Low-Medium	Medium-High	High
Smartphone penetration	Very Low	Low	Medium	High
Distance to regulatory frontier	Very Low	Low	Medium	High
Motorization rate	Low	Medium	High	Very High

Source: Own Calculations

ENDNOTES

3 http://www.worldbank.org/en/news/press-release/2016/06/28/germany-tops-2016-logistics-performance-index.

4 Based on discussion with Jose Viegas, See: https://www.linkedin.com/pulse/toward-passenger-mobility-performance-index-jose-viegas/

5 LPI data extracted from the World Bank (2016) in Figures 2.3–2.7.

3. INTERNATIONAL AGREEMENTS AND OTHER INSTRUMENTS

International agreements and instruments have addressed various aspect of efficiency, including standards harmonization, energy efficiency, liability for multimodal transport, and logistics performance. The Logistics Performance Index is affected in several ways. Three of its six subcomponents directly concern international agreements: (i) efficiency of customs and border management clearance; (ii) competence and quality of logistics services; and (iii) ability to track and trace consignments.

3.1. INSTRUMENTS

Coordination among countries and harmonization of rules and practices are crucial for developing efficient transport systems. The international community uses both binding legal agreements and nonbinding tools to improve the efficiency, energy efficiency, multimodality, and logistics performance of transport systems. Legal instruments operate under the auspices of the United Nations (UN) and other intergovernmental organizations. Nonbinding tools for coordination among countries include adopted resolutions, signed declarations, and endorsed action plans.

3.1.1. Binding agreements

Binding international legal agreements are important regulatory instruments that address transport and mobility challenges worldwide. They provide a framework for establishing national legislation and technical standards. They facilitate cooperation and coordination among countries for international transport by various modes, for both passengers and freight. Countries bind themselves to the provisions of these agreements by ratifying or acceding to them, at which point they become contracting parties. Contracting parties commit to uphold these binding agreements, and undertake to observe and implement their provisions. Such instruments may include: commitments to create grids of reference infrastructure; construct or upgrade transport infrastructure in their territories; to introduce agreed standards, uniform rules, or systems; and to simplify transport operations or promote international trade.

The United Nations is at the center of many binding international agreements and conventions that aim to make transport systems more efficient. Some of these agreements are global in scope, whereas other are regional.

Global inland transport agreements are administered by UNECE through its specialized Inland Transport Committee (ITC) whose membership extends to all UN Member States that are Contracting Parties to these agreements. They prescribe detailed operational and procedural norms that are consistent with the objectives of the WTO TFA, and provide tools for its practical implementation. Among these, notably the Convention on International Transport of Goods Under Cover of TIR Carnets (TIR Convention) establishes a system to: (i) ensure streamlined border crossing procedures, allowing customs clearances to also take place at internal customs points instead of at congested borders; (ii) enhance security in the supply chain by using approved carriers and vehicles; and (iii) permit transit through any country without reinspection of the goods due to an internationally valid guarantee. Seventy-three parties have acceded to the TIR convention, including the European Union.

Other global conventions under the purview of UNECE/ITC that facilitate cross-border transport include: (i) the Convention on Harmonization of Frontier Controls of Goods, which reduces formalities such as medico-sanitary and phytosanitary inspections, and increases coordination and cooperation; (ii) the Cus-

toms Convention on Containers, which facilitates the temporary use of containers in international transport; (iii) the Convention on the Contract for the International Carriage of Goods by Road (CMR), which standardizes the conditions governing contracts, including documentation and liability; and (iv) the e-CMR additional protocol, which helps contracting parties transition to using electronic rather than paper consignment notes. There are other binding agreements, including the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR), which is open to all UN member states, and Agreement on the International Carriage of Perishable Foodstuffs and on the Special Equipment to be used for such Carriage (ATP). In total, 59 UN conventions or agreements have been formulated to cover various aspects of cross-border movements of freight and passengers by road, rail, inland waterway, and their combinations.

The UN Conference on Trade and Development (UNCTAD) has been extensively involved in rule-making and standard setting in the field of maritime law, with emphasis on the economic and commercial aspects of shipping. A number of international conventions, mainly in the field of commercial maritime law, were negotiated and adopted by consent at international conferences under the auspices of UNCTAD. Worth highlighting in this context is UNCTAD's particular focus on developing countries. Several other sets of nonmandatory rules and standards were adopted, and have contributed to shaping and harmonizing the international commercial maritime transport law framework. All these instruments help facilitate the efficiency of maritime transport operations.

International conventions developed or adopted under the auspices of UNCTAD, broadly distinguished by areas of subject matter, deal with: (i) economic aspects of shipping—including setting out an international legal framework for liner shipping conferences, and conditions for the registration of ships; (ii) liability for carriage of goods by sea and multimodal transport, aiming to provide an internationally uniform and modern liability framework for international transport; and (iii) enforcement of maritime claims—including the recognition and enforcement of maritime liens and mortgages at the international level, and circumstances under which ships may be arrested or released from arrest. Also, UNCTAD has adopted different sets of model rules and nonmandatory standards, which may also be used by countries as a basis for their national law, and may be voluntarily adopted by industry organizations and bodies, or incorporated into commercial contracts. All these instruments help increase efficiency of and facilitate cross-border transport operations.

International aviation is regulated in large part by agreements administered by the International Civil Aviation Organization (ICAO). The Convention on International Civil Aviation seeks to: (i) maintain a degree of uniformity in regulations, standards, procedures, and organization across countries; (ii) establish measures to facilitate air navigation; and (iii) set efficient practices, among many other provisions, which are addressed in the 19 annexes of the convention. ICAO also administers the Montreal Convention of 1999 (signed by 136 States) which deals with air carrier's liabilities.

A number of regional agreements focus on efficiencies of infrastructure — the identification, design, development, construction, and signage of international transport networks, and the creation of mode-specific or multimodal transport facilities, such as terminals and border-crossing points. These agreements contribute to transport efficiency by enhancing infrastructure quality and connectivity within and between countries. Examples of binding infrastructure agreements include the United Nations Economic Commission for Europe (UNECE),[6] which defines European road, rail, inland waterway, and combined transport networks and sets standards for their design, construction, and maintenance; the United Nations Economic and Social Commission for Western Africa (UNESCWA), which is responsible for agreements relating to the road and railway networks in the Arab Mashreq countries; the United Nations Economic Commission for Africa (UNECA), which supports the implementation of the Intergovernmental Agreement on the Trans-African Highways; and the United Nations Economic Commission for Asia and the Pacific (UNESCAP), which handles the intergovernmental agreements on the Asian Highway Network, the Trans-Asian Railway Network, and regional Dry Ports.[7] These three agreements under UNESCAP form the basis for comprehensive infrastructure planning in Asia and the Pacific, with the

overarching objective of creating infrastructure that can support intra- and inter-regional integrated intermodal transport and logistics systems there.

World Customs Organization is responsible for administering the International Convention on the Simplification and Harmonization of Customs procedures (known as the Revised Kyoto Convention).

This international instrument (ratified by 115 countries) supports: transparency and predictability of Customs actions; standardization and simplification of the goods declaration and supporting documents; simplified procedures for authorized persons; maximum use of information technology; minimum necessary Customs control to ensure compliance with regulations; use of risk management and audit-based controls; and coordinated interventions with other border agencies. These are relevant elements for international agreements affecting the Logistics Performance Index.

The WCO maintains the international Harmonized System (HS) of goods nomenclature, and administers the technical aspects of the World Trade Organization (WTO) Agreements on Customs Valuation and Rules of Origin.

Other WCO instruments (SAFE Framework of Standards, Single Window Compendium, Time Release Study and WCO Data Model) are instruments and tools that support the Customs-related provisions of the WTO Trade Facilitation Agreement (see below).

Other binding international conventions are intended to increase transportation efficiency by facilitating its operations and related international trade procedures. Facilitation of transport is inextricably linked to the use of international standards, information and communication technology (ICT), and best practices to rationalize, simplify, and harmonize border procedures, formalities, documents, regulations, and laws related to transport, import, export, and transit of goods. Among these, the WTO Trade Facilitation Agreement (WTO TFA) merits special attention because it contains provisions for expediting the movement, release and clearance of goods, including goods in transit. It also sets out measures for cooperation between customs and other appropriate authorities on trade facilitation and border compliance issues.[8]

3.1.2. Nonbinding instruments

In addition to binding international agreements and conventions, nonbinding instruments such as political declarations, resolutions, and action plans have helped shape the transport efficiency agenda in recent years. Overall, these efforts underscore sustainable mobility and provide policy recommendations pertaining to: (i) relevant international transport policies; (ii) trade facilitation; (iii) transport infrastructure investment and maintenance, including multimodal systems; and (iv) regional integration promotion in countries that lack access to global markets and are burdened by prohibitive transport costs. They result from the knowledge sharing of best practices and recommendations by various entities, including international organizations, the private sector, civil society, academia, and other nongovernmental organizations.

3.1.3. Resolutions

The U.N. General Assembly has underscored the importance of transport efficiency by adopting three resolutions[9] on sustainable mobility between 2014 and 2017, and by recommending a set of measures that focus on the efficiency goal. These resolutions call for more international cooperation, harmonization, and improvement of transport and border-crossing infrastructure, facilities, and services, and for stronger links between all modes of transport. Also, the Ashgabat Statement, endorsed by the participants of the United Nations Global Sustainable Transport Conference in 2016, addresses the efficiency themes of the Sustainable Development Goals by calling specifically for action related to transport corridors, border crossings, multimodality, and energy efficiency.[10]

The United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States (UN-OHRLLS) facilitates the coordinated implementation of the respective Programmes of Action, which were adopted by the UN General Assembly. These action plans integrate policy recommendations for enhancing transport efficiency for three groups of nations, with an emphasis on connectivity and trade integration.[11] A similar tool for addressing connectivity issues from a regional perspective is the UNESCAP Action Programme for Sustainable Transport Connec-

tivity in Asia and the Pacific (Phase I, 2017–2021) which sets a number of targets on: (i) regional transport infrastructure connectivity; (ii) regional transport operational connectivity; (iii) Euro-Asian transport connectivity; (iv) transport connectivity for Least Developed Countries (LDCs), LLDCs, and SIDS; (v) sustainable urban transport; and (vi) rural transport connectivity to wider networks.

Two resolutions from 2016 are intended to improve efficiency in civil aviation: the Council Resolution on Aviation Contribution toward the United Nations 2030 Agenda for Sustainable Development and the Council Resolution on the No Country Left Behind initiative. They urge member states to implement efficiency standards, adhere to recommended practices, and ensure economically viable civil aviation systems.

Numerous international action plans and commitments both within and outside the UN system and across different modes of transport focus on energy efficiency as it relates to sustainable mobility. These include: (i) the IMO Energy Efficiency Design Index (EEDI); the Ship Energy Efficiency Management Plan (SEEMP) and the Energy Efficiency Operational Indicator (EEOI); (ii) the Collaborative Aviation Climate Action, to improve air transport fuel economy; (iii) the C40 clean bus declaration; (iv) the low carbon rail transport challenge; (v) the global fuel initiative; and (vi) the global green freight action plan.

The World Road Association (WRA, PIARC) has developed several reports and manuals regarding efficiency, asset management, and road maintenance issues and an online manual on asset management and maintenance.

The Union Internationale des Chemins de Fer (UIC) or International Union of Railways promotes world rail transport with the objective of meeting the challenges of mobility and sustainable development. It promotes interoperability, (including common solutions with other transport modes), and facilitates international cooperation among members and the sharing of best practices (benchmarking). The air transport industry plays a major role in the global economy. The International Civil Aviation Organization (ICAO) improves aviation's successful safety performance while maintaining a high level of capacity and efficiency. ICAO's 12,000 Standards and Recommended Practices, which include 19 Annexes and five Procedures for Air Navigation Services to the Chicago Convention, as well as dozens of manuals, provide states and industry stakeholders with the necessary regulatory framework and guidance to develop and enhance their aviation sectors.

The ICAO Global Air Navigation Plan (GANP) is a strategy to achieve global interoperable air navigation system, for all users during all phases of flight, that meets agreed levels of safety, provides economic operations, is environmentally sustainable and meets national security requirements. The GANP encourages innovation and guides the aviation community to modernize the provision of air navigation services by applying innovative solutions while increasing capacity and improving efficiency.

3.2. IMPLEMENTATION

While binding and non-binding agreements, conventions, action plans, resolutions, and declarations address many topics, continued implementation remains an imperative. There are countries that have not yet acceded to any binding conventions and agreements to date, while other countries have acceded to only a few, and still others have acceded to conventions but face implementation challenges.

The farthest-reaching global agreement of this kind is the TIR convention, ratified at the time of preparation of this report by 75 States and the European Union. Despite the increasing number of accessions to border crossing facilitation agreements, poor or insufficient adoption of the provisions by some countries can be a challenge to the implementation of the TIR and similar Conventions. This challenge can be for various reasons, such as inefficiency of customs procedures, additional control measures, and technical specifications, poor facilities at border crossing points, and implementation costs. To meet TIR's requirements some countries would benefit from enhanced support and targeted technical assistance.

Some conventions address region-specific needs. Most of these are infrastructure conventions that define transport networks. Because countries that accede to regional infrastructure conventions may not

possess a uniform quality of infrastructure or a consistent density of transportation networks, these regional groupings may need to improve networks according to the shared standards.

Like binding global and regional agreements, non-binding resolutions, declarations, and action plans also face obstacles to be put into practice. They are often endorsed by all member states, but mainstreaming these recommendations requires complex effort from central and local governments, the private sector, international development organizations, and many more stakeholders.

UN agencies monitor the implementation of existing plans of action in order to track progress. Data availability continues to be a challenge in some areas, not only because the harmonization of indicators and methodologies for data collection between countries is difficult, but also because of variations in national and local capacity for data collection—particularly in developing countries.

The instruments endorsed, adopted, and administered by the international community are crucial for improving specific aspects of transport efficiency. Collectively, they improve the efficiency of international transport. However, endorsing and ratifying these instruments is not sufficient: challenges to implementation must be overcome to maximize impact toward more efficient transport systems.

ENDNOTES

6 www.unece.org/oes/nutshell/member_States_representatives

7 Intergovernmental Agreement on the Asian Highway at: http://www.unescap.org/resources/intergovernmental-agreement-asian-highway-network Intergovernmental Agreement on the Trans-Asian Railway at: http://www.unescap.org/resources/intergovernmental-agreement-trans-asian-railway-network and Intergovernmental Agreement on Dry ports at: http://www.unescap.org/resources/intergovernmental-agreement-dry-ports

8 See, World Trade Report, 2015. https://www.wto.org/english/res_e/booksp_e/world_trade_report15_e.pdf

9 UNGA Resolutions A/Res.69/213, A/Res.70/197, and A/Res.72/212.

10 See: http://sdgtoolkit.org/wp-content/uploads/2017/03/Ashgabat-Statement-on-Commitments-and-Policy-Recommendations-of-the-Global-Sustainable-Transport-Conference-1.pdf.

11 For further information, see The Istanbul Programme of Action for Least Developed Countries, the Vienna Programme of Action for Landlocked Developing Countries, and/or the transportation component of the Small Island Developing States Accelerated Modalities of Action (SAMOA).

4. CATALOGUE OF MEASURES

This section sets out a list of 47 measures or actions that will help countries achieve the efficiency goal, grouped under four approaches, or "toolboxes"—Economics & Finance, Regulatory & Institutional, Engineering & Technology, and Communications. The toolbox approach is used across all the streams of the Global Roadmap of Action (GRA) to consolidate the various measures in a consistent way.

Necessary preconditions for implementing these measures effectively are: an overall functioning economy with no substantial failures in the factor markets; and a functioning governance system for transport. The latter includes: relevant institutions; an overarching legal, regulatory, and commercial framework; established procurement practices; and regulatory and law enforcement mechanisms.

Within each toolbox, measures are listed in accordance with their application and contribution to the two efficiency aspects, allocative and productive. In practice, more than one toolbox of activity will concern a particular transport actor. For example, a truck operator might locate a depot or a stop according to economic tools (E09), build the depot using engineering tools (E36), arrange driver shifts according to regulatory tools (E29), and support users with marketing tools (E47).

The measures are grouped within each efficiency section by five "themes," which consider aspects that define the transportation systems, namely:

1) Infrastructure asset creation—the construction of linear or nodal transport infrastructure, such as a rail line, port, an airport, or a station.
2) Infrastructure asset management—the use of transport infrastructure to support provision of a transport service, such as maintaining a road or a port. This includes maintenance and upgrading or refurbishment of an existing asset to new capacity or function .
3) Transport service provision—making use of the available physical infrastructure, other assets such as equipment and vehicles, and other operating and maintenance activities, including equipment maintenance, to offer services such as shipping or a bus service.
4) Innovation—learning from experience, adapting and adopting new technology and practices, diffusion of innovation, support for human resources.
5) Public support and behavior—building understanding and support for investments and innovation, supporting users of transport (travelers and shippers), encouraging lifestyle and behavior changes to make best use of sustainable transport opportunities.

The six attributes that were discussed in Section 2 are relevant indicators for each of these five themes. The attributes which most correspond to the themes are shown in table 4.1.

The inputs to the activities or actions described by the measures are the same as defined earlier: time, energy, technology, land, capital, and labor; and institutions and regulations used as economic resources or initial conditions.

The relevant parameters measuring efficiency and the outputs from the activities or actions described by the measures include cost, time, reliability, and predictability. The activities or actions will apply to the public sector or the private sector (including not-for-profit) depending on the particular arrangements in each country.

Table 4.1: Relationship of Transport Themes and Efficiencies Theme

Transport Theme	Allocative Efficiency "do the right things" (long run perspective, demand and supply, pricing)	Productive Efficiency "do things the right way" (standards, practices)	Related country attributes (from Section 2)
Asset creation	Economic choice of the asset. Plan and evaluate. Build capacity and coordinate.	Standards and international conventions. Physical and technical construction as specified. Fit for purpose	Transport infrastructure index, motorization rate
Asset management	Economic provision and use of asset. Coordinated arrangements. Competition policy	Technical use and management of asset. Active oversight	Distance to regulatory frontier
Service provision	Economic provision and use of service. Pricing. National, city-level strategies	Harmonization and international conventions. Technical operation and maintenance of service	Government effectiveness, GDP per capita,
Innovation	Policy support. Use economic instruments	Harmonization and international conventions. Remove regulatory barriers. Human resources development	Smartphone penetration
Public support and behavior	Shared information and active support for public discussion	User supports. Supportive lifestyle choice and behavior	Government effectiveness

Source: Own elaboration

In the list below each measure has an identification number added (E01, E02, etc.) for easy reference. This makes it possible to sort the measures by type of efficiency, efficiency theme, type of traffic (freight, passenger, or all), geography (whole country, rural, urban, remote), and country typology (discussed in Section 6 below).

Annex 1 shows the 47 measures re-grouped into 32 measures, and the format, used in the Global Roadmap of Action.

4.1. ECONOMICS AND FINANCE TOOLBOX

ALLOCATIVE EFFICIENCY

Infrastructure Asset Creation

E01. *Prepare strategic goals and a plan for the transport system and the role of transport services, nationally and subnationally.* This must consider current and expected demand, the location of network and facilities, connectivity, cross-border transport, rural transport, rural-city transport, inter-city transport, trade-offs between modes, intermodal, multimodal, modal shift, terminal access, and the roles of the public sector and private sector. This work must explicitly reference transport's alignment to environmental sustainability, including: improving energy efficiency, sustainable land use policy, sustainable natural resource policy, the role of environmental taxes or subsidies, climate resilience of infrastructure, sustainable and smart transport, and more. It will evaluate and encourage innovation in the transport system through the application of new technologies (E15, E33).

The plan will address any country-specific issues such as Landlocked Developing Country (LLDCs) and Small Island Developing States (SIDS), including: secure access to and from the sea by all means of transport; reduction of costs; and improvements to service to provide connectivity, accessibility, and competitiveness of trade.

A strategic framework insures area integration and social cohesion, as well as economic (market) integration and promotes a long run, comprehensive perspective

on the transport system in several ways. First, it ensures connectivity across a whole country, between countries, and within regions and urban/rural/remote areas within the country. This encourages long-run efficiency—such as lower cost, faster, and more reliable travel time—and enhances productivity. Second, it promotes consistency with the long-run goals of other economic sectors, including their infrastructure finance needs; encourages asset interconnections and interoperability; and improves service integration. Finally, it enables the identification of issues of specific importance to a country/region, such as urban transport or landlocked transit, environmental impact, and the climate vulnerabilities of transport systems, as well as the identification of issues of global importance, such as motorization, urbanization, globalization, and natural resource depletion and climate change.

E02. *Implement comprehensive and integrated transportation planning and land-use planning processes, including environmentally sustainable and climate resilient land-use planning.* In most countries this will include providing authority and building capacity to local actors including at municipal levels.

Land use is a fundamental determinant of transport demand, and needs to be planned simultaneously with transportation to ensure that development is consistent between the two activities. This planning coordination can provide the optimal location of assets and technology choice—such as the optimal location of stations and access for the population; weigh the trade-off between urban and rural development and between different areas of concentration within a city or country; and guide the choice and location of different transport approaches that may be needed, even within the same city or region. Integrated transportation and land use planning must consider climate change and environmental sustainability, such as: climate adaptation, climate mitigation, habitat protection, and natural resources preservation. It must inform and be informed by interrelated policies such as social inclusiveness (E10) and urban transport policy (E11, E12).

Cities, for instance, cannot continue to grow sustainably, ensuring proper mobility of people and goods, without shifting away from car use where possible. An integrated approach to planning is needed to reduce dependency on cars in favor of increased walking, cycling, and public transport use. Urban development should make the most effective use of land, reflecting its connectivity to existing and future public transport, walking, and cycling routes, and should ensure that any impacts on transport networks and supporting infrastructure are mitigated.

E03. *Plan complete networks that optimize supply, demand, and service availability.* Minimize missing links, prevent overbuilding, specify the optimal location of corridors, linear facilities, hubs, etc. Network plans for the transport system will be informed by the strategy setting process (E01) and integrated land use and transport planning (E02). Improvements in the performance of transport networks can be achieved through technological innovation (E33) and by using advanced planning and regulatory tools (E15, E32).

E04. *Adopt strategic policy perspectives on finance, pricing, and subsidy policy by mode; including revenue sources and the role of the public sector, the private sector, and of public-private partnerships (PPPs) – separately for freight transport and for passenger transport.* Strategic perspectives must evaluate long-run infrastructure finance needs, including any existing backlog of deferred maintenance (the "infrastructure gap"). Because infrastructure finance is tightly linked with the choice of price, consistency between pricing and financing policies is essential. The infrastructure finance needs of transport must be balanced with the long-run needs of other economic sectors (E01). Increasing investments in transport infrastructure leads to increasing need to also invest in asset maintenance. The evaluation of infrastructure finance needs must be coordinated with the development of the financing policy framework. Examples include: application of sustainable, innovative, financing and guarantee schemes for asset creation, or asset use charges to allow for return on investments. Price is a signal for both demand and supply behavior. It can be used to match demand and supply and so ensure allocative efficiency.

Because of market failure, markets may not be optimally balanced by price, and so policy is needed to understand and decide on the role of price in different markets, and for passenger and freight transport. Finance, pricing, and subsidy also must consider the

needs of asset management and maintenance (E38) and ultimately, service provision (E40). Infrastructure asset management is an ongoing activity over the life of the asset, and is sensitive to the cumulative effect of financial and pricing arrangements.

E05. *Use a robust investment evaluation framework to decide the allocation of public infrastructure investment, applied to all modes and to freight and passenger transport, using economic and financial life-cycle evaluations and network-based demand estimates.* The core of the evaluation framework will be a modern and comprehensive cost-benefit analysis that will incorporate quantifiable social and environmental considerations.

The framework considers current deficiencies and forecast demand and is informed by the finance, pricing, and subsidy policy (E04) land policy (E02), and urban transport policy (E11, E12). The framework considers which ultimate level of service is being designed for (E09). Efficient minimum services (such as a minimum social standard of access) should be evaluated on the basis of cost effectiveness.

Demand forecasts must consider latent demand and the trade-offs between latent demand by mode—for example, not just building road capacity because the road is saturated. The framework must consider a range of possible alternative investments and include consideration of innovations. It must evaluate risks, including the possible future impacts of climate change. It should ensure that proposals have a good match between demand and supply, including: product match – the type of service and service integration; geographic match; timing match; and possibilities for revenue generation. A good match of supply and demand prevents inefficiency from the underutilization of the asset, or inefficiency from unmet demand if the asset is inadequate to need.

Broad social costs and externalities should be considered, including: environmental—air, water, soil, and noise pollution; economic—the cost of congestion; and overall competitiveness—including the long run creation of, and access to, employment. One example is trade corridor development being evaluated on the basis of current and future trade flows. Where these can be reasonably quantified, they can be included in the main cost-benefit analysis. Multi-criteria analysis can be used to organize and evaluate non-quantifiable considerations.

Infrastructure Asset Management

E06. *Set up network management arrangements to optimize supply, demand, and service availability.* This is to provide the optimal availability of linear facilities, routes, and hubs. Following on the network plan for the transport system (E03), arrangements must be made to manage and maintain the created infrastructure assets. These must provide complete networks and available hubs that operate reliably and consistently in a coordinated way over time, to attract and support service providers. The specific arrangements for public and private sector actors will be informed by the strategic policy on finance, pricing, and subsidy policy (E04), and competition policy (E08).

E07. *Use a robust evaluation framework to decide the allocation of public expenditures for infrastructure management.* The evaluation framework considers current deficiencies and forecast demand, and is informed by the strategic policy on finance, pricing, and subsidy policy (E04) and infrastructure management arrangements (E06). Public spending decisions can continue indefinitely after infrastructure management arrangements have been set up. Evaluation should use, and be as robust as, the methods used in evaluating asset creation and service provision (E05, E13). Refer to E05 for the complete description of the evaluation framework.

E08. *Adopt an overall transport competition policy and mode-specific policies.* Competition policy is needed to guide and inform the regulations that will govern the behavior of public and private sector actors in the transport system. In infrastructure management, areas of competition can include: shared infrastructure, contested infrastructure, revenue sharing, access to linear facilities, access to terminals and ports, and intermodal policy. In transport service provision, areas of competition can include: joint operations, contested operations, joint ticketing, sharing customer data, access to terminals and ports, and intermodal policy. Competition policy is needed to understand and guide the case-by-case application of pricing to service provision. This policy needs to be specific to passenger and freight transport, as well as to each mode of transport. Competition policy will be

considered by regulatory bodies (E25) and in service provision (E22, E27).

End-User Service Provision

E09. *Plan levels of service to optimize supply, demand, and service (availability, reliability, and access) and provide the optimal level of service along routes and to hubs.* Plan services to maximize the match between transport demand and supply, and ensure alignment with other transport and nontransport activities. Services will use the network infrastructure provided by infrastructure managers (E06).

Transport services are vital to the economy, and interact with people, business, land use, and other sectors daily. Because transport is needed by everyone, every day, it must be available to everyone, every day. This requires an understanding of the minimum standard level of transport service that must be provided to everyone, including poor or vulnerable users. Service provision thus has two dimensions: a minimum standard of service and a level of service relevant to demand.

Transport services will be delivered by service providers (E27) and day-to-day service provision (E40) will direct operational plans. Service planning as conceived here will take into account the needs of vulnerable users (E10) and human resources development in transport (E35).

E10. *Consider developing support for access for low-income or vulnerable users of transport services.* This includes concessionary fares, other fare discounts, and integration of fares into the broader social welfare framework. It may also include issues such as tailored service delivery and physical access to vulnerable users, and training of operators/drivers. In urban areas, these supports will include cooperation with city-level implementing authorities (E22).

E11. *Consider developing city-level public transit strategies and policies to support and improve public transport efficiency, such as: transit-supportive land use, travel demand management (TDM), and active transport.* Ensure an adequate city-level regulatory framework to improve public transport efficiency. Use new technologies and data analytical tools to improve public service delivery (E15, E33). City-level strategies will include cooperation with city-level implementing authorities (E22).

E12. *Consider developing city-level road management strategies that favor higher-value trips and more efficient modes, including cycling—such as efficient road and parking pricing, high-occupancy vehicle priority lanes and traffic control systems, travel demand management programs, and use of real time information and innovative technology solutions (ITS) to optimizing road users' use of the network.* A shift from car use to more space-efficient travel is one of the long-term solutions to road congestion challenges. Reliable deliveries and servicing, and easy access to markets, workplaces, and key locations are dependent on increasingly efficient transport networks. Roads will continue to play a vital role in this, and greater priority needs to be given to making them more efficient for those activities that depend on them the most. City-level strategies will include cooperation with city-level implementing authorities (E22).

E13. *Apply a robust evaluation framework to decide allocation of public expenditures supporting transport services.* Evaluation of service provision is used to promote an efficient match between supply and demand. The evaluation framework considers current deficiencies and the forecast demand, and is informed by the finance, pricing, and subsidy policy (E04), land policy (E02), and urban transport policy (E11, E12). Evaluation should use, and be as robust as, the methods used in evaluating asset creation and asset management (E05, E07). Refer to E05 for the complete description of the evaluation framework.

E14. *In coordination with local governments, develop a "local perspective" policy on passenger pricing, subsidy, and finance policy.* The national strategic policy perspective on finance, pricing, and subsidy policy (E04) provides an overall framework for pricing, including the role of the public sector, the private sector, and of PPPs. Passenger service provision is the part of the transport system where local governments are most likely to be involved; in planning, operation, or finance. This measure is concerned with location and market-specific user fees, including local government relations, fiscal capacity, and local social conditions. Local knowledge of conditions could be used to fine-tune the national policy where warranted.

Innovation

E15. *Encourage innovation in transport policy development and decision making and the use of economic instruments to foster innovation.* It is critical to counter the tendency of existing actors and incumbents to resist innovation. Decisions in the transport system—such as planning, policy, financing, pricing, procurement—should be based on a clear understanding of current technology and practice, but should also consider expected progress and possible innovations. At the same time, innovations need to be considered in the context of harmonization. For example, these decisions should consider how vehicle electrification, automated vehicles, or other digital innovations may provide significant insights and affect decisions about public transit infrastructure and public service delivery, or support smart transport networks. Use economic incentives to promote innovation, such as: support for dedicated training and education programs; subsidies or tax breaks to encourage research and development; subsidies or tax breaks to supply innovative projects, products or services; and reduced tariffs—perhaps replaced by transfer payments—for experimental or pilot projects. These incentives can include: income or sales or property tax reductions for individuals or corporations; and temporary funding or funding for a specific initiative.

E16. *Foster a culture of learning from experience.* Review the outcomes of the components of the transport system (asset creation, management, and services) periodically or at appropriate milestones. Review the outcome of policy decisions and regulatory practices and adjust accordingly. Monitoring and evaluation practices should be a standard component investment projects and of on-going operations. Lessons learned should be disseminated and discussed.

PRODUCTIVE EFFICIENCY

Infrastructure Asset Management

E17. *Use pricing mechanisms (tolls, port charges, asset use charges) to manage demand, raise revenue, and finance infrastructure management and maintenance.* This must be informed by the strategic policy perspective on finance, pricing, and subsidy policy (E04) and the "local perspective" policy on passenger pricing, subsidy, and finance policy (E14).

End User Service Provision

E18. *Use pricing mechanisms (fares, user charges, tolls, port charges) to manage demand, raise revenue, and finance service provision.* This must be informed by the strategic policy perspective on finance, pricing, and subsidy policy (E04) and the "local perspective" policy on passenger pricing, subsidy, and finance policy (E14).

4.2. REGULATORY AND INSTITUTIONAL TOOLBOX

ALLOCATIVE EFFICIENCY

Infrastructure Asset Creation

E19. *Ensure coordination and national capacity.* Coordinate across the national government to ensure broad and multi-sector issues are well considered between transport and other sectors. Minimize fragmentation of the legislative framework, and ensure legal certainty for asset creation and maintenance. Ensure good intergovernmental relations with local government (municipal, rural, and remote). Improve planning and administration among different jurisdictions, organizations, and modes; for the public sector and private sectors. Adopt government budget processes that provide adequate financial resources for all transport expenditures or supports, at all levels of government (E40, E41). Ensure availability of information and data to support policy making (E21). Ensure coordination of land use and transport planning processes. For example, freight transport network planning helps align land-use plans with the movement of goods through and within countries and regions, to support the economic performance of industries, ensure connectivity, and reduce the potential for negative impacts (pollution, congestion, accidents) associated with the movement of freight. The requirement to build coordination also applies to infrastructure asset management and to transport service provision.

E20. *Build local capacity and coordination.* Provide institutional strengthening for local actors to help ensure the appropriate management of contracts, oversight of operations, and successful integration of local systems and services. Promote the exchange of ideas between different actors in the transport and logistics

systems—including suppliers and customers throughout the logistics chain. Promote digital connectivity across the transport and logistics systems.

Infrastructure Asset Management

E21. *Require usage and financial information and operational data (in confidence) from public or private infrastructure asset managers, to provide support for decision making and regulatory oversight*. Good policy and regulatory development require good input information and data. However, private sector asset managers may regard information sharing as an unnecessary cost or a commercial risk, so it needs to be explicitly required. This requirement also applies to transport service providers (public or private) to provide financial information and operations data to support policy making, services and land-use planning, rate setting, and pricing.

End User Service Provision

E22. *Single urban authority*. For urban areas, consider concentrating responsibility for decisions about all transport modes in a single political authority, which may be supported by different technical bodies for various modes. The authority should combine political legitimacy, good governance practices, sufficient financial resources, institutional capacity, relevant geography, and appropriate regulatory frameworks. Such an authority would be supported by higher orders of government (E20), regulatory bodies (E25), and include considerations of social inclusion (E10), public transit (E11), urban roads (E12), complete service provision (E44), and public participation (44, E45).

PRODUCTIVE EFFICIENCY

Infrastructure Asset Creation

E23. *Create construction standards so that assets are created using accepted, up-to-date, harmonized standards and regulations—including across borders, within regions, and along transport corridors*. These could include building codes, mode-specific technical standards, and procurement standards. The adoption and use of these standards, regulations, and norms will support the broader construction industry and ensure construction of assets that: (i) promote sustainability in transport and adaptation to climate change; (ii) are not reinvented for each project; (iii) encourage efficiency, such as lower cost, faster and more reliable travel time, greater productivity; (iv) promote interconnections between different assets; (v) promote system inter-operability (such as narrow versus standard rail gauge); and (vi) take account of advances in knowledge and evidence and do not lead to costly over- or under-design. Construction standards are deployed through the engineering and technology toolbox (E36).

Infrastructure Asset Management

E24. *Create management standards*. Manage assets using accepted, up to date, and harmonized standards and regulations for asset management and maintenance. The adoption and use of these standards, regulations, and training methods will ensure: (i) management practices that do not need to be redeveloped in each case; (ii) will promote interoperability among the use of various assets and technologies; (iii) applies also for asset decommissioning. Harmonize standards and norms with conventions and regional agreements related to infrastructure asset management, to promote the harmonization of infrastructure networks. Transfer or transpose international regulations into local text. Management standards are deployed through the engineering and technology toolbox (E38).

E25. *Promote application of management standards*. Organize the asset management industry and ensure legal clarity for asset management by adopting mode-specific enabling legislation and regulatory law, including mode-specific agencies and their governance. Establish mode-specific regulatory bodies to monitor competition, access, service quality, tariffs, and safety among infrastructure asset managers. Establish infrastructure asset management quality practices, using mode- and network-appropriate standards. Use of accepted, up-to-date operating practices will ensure consistent approaches to management that can: (i) help the development of the asset management industry or agency; and (ii) will be specific to freight transport and to passenger transport. The mode-specific regulatory bodies established here will also provide the regulatory framework for service provision.

End User Service Provision

E26. *Create transport service standards.* Provide services using accepted, up to date, and harmonized standards for service provision—mode-specific management, business, operating, and maintenance standards. Using such standards and regulations will encourage efficiencies such as lower cost and faster and more reliable travel time. Transfer or transpose international regulations into local text. Service standards are implemented through the engineering and technology toolbox (E40) and by service providers (E27).

E27. *Organize transport service delivery and ensure legal clarity for services by adopting mode-specific enabling legislation and regulatory law, including mode-specific agencies and their governance.* Use mode-specific regulatory bodies (E25) to monitor competition, access, service quality, tariffs, and safety among service providers. Establish service quality practices, using mode- appropriate standards. Urban services for passengers and freight will be informed by the urban specific policies in E10 E11, E12, E14, and E22.

E28. *Ensure cross-border trade facilitation, implement and adhere to service conventions, border crossing facilitation conventions, and regional agreements.* Ensure efficient transit though: harmonized and integrated border clearance; customs cooperation; one-stop border posts and single windows; use of e-documents such as eTIR, eAWB, and eCMR; trade facilitation measures including under the WTO TFA; and clear transit transport instruments (such as the TIR Convention).

E29. *Ensure legal certainty for national and subnational transport operations and regional harmonization, including transparent, non-discriminatory rules on: (i) provision or withholding of licenses and permits; and (ii) drive times and rest periods for professional drivers.* Adopt and enforce rules on rights and obligations of users (travelers and freight). This will help to promote service integration between providers.

E30. *Remove regulatory barriers to improve interoperability between operators and modes.* Adopt mode-specific operational licensing standards for pilots and commercial vehicles, and standards for weights and dimensions for road, rail, and water vehicles. Clear, consistent operating practices will help the development of the transport system.

E31. *Address country specific issues such as Landlocked Developing Country (LLDCs) and Small Island Developing States (SIDS), including: problems of transport costs, delays, uncertainties, and poor connectivity in trade routes; and loss, damage, and deterioration in transit.* Improve competitiveness and export expansion.

Innovation

E32. *Put in place an approach to regulation that supports innovation, and review regulatory barriers to innovation.* Require the development and adoption of performance-based or functional standards (for example, throughput and connectivity levels) replacing design-oriented technical standards and practices. Review existing regulations to identify areas needing to be revised. Evaluate the tendency of incumbents to resist innovation, and create conditions that encourage innovation and its deployment to existing systems. Ensure harmonization of innovation with existing practices where needed for efficiency. This approach to "top-down" regulatory innovation needs to support technical innovation (E33) and "bottom-up" operational or front-line innovation (E43). For example, ensure that regulations for domestic and international freight and passenger transport can support digital connectivity and facilitate data transmission of operational data. Operational data transmission is a growing activity that is already critical to the logistics chain, equipment management, and customer information and service, and is becoming important for automated vehicles

E33. *Support technical innovation while ensuring interoperability and harmonization.* This includes "hard science" innovation in civil or mechanical engineering, vehicle technology, instrumentation, and data transmission; "soft" innovation in business practices, information sciences, or logistics; and interactions between both kinds of innovation. Encourage technical experimentation and pilot projects through funding and expedited authorization. Ensure national and international interoperability and harmonization, as well as regulatory flexibility in support of technical innovation. Examples include: cross-border or global regulatory support for technical innovation in transport

equipment and vehicles—requiring harmonization to guarantee interoperability; demand responsive services; better integration across modes; and "mobility as a service" (MaaS).

E34. *Support information sharing and the diffusion of innovation across government, organizations, agencies, companies, civil society, and the education sector.* Encourage an open attitude toward improvement. Benchmark local practices against international standards. Promotion of innovation will encourage: (i) resource-efficient standards; (ii) standards able to meet new challenges, including climate change; and (iii) linkages and synergies with technical developments in other areas which could lead to reductions in costs, and extend asset life cycles.

E35. *Support development of human resources in transport.* Coordinate transport sector requirements with broader government human resources policy. Provide sufficient funding for technical training for the current and future transport workforce. Provide funding for workforce transition where shifting requirements have made workers redundant.

4.3. ENGINEERING AND TECHNOLOGY TOOLBOX

PRODUCTIVE EFFICIENCY

Infrastructure Asset Creation

E36. *Build complete multimodal networks specified to optimize supply, demand, and service availability Build according to plan, with no implementation errors resulting in missing links or nonoperational locations of linear facilities and hubs.* Use of accepted practices, based on up-to-date standards and regulations, will: (i) help the development of a broad-based construction industry; (ii) allow verification of the quality of construction; and (iii) improve resilience to climate change. Construction standards are created through the regulatory and institutional toolbox (E23). The specification of network type, location, and funding is provided through the economics and finance toolbox (E03, E04, E05).

E37. *Provide active oversight of the construction industry.* Set up a program of independent audits of design and safety before construction begins, and audits of asset condition upon completion of construction, to ensure quality and improve the functioning of the construction industry.

Infrastructure Asset Management

E38. *Make available and maintain complete transport networks to transport service providers that optimize supply, demand, and service availability.* This is to provide the operational availability of linear facilities and hubs. Use standard maintenance arrangements as the starting point for tailoring management to the specific needs of each asset in each location. Management standards and industry organization are created through the regulatory and institutional toolbox (E24). Ensure regular production, by independent entities, and the publication of reports on actual conditions of infrastructure.

E39. *Provide active oversight of the asset management industry.* Increase the capacity of the infrastructure asset management agency or industry. Improve the quality of the transport organization —the public and private sector involvement in asset management and operation. Review the quality of infrastructure asset management practices against the established standards. Industry behavior and competition policy are covered under the economics tool box (E06, E08). Public reporting on asset management outcomes is described under the communications toolbox (E45).

End User Service Provision

E40. *Provide complete transport services that optimize supply, demand, and service availability and reliability, and ensure efficient operational use of linear facilities and hubs.* Use standard service arrangements as the starting point for tailoring operations to the specific needs of each service in each location. Service providers and service standards are created through the regulatory and institutional toolbox (E26, E27). Service plans are created through the economics and finance toolbox (E09) to ensure alignment with other transport, including active transport and non-transport activities. Easily accessible information of the services available—timetables, points of access and egress, and prices— is essential for users to make efficient use of the services on offer (E47).

E41. *Use optimal levels of inputs, such as sufficient levels of equipment or rolling stock to reduce crowding or damage, in adequate condition to minimize operation breakdowns and to meet demand.* For example: (i) Freight: locomotives, rail wagons, and containers; (ii) Passenger: locomotives, rail coaches, and buses.

E42. *Provide active oversight of service provision and quality review, using mode-appropriate standards.* Implement an ongoing program review that enables service providers to learn technical and customer service lessons from specific local services, and supports improvements in standards and practices. Independent reports on quality of service provision should be regularly produced and published (E45).

Innovation

E43. *Management and organizational support for continuous improvement.* Encourage "bottom-up" innovation from operational and front-line staff. Encourage the use of new commercial off-the shelf technologies (COTS) and new concepts of freight and passenger transport operation and logistics, including integration with suppliers and customers throughout the logistics chain. Support and promote in-the-field improvements, including technical innovation in transport vehicles, or in transport facilities, such as depots or stations. Require computerization, digitization, and regional harmonization of transport documents for freight and passengers.

4.4. COMMUNICATIONS TOOLBOX

ALLOCATIVE EFFICIENCY

Public Support and Behavior

E44. *Build general public support for investments, infrastructure management arrangements, and transport services by describing the role of the transport system and its supporting policies.* Topics could include: the scope and importance of transport; the roles of the public sector and private sector; desired outcomes at individual and government levels; and trade-offs to achieve sustainability.

Public understanding and acceptance of transportation plans and investment strategies is a necessary condition for broad social license and political support. This acceptance needs to be long lived and durable, to support the long duration of asset creation and lengthy asset management arrangements.

E45. *Support specific public discussions and understanding.* Provide the basis for informed discussion by publishing the mode-specific legislation and regulatory laws, infrastructure construction standards, infrastructure asset management standards, procurement methods, and related educational materials.

Publish transport pricing and subsidy policies, outlining the role of user fees and public financial support. Regularly report to civil society to demonstrate that desired construction, asset management, and service provision outcomes have been achieved. Communication of information about services must address: price to the shipper or user; service availability and quality; travel time and reliability, personal safety for travelers; industrial safety for freight; local environmental impacts; local input into service planning; and local input into policy, including pricing.

PRODUCTIVE EFFICIENCY

Public Support and Behavior

E46. *Encourage behavioral change to support sustainable transport.* Transport efficiency is increased when users—both travelers and shippers— make lifestyle choices and adopt behaviors that reinforce efficient results, either within the transport sector or in other areas such as residential or work locations, purchase of transport-related goods—bicycles, motor vehicles, and energy efficient trucks.

E47. *Improve user information (on mode, route, and routing conditions) for both passenger and freight transport.* Better user information supports more efficient use of time, more efficient choices of route, and more efficient responses to service interruptions.

Table 4.2. Actions by Theme by Toolkit

Theme	Economic	Regulatory	Engineering	Marketing
Allocative Efficiency				
Asset creation	E01, E02, E03, E04, E05	E19, E20		
Asset management	E06, E07, E08	E21		
Service provision	E09, E10, E11, E12, E13, E14	E22		
Innovation	E15, E16,			
Public Support and Behavior				E44, E45
Productive Efficiency				
Asset creation		E23	E36, E37	
Asset management	E17	E24, E25	E38, E39	
Service provision	E18	E26, E27, E28, E29, E30, E31	E40, E41, E42	
Innovation		E32, E33, E34, E35	E43	
Public Support and Behavior				E46, E47

Source: Own elaboration

5. COUNTRY AND PRIVATE SECTOR EXAMPLES

Multi-country Multi-modal efficiency example: Transport and Trade Facilitation along the Northern Corridor, Sub-Saharan Africa.

This example is a good illustration of actions to support productive efficiency in asset management:

- E38, Ensure optimal operational availability of networks, and in service provision, in particular.
- E28, Ensure cross border trade facilitation, and implement service conventions and agreements.
- E29, Ensure legal certainty for transport operation.
- E40, Ensure optimal operational use.

The Northern Corridor is a transport corridor linking the Great Lakes land-locked countries of Burundi, Democratic Republic of the Congo, Rwanda, South Sudan, and Uganda to the Kenyan seaport of Mombasa. It also serves Northern Tanzania, Ethiopia, and Somalia. It is a part of Trans-African Highways, TAH8. It is a multimodal corridor, encompassing: road, rail, pipeline and inland waterways transport. It is the busiest and most important route in East and Central Africa handling more than 30 million tons of cargo per year.

The Northern Corridor Transit and Transport Coordination Authority (NCTTCA) was established in 1985 in Mombasa to coordinate and oversee the implementation of the Northern Corridor Transit and Transport Agreement (NCTTA) and related protocols.

The Agreement was revised in 2007 to transform the corridor into an economic development corridor. This included the following actions: facilitate and enhance the seamless movement of trade and traffic across the corridor; stimulate economic, social development and inclusive transport; and transform the corridor into a development corridor that will stimulate investments and encourage sustainable development and poverty reduction.

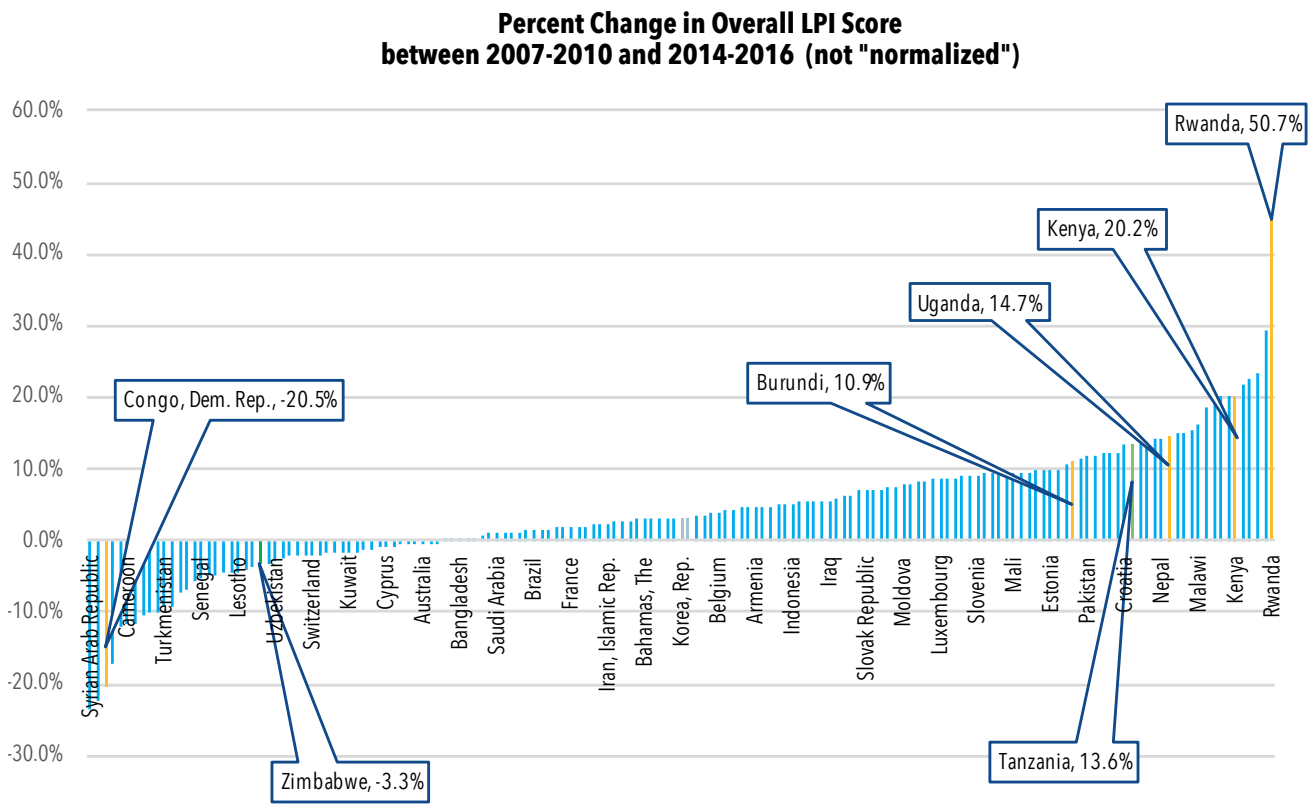
To achieve the above objectives, a five year Strategic Plan 2012–2016 toward a seamless and smart transport corridor was endorsed, from which following initiatives are underway:

- Development of Northern Corridor Infrastructure Master Plan (22 OSBP, 8200km Roads, Port, Railways, Pipeline).
- Automation of customs and administrative procedures.
- Integration of Systems under Electronic Single Windows (ESWs).
- Implementation of Electronic Cargo Tracking Systems.
- Migration to ASYCUDA World by customs authorities.
- Vehicle Axle Load Control (Self-regulatory charter signed in October 2014 for a coordinated and safe transport).
- Use of High-Speed Weigh-In Motion Weighbridges(HSWIM).
- Pilot Single Customs territory: stationing Uganda and Rwanda Customs Officers at Mombasa Port.
- Focus on intra-regional trade: women in cross border trade, Small and Medium Enterprises (SMEs), health dimensions, and cross-border communicable diseases in the corridor.
- Development of a comprehensive program on roadside stations, rest stops, parking, road safety, wellness centers, and other facilities along the corridor to be implemented under PPPs.

The Standard Gauge Railway (SGR) linking Mombasa and Nairobi.

The results have been very positive. For example, reviews by external consultants over the 2009 to 2014

Figure 5.1. Change in Freight Efficiency



Source: Own calculation based on World Bank (2016)

period have estimated reductions in cargo dwell time at the port of Mombasa from seven to four days; average transit time in Kenya by road in 2013–2014 declined from 12 to 7 days; Mombasa – Kampala trucking rates declining by 16 percent; and total costs, including hidden costs, declining by 26 percent.

These results are also seen in the LPI Efficiency Indicator. In figure 5.1, Tanzania has also been shown to provide a regional comparison.

Multi-country, Multi-modal Efficiency Example: Intermodal container transport involving road, sea, and rail legs using TIR, Europe and Central Asia (Figure 5.2)

Route: Ljubljana (Slovenia) – Trieste (Italy) – Mersin (Turkey) – Razi (Iran) – Sahlan (Iran) – Bandar Abbas (Iran)

This example demonstrates actions to support productive efficiency in service provision, in particular: E30, improve interoperator and intermodal interoperability, and E28, Ensure trade facilitation and efficient transit.

The TIR system (Transports Internationaux Routiers or International Road Transport) is the international customs transit system with the world's widest geographical coverage (50 countries).

In November 2017, the first successful intermodal TIR operation involving road, sea, and rail legs took place between Slovenia and Iran. It was organized in cooperation with representatives of International Road Transport Union (IRU); member associations Iran Chamber of Commerce, Industries, Mines and Agriculture (ICCIMA) and Intertransport; TIR carnet holder

shipping companies, and the Customs Authorities of Iran and IRU.

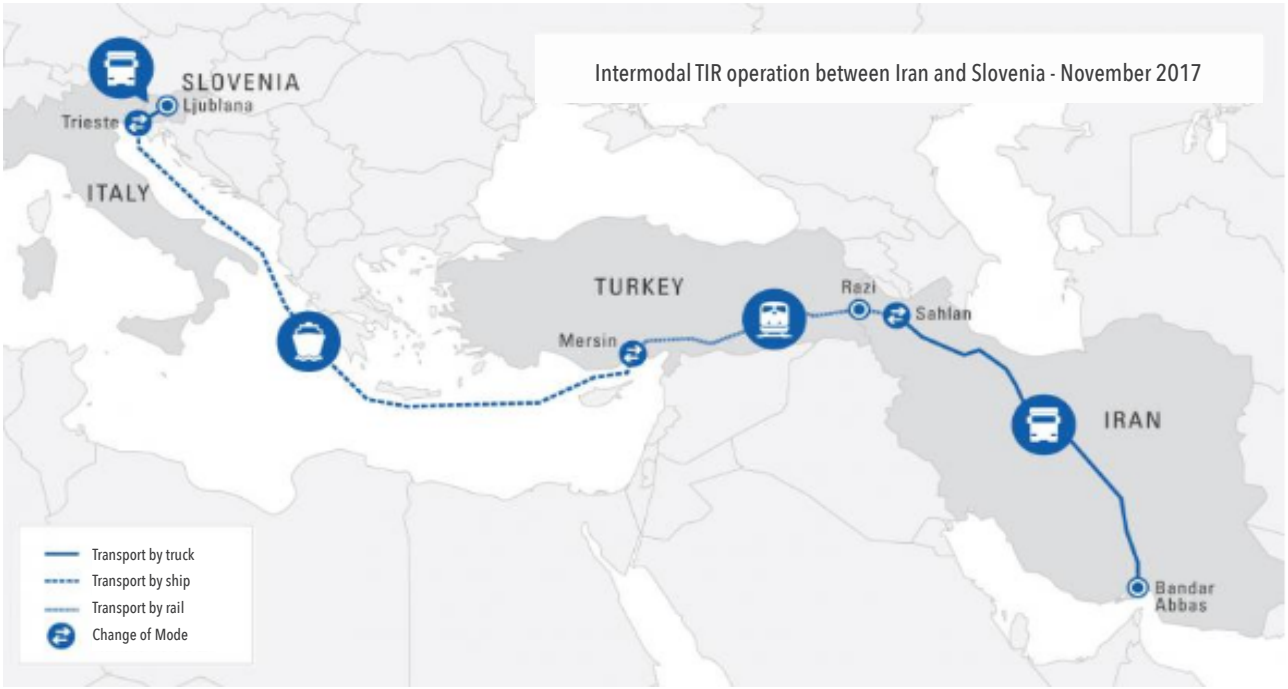
The intermodal transport operation of the container included a road leg from Slovenia to Italy, followed by a sea crossing from the port of Trieste in Italy to the port of Mersin in Turkey. At Mersin, the container was loaded onto a train through to the Iranian Customs office at Razi and continued by rail to the Sahlan Customs office and rail terminal in Iran. There the container was placed onto an Iranian truck and continued to the destination port of Bandar Abbas. The combination of rail and road transport in Iran saved five days, compared to the use of rail alone.

TIR was used on the road leg between Slovenia and Italy, further reactivated at the customs port of entry to Iran (Razi), and used until the final destination at the port of Bandar Abbas. The TIR carnet used for this transport operation belonged to a Slovenian TIR carnet holder who completed the road transport leg from Slovenia to Italy, and was responsible for the organization of the transport and liable for the intermodal transit where TIR guarantee was in use. The road transport leg in Iran was performed by an Iranian partner of the Slovenian TIR carnet holder that is also an authorized TIR operator and a member of ICCIMA.

In order to make the intermodal corridor operational, Iranian Customs opened an office in Razi for the use of TIR and began to accept TIR both as a transit document and a guarantee for the transport of goods during the rail leg.

The use of TIR IT tools significantly facilitated the transport operation and enhanced its security. With TIR-EPD (Environmental Product Declarations), the TIR carnet holder sent electronic pre-declarations to the countries along the route where TIR was in use and EPD was required, free of charge, with the possibility of following the status allocated to EPD in real time. Also, the TIR carnet holder was able to provide to Iranian Customs with the information about the vehicle collecting the container on the second road leg. Using TIR-EPD, the customs authorities performed an advance risk assessment of the cargo transported under TIR, rather than being obliged to wait until the vehicle arrived. Using RTS (Real-Time SafeTIR), customs

Figure 5.2: Map of Intermodal TIR Operation



authorities were able to control the validity of the TIR guarantee, and transmitted the TIR termination data once the TIR journey was completed.

All-countries Mode-Specific Efficiency Example: International Civil Aviation Organization (ICAO), the specialized agency of the United Nations for aviation worldwide.

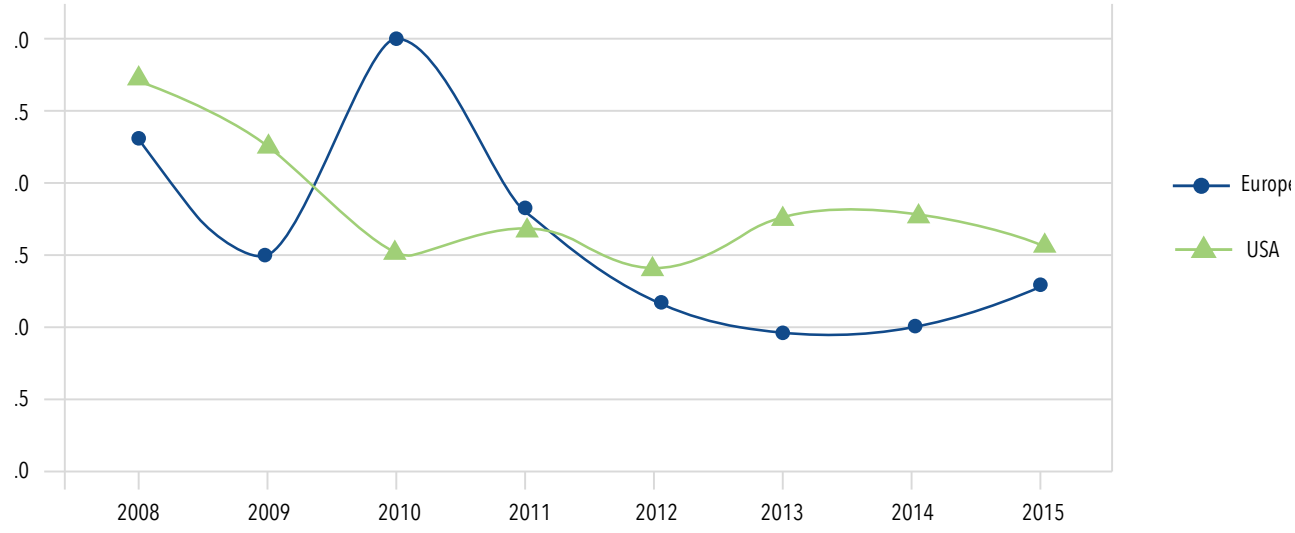
These initiatives show the application of creating construction standards (E23), regulatory innovation (E32), technical innovation (E33), and investment in complete transport networks (E38).

Air navigation system modernization, undertaken by the EU and US since early 2000, have brought systemic efficiencies. For example, one of these efficiencies is the reduction in the average delay of flights related to aviation infrastructure or its environment. The latter was drastically reduced between 2008 and 2015 (Figure 5.3). Further modernization of the air navigation supported by ICAO activities at the global level is expected to further ameliorate the overall global system's performance.

Another example of efficiency brought by the global standardization of aviation is the advent of satellite navigation and the associated procedures published by ICAO. These allowed many Brazilian airports –which suffer from heavy fog during some periods of the year, limiting their operations–to remain open during these periods. Another example is that GOL (a Brazilian airline) estimated that these new types of approaches could shave off 22 miles and 7.5 minutes per landing approach to the airport in the capital, Brasilia, compared with old paths. It also reduced carbon dioxide emissions by more than 1,620 pounds and planned to deliver $24 million in operational savings over five years for that airline.

In France, the deployment of the same satellite navigation and procedures allowed for a certain number of airports to remain open when meteorological conditions are below the conditions to operate visually. In Belgium, some runways that couldn't be used in the past, because of the absence of ground equipment, are now usable for commercial aviation. All these new operational possibilities brought major enhancements to the air navigation systems at limited cost, as they do not require investment in expensive ground equipment.

Figure 5.3: Average Delay per Flight (in minutes) in Europe and the US



Source: https://www.faa.gov/air_traffic/publications/media/us_eu_comparison_2015.pdf

Note: Between 2008 and 2015, linked to the aviation infrastructure and/or its environment.

6. THE GLOBAL ROADMAP OF ACTION

6.1. PRIORITY ACTIONS

The Global Roadmap of Action provides a list of priority measures and actions to be undertaken by the four country groups to reach the Efficiency objective, as represented by the Logistics Performance Index (LPI).

Each of the actions developed in the Catalogue of Measures in Section 4 is relevant, over time, to each of the four country groups. Professional judgement was applied to identify the most relevant or first actions to be implemented by each country group.

- Country Group D—actions that cover basic needs
- Country Group C—actions that set up frameworks and institutions
- Country Group B—actions that apply and strengthen frameworks and institutions
- Country Group A—actions that develop and apply advanced and new approaches

Table 6.1 shows the country group for which an action is one of the most relevant or first to be implemented. It illustrates how the actions accumulate across the country groups. For example, a basic measure such as E01, Strategic Goals and Plan for the transport system and the role of transport services would apply to all countries, even countries with the least progress (Group D), and so would be shown under Group D; but is implied for all groups (C, B, A). Within this one measure there will be evolution in the level of sophistication as countries move along the development path, but the concept of doing a strategic plan applies to all countries.

A more complex measure such as E04, Strategic policy on finance, pricing, infrastructure needs, and subsidy policy may apply beginning with countries of Group B (more progress). Note that the more complex concept of financial strategy is not ignored for countries of Group D, but this consideration is included in the basic strategic plan, E01. As countries make more progress toward sustainable mobility, more complex extensions of basic measures become relevant and show up as separate measures. Nevertheless, they still conceptually underlie more advanced actions. Some measures may be so basic that they become automatic or justifiably assumed for country Groups B or A, and so may appear redundant, such as E01, Strategic Goals and Plan for Country Group A.

Table 6.1: All Actions, Implementation by Country Group

Family of Action		Country Group			
	Measure	D	C	B	A
Allocative Efficiency, Asset Creation	E01 Strategic goals and plan	X			
	E02 Comprehensive integrated transportation and land use planning		X		
	E03 Complete networks		X		
	E04 Strategic policy on finance, pricing, infrastructure needs, and subsidy policy			X	
	E05 Robust evaluation of infrastructure investment	X			
	E19 Coordination across broad and multi-sector issues and national capacity		X		
	E20 Local capacity and coordination			X	
Allocative Efficiency, Asset Management	E06 Network management arrangements		X		
	E07 Evaluation of infrastructure management expenditures		X		
	E08 Overall transport competition policy by mode				X
	E21 Usage and financial information and operational data			X	
Allocative Efficiency, Service Provision	E09 Optimal levels of service		X		
	E11 City-level public transit strategies			X	
	E12 City-level road management strategies				X
	E10 Access for low-income or vulnerable users	X			
	E13 Evaluation of transport services support expenditures	X			
	E14 "Local perspective" passenger policy				X
	E22 Single urban authority			X	
Allocative Efficiency, Innovation	E15 Innovation in policy and decision making, use of economic instruments				X
	E16 Culture of learning from experience		X		
Allocative Efficiency, Public Support and Behavior	E44 General public support for transport			X	
	E45 Specific public discussion and understanding				X
Productive Efficiency, Asset Creation	E23 Harmonized construction standards, promote sustainability	X			
	E36 Specified complete multimodal networks	X			
	E37 Active oversight of the construction industry	X			

Family of Action	Measure	Country Group			
		D	C	B	A
Productive Efficiency, Asset Management	E17 Pricing mechanisms for infrastructure management		X		
	E24 Management standards	X			
	E25 Asset management industry		X		
	E38 Optimal operational availability of networks	X			
	E39 Active oversight of the asset management industry			X	
Productive Efficiency, Service Provision	E18 Pricing mechanisms for service provision			X	
	E26 Harmonized transport service standards	X			
	E27 Organize `transport service delivery	X			
	E28 Trade and border-crossing facilitation, service conventions, and international agreements		X		
	E29 Legal certainty for transport operation		X		
	E30 Inter-operator and intermodal interoperability			X	
	E31 Country specific issues such as LLDCs and SIDS	X			
	E40 Optimal operational use		X		
	E41 Optimal level of inputs			X	
	E42 Active oversight of service provision and quality review				X
Productive Efficiency, Innovation	E32 Regulatory framework to support innovation and harmonization			X	
	E33 Technical and business innovation			X	
	E34 Information sharing and the diffusion of innovation				X
	E35 Human resources in transport		X		
	E43 Continuous improvement				X
Productive Efficiency, Public Support and Behavior	E46 Behavioral change to support sustainable transport				X
	E47 Improved user information	X			
	Number of actions first implemented by country group	13	13	12	9

Further judgement was applied to select 29 actions as priority actions for each country group (Table 6.2).

Table 6. 2: Priority Actions by Country Group

Family of Actions	Group D (least progress)	Group C (less progress)	Group B (more progress)	Group A (most progress)
Allocative Efficiency, Asset Creation	E01 Prepare strategic goals and plan for the transport system and the role of transport services	E19 Ensure coordination and national capacity	E05 Strategic policy on finance, pricing, infrastructure needs, and subsidy policy	
Allocative Efficiency, Asset Management		E06 Set up network management arrangements. Ensure optimal planned availability of infrastructure	E21 Require financial information and operational data to support decision-making and regulatory oversight	E08 Adopt an overall transport competition policy and mode-specific policies
Allocative Efficiency, Service Provision	E10 Consider developing support for access for low-income or vulnerable users	E09 Plan levels of service to optimize supply, demand, and service. Ensure optimal planned level of service.	E11 Consider developing city-level public transit strategies	E12 Consider developing city-level road management strategies
Allocative Efficiency, Innovation		E16 Foster a culture of learning from experience		E15 Innovation in policy and decision making, use economic instruments
Allocative Efficiency, Public Support and Behavior			E44 Build general public support for the transport system and supporting policies	
Productive Efficiency, Asset Creation	E23 Create harmonized construction standards, support construction industry, promote sustainability in transport and adaptation to climate change E36 Build specified complete networks			

Family of Actions	Group D (least progress)	Group C (less progress)	Group B (more progress)	Group A (most progress)
Productive Efficiency, Asset Management	E38 Make available and maintain complete transport networks	E17 Use pricing mechanisms for infrastructure management	E39 Provide active oversight of the asset management industry	
Productive Efficiency, Service Provision	E27 Organize transport service delivery	E28 Trade and border-crossing facilitation; implement and adhere to service conventions E29 Ensure legal certainty for transport operation and regional harmonization	E30 Remove regulatory barriers to improve inter-operator and intermodal inter-operability	E42 Review the quality of service provision
Productive Efficiency, Innovation		E35 Support development of human resources in transport.	E32 Put in place a regulatory framework to support innovation and harmonization	E33 Support technical and business innovation E43 Management and organizational support for continuous improvement
Productive Efficiency, Public Support and Behavior	E47 Improved user information			E46 Encourage behavioral change to support sustainable transport
Number of priority actions by country group	7	8	7	7

7. SCALE OF THE CHALLENGE

According to the Global Mobility Report 2017, "We know that mobility will increase as more people and goods move across towns and across the globe: by 2030, annual passenger traffic will exceed 80 trillion passenger-kilometers—a 50 percent increase compared with 2015; global freight volumes will grow by 70 percent compared with 2015; and an additional 1.2 billion cars will be on the road—double today's total."

The growing demand for mobility and trends in development, economic integration, and urbanization all point to the need for better utilization of resources to meet these growing demands while reducing our environmental footprint. Overall efficiency, made up of efficiencies in many particular ways, is critical to obtaining mobility and reducing our environmental footprint.

Transport is pervasive. Transport is used by, or touches on, the lives of every person and the activities of every government or company on the globe, every day. The existing technologies and practices of transport are tightly integrated into all other economic and social activity. This means that our personal behaviors, social habits, and business practices are conditioned by the transport sector.

Yet the very pervasive and integrated nature of transport means it can also influence and promote change in areas across the entire economy and society. Transport services are always an intermediate product, but they are everyone's intermediate product.

This high importance of transport attracts great attention from governments and private actors to provide for and benefit from pervasive transport. Not only are personal behaviors and social habits conditioned by transport, but established practices are adopted and guarded by those currently providing them. There is a tension between the longer-run benefit of productive innovation and the shorter-run cost of disruptive innovation, while the productive aspects of the innovation are proved, and broader systems adapt to integrate the innovation. There is no single model of how to move from disruptive to productive innovation.

Ultimately the greatest challenges for efficient sustainable transport are public opinion and political will, points recognized in this report by the emphasis placed on the "communications toolbox."

The concept of Efficiency is fundamental to the SuM-4all initiative because it cuts across, and interacts with and between, all aspects of sustainable mobility, including: demand, society, supply, connectivity, geography, technology, change and innovation, and the transformations needed to reduce the physical movement of people and goods, across all places and times. The two aspects of efficiency discussed here, allocative and productive, provide clues to how transport can contribute to overall sustainability. The multimodal, connected, interactive nature of transport's subsectors means transport as a whole has always been forced to confront complicated patterns of interactions, transactions, difficult geography and distance, joint production, joint consumption, and government and private sector interactions. The existing international, national, and local mechanisms, institutions, arrangements, and patterns provide a starting point to improve upon. We are not starting from zero.

Productive efficiency is conceptually straightforward, to provide the best technical solution. Allocative efficiency is a more complex concept and includes the interaction of demand and supply; the human choice of consumption; and the engineering choice of production. Allocative mechanisms such as market behavior and other expressions of choice bring questions of

value and quality into decision making. Perhaps the greatest contribution of efficiency is to incorporate these considerations of value and quality.

Some specific next steps in promoting efficiency include:

- Adoption and promotion of the GRA and its actions
- Development of a summary performance indicator for traveler and passenger mobility. This paper has sketched out an approach for the development of a Mobility Performance Index (MPI) which provides a basis for beginning this work
- Analysis of changes in the LPI and the MPI over time, and the reasons for this
- Despite much progress in international cooperation and coordination over the recent past, there remains much to be done to integrate and harmonize transport institutions, standards, and practices
- Cooperation and coordination within a country and within cities remains critical
- Country specific issues such as SIDS and LLDCs need to be addressed
- Regulations must not act as barriers to entry into new activities, and incumbents should not restrict innovation or competition. At the same, time there is tension between disruptive innovation and the efficiency gains of harmonization and coordination. Policy work is needed to support the integration of productive innovation into common systems

ANNEX I: LIST OF POLICY MEASURES

The list of policy measures identified in this paper to achieve efficiency in mobility has been consolidated and harmonized with the policy measures to achieve all other policy goals toward sustainable mobility. The Global Roadmap of Action toward Sustainable Mobility provides the consolidated list of measures.

The consolidated policy measures that have an impact on transport efficiency are shown in the table I.1.

Table I.1: Policy Measures with Description (by toolbox and thematic area, with an impact on efficiency)

Policy Measure	Policy Measure Description
Toolbox: Regulatory and Institutional	
Thematic Area: Plans and Strategies	
Develop an Integrated National Transport Plan	Develop and implement an integrated national transport plan to cover the four policy goals, all modes of transport, and passenger and freight traffic.
Set Targets across Policy Goals	Set clear targets to be achieved in the long term and in the interim for the four policy goals, aligned with an integrated sustainable mobility plan.
Develop Mobility Plans at the Sub-National Level	Develop a sustainable urban mobility plan and implement strategies at the sub-national level that are consistent with the integrated national sustainable transport plan.
Plan for a Multi-Tiered Rural Access Approach	Use a multi-tiered and multimodal approach to universal rural access in the integrated national transport plan, supporting both early attainment of universal rural access and further upgrading to higher-access tiers based on affordability and feasibility.
Adopt TOD Principles in Land Use Planning	Adopt integrated land use planning that supports transit-oriented development (TOD), mixed land use and compact city planning, reforming development policies and zoning codes, limiting urban expansion, and incorporating rail network development in urban planning.
Provide Policy Certainty to Businesses and Investors	Ensure a stable regulatory and policy framework, setting a timeline sustainable mobility targets, to increase the confidence for businesses and financial investors to make long-term decisions.
Thematic Area: Institutional Design, Cooperation, and Coordination	
Coordinate Planning across Government Agencies	Coordinate across agencies to ensure integrated planning and shared responsibility for results across levels of government, jurisdictions, and agencies, including but not limited to the coordination of road safety responsibilities and the coordination of response to extreme weather events.
Define Roles and Accountabilities across Agencies	Define government roles, responsibilities and accountabilities in the transport sector across the four policy goals, modes of transport, national and sub-national government levels, and passenger and freight transport.

Policy Measure	Policy Measure Description
Establish a Metropolitan Transport Governance	Establish a governance structure and an institutional framework for transport at the metropolitan level.
Thematic Area: International agreements and regulations	
Remove Non-Tariff Barriers for International Trade	Remove non-tariff barriers for cross-border traffic, including barriers for rail and waterborne transport.
Implement Single-Window and One-Stop Border Posts	Implement one-stop border posts and a single-window system, i.e., border facilities combining two stops for national border control processing into one, and a single location where international traders can submit documents.
Adopt the Use of E-Documents for International Trade	Adopt the use of electronic documents for international trade.
Accede to and Implement International Conventions	Accede to and implement relevant international agreements and conventions that address one or more policy goals, for example, the TIR Convention, the WTO Trade Facilitation Agreement, or core road safety-related UN legal instruments.
Adopt Trucking Cabotage Rules	Adopt cabotage rules to optimize trucks' load factors, i.e., allow truck transport between two places in the same country by a transport operator from another country.
Implement ICAO's Carbon Emission Scheme	Adopt sector specific emission mitigation approaches such as the Carbon Offset and Reduction Scheme for International Aviation (CORSIA).
Implement IMO's Energy Efficiency Framework	Strengthen and implement the International Maritime Organization's energy-efficiency technical and operational framework, including ship design standards, and pollution standards and regulations
Thematic Area: Regulations for Transport Services	
Adopt a Coherent Competition Policy	Adopt a coherent competition policy for passenger and freight transport based on the principles that competitive markets are central to efficiency, and acknowledge that market failures in the transport sector require regulation.
Regulate Truck Size and Weight Limits	Adopt regulations of truck size and weight limits by transport corridor.
Regulate Freight Delivery Hours in Urban Areas	Introduce regulations about the hours and areas in which freight delivery in urban areas is allowed to reduce congestion and noise pollution, mindful of the important role of freight delivery for economic activity.
Remove Barriers to Intermodal Interoperability	Remove regulatory barriers to improve inter-operator and intermodal interoperability.
Allow and Regulate Vehicle Sharing and TNCs	Reform regulations to allow and support vehicle sharing programs (cars, bicycles, scooters), transportation networking companies (TNCs), and demand-responsive transport solutions, with a focus on last mile connectivity to high capacity modes, and support vehicle-sharing community networks such as car-sharing fleets within companies and administrations.
Review transport regulations periodically	Promote the periodic review of the regulations to allow the fast-moving mobility solutions to evolve towards a sustainable and inclusive transport system

Policy Measure	Policy Measure Description
Thematic Area: Regulations for Vehicles and Vehicle Use	
Ensure Legal Certainty Regarding Driver Permits	Adopt standards and compliance regimes for the provision and withholding of driver licenses and permits, including compliance regimes designed to prevent and reduce fatal and serious injury risk.
Limit the Number of Parking Spaces in New Developments	Replace parking minimum requirements with caps (maximum limits) and other policies that support parking management.
Establish Electric Vehicle Manufacturing Mandates	Establish mandates for manufacturing electric vehicles and gradually increase their supply.
Limit the Number of New License Plates for Cars	Implement restrictions on vehicle ownership by limiting the number of new license plates issued.
Establish More Stringent Fuel Economy Standards	Establish stricter fuel economy standards and CO_2 emission standards for new motor vehicles, as well as stricter fuel specifications, for example, the use of low-sulphur petroleum products.
Set Fuel Quality Requirements and Blending Mandates	Determine fuel quality requirements, for example, the use of low-sulphur petroleum products, and blending mandates to support alternative fuels.
Adopt Emission Standards for Aircraft	Adopt the ICAO engine emissions standards and implement the ICAO airport air quality manual to minimize the impact of aviation emissions on local air quality (LAQ).
Adopt Noise Management Approaches to Aircraft	Adopt the ICAO balanced approach to aircraft noise management to minimize the number of people affected by significant aircraft noise.
Implement Regulations to Prevent Pollution from Ships	Strengthen the design standards and regulations for the prevention of pollution from ships.
Adopt Emission Standards for Rail Transport	Adopt emission standards for diesel-powered locomotives and railcars, for example, the non-road mobile machinery by European Commission regulations.
Support Vehicle Connectivity and Smart Charging Regulations	Implement regulations supporting internationally harmonized vehicle-to-everything (V2X) technologies and smart charging solutions, both in terms of hardware and software, to facilitate the growth of e-mobility
Thematic Area: Regulations for Data Collection, Share and Use	
Require Service Providers to Report Standardized Data	Establish standardized data reporting requirements for all transport service providers, including transportation network companies (TNC), public transport operators, and bike- or car-share companies.
Develop Data Repositories and Data Collection Guidelines	Develop centralized data repositories and establish data collection guidelines at the national and metropolitan levels, and facilitate data access to different stakeholders (academics, private sector, etc.) while stablishing a legislative framework defining the context and purpose of its use.
Require Use of Data to Support Decision Making	Require using operational data to support decision making and regulatory oversight.

Policy Measure	Policy Measure Description
Thematic Area: Procurement and Contracts	
Prepare Public Procurement Rules and Procedures	Prepare procurement rules and procedures, standard contract documents for infrastructure construction and maintenance, supported by an e-procurement platform, and harmonize those at a regional or international level to foster economies of scale.
Procure Contractors on a Competitive Basis	Procure contractors on a competitive basis, using packaging of batches of projects to attract multiple capable contractors.
Thematic Area: Capacity Building and Human Resource Development	
Identify and Empower Sustainable Mobility Champions	Identify and Empower Country Champions to Help Move Forward the Sustainable Mobility Agenda, for example, ministers and mayors.
Build Capacity Across Levels of Government	Build national and local capacity across levels of government, jurisdictions, organization, and modes, including providing training and indormation resources.
Provide Training for Workforce in Leadership Positions	Provide training for the current and future transport workforce in leadership positions, enabling well-trained staff to drive change toward sustainable mobility.
Facilitate Capacity Building at the International Level	Facilitate sector specific capacity building at the international level.
Create Mentoring Programs and Professional Networks	Create programs to promote role models, mentoring and networks of transport professionals, including programs targeted to women.
Toolbox: Engineering and Technology	
Thematic Area: Technical Standards	
Establish Technical Standards for Transport Infrastructure	Establish high technical standards for transport infrastructure design, for example, performing climate vulnerability screening, protecting roads against water penetration, and using local materials and resources when feasible.
Harmonize Construction Standards along Corridors	Adopt construction standards so that assets are created using accepted, up-to-date, harmonized standards and regulations, across borders, within regions and along transport corridors.
Recruit Qualified Firms for Project Design and Feasibility	Recruit qualified consulting firms for preparing feasibility reports and engineering designs, and supervising civil works.
Ensure Integration of Public Transport and Bicycles	Ensure physical integration between public transport and bicycles, for example, providing bicycle parking and allowing bicycles in public transport (with limitations because of vehicle size or passenger density).
Improve Intermodal Connections in Transport Hubs	Improve local access to transport hubs including bus and train stations, ports and airports.
Set and Implement Climate Change Adaptation Standards	Set climate change adaptation and resilience standards and practices, and integrate them into project design across transport infrastructure, including roads, airports, and seaports.
Modernize Air Traffic Management	Modernize air traffic management to improve aviation safety and efficiency as defined in the ICAO global air navigation plan (GANP) endorsed by the ICAO Assembly.
Coordinate New Transport and Telecom Infrastructure	Coordinate among the different civil works necessary for new mobility infrastructure, for instance, road and telecommunication infrastructure, in order to maximize synergies and limit costs

Policy Measure	Policy Measure Description
Thematic Area: Asset Construction	
Build Complete Multimodal Networks	Build complete multimodal networks ensuring optimal network operational availability.
Build Rail and Maritime Transport Infrastructure	Build infrastructure for energy- and space-efficient modes such as rail and waterborne transport, including high-speed rail for corridors with sufficient demand.
Expand Public Transport Infrastructure	Expand the public transport network adjusted to demand requirements, with an emphasis on equitable access and considering the most appropriate modes in each context, including bus, rail, demand-responsive service, cable-propelled transport and ferry transport.
Build Logistics Consolidation Centers	Build logistics consolidation centers and exchange platforms with a focus on multi-modal transport to avoid fragmented supply, production, and distribution chains, fostering private sector participation in investment and operations of logistics hubs.
Build Roadside Produce Storage for Farmers	Create simple roadside produce storage facilities to allow farmers to consolidate produce before collection and to reduce losses due to perishability.
Invest in Quality Aviation Infrastructure	Invest in the modernization and expansion of quality aviation infrastructure as defined in the ICAO GANP endorsed by the ICAO Assembly.
Develop Infrastructure for Road Transport Electrification	Develop infrastructure for road transport electrification, such as charging stations, electric road systems, including electricity and hydrogen power for trucks, cars, buses, etc.
Invest in Port Electrification	Invest in infrastructure for port electrification, such as electric charging facilities in ports and hybrid and electric ships.
Invest in Railway Electrification	Invest in railway electrification, battery-hybrid trains, biogas or hydrogen-powered trains, to reduce the dependence on diesel fuel, increase energy efficiency, and reduce noise and vibrations.
Expand the All-Season Road Network	Expand the density of the all-season road network in rural areas.
Repurpose Road Space to Allow Access for All Modes	Repurpose existing road space with complete street designs accommodating diverse users and uses, with access for all modes, particularly pedestrians and cyclists and their access to public transport stations.
Invest in Sustainable Fuel Storage for Ships	Invest in facilities for the production and storage of sustainable alternative fuel for ships.
Ensure an Optimal Level of Vehicle Availability and Use	Ensure an optimal level of vehicle availability and use, for example, adapt bus or train capacity to activity and load factor, invest in buses and rolling stock to reduce public transport crowding.
Thematic Area: Design and Deployment of Transport Services	
Provide Effective Car and Bicycle Sharing Systems	Provide effective shared car and bicycle-sharing systems as an alternative to vehicle ownership.
Support Truck Platooning Strategies	Support truck-platooning strategies based on trucks equipped with state-of-the-art driving support systems closely following each other.
Provide Eco-Driving Training for Truck Drivers	Provide eco-driving training for truck drivers, including driving practices that can reduce fuel consumption without increasing travel time.
Develop Online Platforms for Rural Transport Services	Introduce online platforms to create marketplaces linking rural transport service users with service providers for freight and passenger services.

Policy Measure	Policy Measure Description
Implement ITS Solutions for Providing Transport Information	Implement online platforms and other ITS solutions for providing information on traffic, routes, and transport mode options for both passengers and freight transport
Conduct Accessibility Evaluation and Mapping	Develop tools for measuring the accessibility of different locations and evaluation how various transport and land use changes will affect accessibility for various groups and activities, with a special attention to access for disadvantaged groups.
Implement Mobility as a Service Packages	Implement government-coordinated mobility as a service (MaaS) packages combining different services and platforms for transport users to review travel options, changing the focus from providing a specific service on one mode of transport to mobility solutions that are consumed as a service.
Invest in Rail Sector Digitalization	Invest in the digitalization of the rail sector, which includes implementing advanced forms of signaling systems, improvement of train localization, adoption of autonomous trains, optimization of braking curves, inclusion of solutions for cybersecurity, and use of 5G to support the future applications of the railway system.
Integrate New Mobility Solutions to Existing Transport	Support the complementarity of new shared solutions such as car-sharing, electric vehicles rentals and autonomous vehicles with existing public transport networks, for instance by supporting new solutions to direct traffic to public transport stations or as a replacement after operating hours.
Thematic Area: Design and Deployment of Programs	
Adopt Building Back Better Principle for Reconstruction	Adopt a building back better principle, i.e. rebuilding work after disasters and conflicts to be conducted with a decentralized participatory approach for a more cost-effective and sustainable recovery of transport systems.
Map the Full Extension of the Road Network	Map the full extension of the road network and maintain the data updated, including road quality attributes.
Identify Risks and Vulnerabilities to Extreme Weather Events	Conduct risk appraisal and impact quantification of failures and disruptions due to extreme weather events, identifying the most vulnerable transport links.
Monitor Weather Events and Develop Warning Systems	Conduct real-time monitoring of extreme weather events, developing plans to take immediate actions to mitigate damage with early warnings.
Support Data Sharing Programs and Platforms	Establish a framework and promote data sharing programs and platforms across different sectors to exchange data relevant for transport policy, such as data collaboratives models including the public and private sector.
Provide Incentives to Increase Car Occupancy	Provide incentives to increase private vehicle occupancy, for example, high occupancy vehicle (HOV) lanes.
Provide Sustainable Alternatives for Commuting Trips	Encourage initiatives that provide sustainable mobility options for employees, such as employer-sponsored transport programs, carpooling schemes, and public transport commuter benefits.
Implement Telecommuting Policies	Implement policies that allow flexible work schedules and telecommuting, i.e., working from home schemes, to avoid non-essential trips.
Support Freight Parcel Standardization and Containerization	Support corporate initiatives to standardize freight parcels and promote containerization, facilitating intermodal integration.

Policy Measure	Policy Measure Description
Develop Vehicle Rental Platforms for Different Types of Use	Provide effective shared car and bicycle-sharing systems as an alternative to vehicle ownership. Promote the use of vehicles adapted to daily needs (i.e. small BEV for daily trips) and offer alternatives renting solutions for exceptional journeys (i.e range-extender or large BEV holidays).
Thematic Area: Asset Management	
Develop Asset Management Standards and Plans	Develop asset management standards and plans to preserve, maintain, and manage transport infrastructure and their systems over their life cycle.
Establish Approaches to Feeder Road Asset Management	Establish reliable approaches to asset management of feeder roads, with communities performing routine maintenance in rural paths and roads, where feasible, and contractors performing periodic maintenance, based on reliability, availability, maintainability, and safety (RAMS) approach
Set Up Audits for Construction Design and Safety	Set up independent audits of asset management industries and of construction design and safety to ensure the quality of assets.
Toolbox: Economics and Finance	
Thematic Area: Project or Program Cycle	
Evaluate Long Run Transport Infrastructure Needs	Evaluate long-run infrastructure finance needs including the existing backlog of deferred maintenance (i.e., infrastructure gap).
Use a Robust Framework for Project Prioritization	Use a robust investment evaluation framework to prioritize the allocation of public infrastructure funding to infrastructure projects and associated services.
Establish Selection Criteria for Feeder Roads Projects	Establish a set of selection criteria for feeder road projects and disseminate these widely among rural communities with a view to attracting their participation in the process.
Establish Performance Monitoring and Evaluation Schemes	Establish performance and result monitoring and evaluation schemes to inform the regular adjustment for projects, policies and programs, for example, the evaluation of road safety interventions and their institutional delivery.
Conduct Impact Evaluation Studies	Conduct impact evaluation studies to improve the evidence base available to policymakers, considering the impact of transport infrastructure projects on economic growth and employment, and considering differentiated impacts on women.
Implement transport projects on time and on budget	Ensure that transport projects are delivered on time and on budget according to project planning with realistic risk and cost assessments.
Thematic Area: Allocation of Public Funds	
Require Projects to Meet Cost-Effectiveness Thresholds	Require transport projects to meet an economic viability threshold based on a cost-benefit analysis and estimate the economic internal rate of return (EIRR), reflecting least-cost planning principles
Thematic Area: Fiscal and Financial Measures	
Enable Municipal Revenue through Tax and Bonds	Enable city-level revenue generation, such as taxation and bonds, for transport projects to be funded locally, especially in medium and large cities.
Apply Innovative Solutions Financing for Asset Creation	Apply sustainable and innovative financing schemes for asset creation, including new financing mechanisms, new fund management techniques, and new institutional arrangements.
Set User Fees to Support Transport Infrastructure Funding	Adopt transport user fees to help fund transport infrastructure and allow for return on investment, for example, toll roads.

Policy Measure	Policy Measure Description
Mobilize Public and Private Capital for Transport Finance	Mobilize public and private capital for transport finance, using PPPs to improve sector efficiency when appropriate, and help bridge the transport infrastructure gap.
Use Land Value Capture Schemes	Use land value capture schemes to increase funding for urban transport systems, capturing the increase in property value around new transport infrastructure development.
Prioritize Financial Products for Sustainable Investment	Reinforce blended finance models both for local multi-stakeholders' projects and large projects requiring the collaboration of several IFIs and private actors. Ensure their promotion towards both public and private actors including financial institutions.
Support Sustainable Mobility Impact Funds	Define regulatory frameworks to facilitate the creation of impact funds targeting sustainable mobility including small scale projects led by start-ups or NGOs. Support existing funds.
Thematic Area: Pricing for Efficiency and Inclusion	
Implement Fuel Taxes and Phase Out Fuel Subsidies	Implement and increase fuel taxes while phasing out fossil fuel subsidies to offset the social cost of greenhouse gas emissions and air pollution.
Use Congestion Charging or Pay-as-You-Drive Schemes	Use congestion charging or pay-as-you-drive schemes to charge for the congestion costs imposed by personal motorized vehicle use, with rates that increase under urban-peak conditions to reduce traffic congestions.
Implement or Increase Vehicle Registration Fees	Implement or increase vehicle registration fees to support road maintenance funding, reducing the incentives for purchasing a vehicle.
Apply Market-Based Parking Pricing	Apply market-based pricing schemes to on-street and off-street parking, such as variable pricing based on demand.
Promote Green Port Fees	Promote green port fees, charging lower fees to ships that are less polluting.
Provide Financial Incentives to Reduce Environmental Impact	Provide financial incentives, for example subsidies, tax credits, or low tax rates to reduce the environmental impact of transport, including financial incentives for cleaner vehicles, cleaner fuels, old vehicle abatements, and the circular economy.
Make Public Transport Fares Affordable for the Poor	Make public transport fares affordable for the poor using means testes approaches to ensure cost-recovering mechanisms.
Thematic Area: Innovation Policy and Enhancement	
Provide Education Programs for Innovation	Provide neutral trainings and educational programs to develop up-to-date skills, increase awareness of the latest innovations and support innovation in transport, relying on close cooperation with companies to develop curriculums.
Support Innovation through Regulatory Incentives	Develop a framework at national and sub-national level enabling public-private cooperation to design policies such as targets, regulations supporting technical and business innovation and its diffusion
Provide Financial Incentives to R&D and Innovative Products	Provide subsidies or tax credits to encourage research and development and the supply of innovative products or services.
Support R&D to Reduce Environmental Impacts	Support systematic research and development for technologies that reduce the environmental damage from transport through joint industry and government research, for example, research to optimize the life cycle of batteries for vehicle electrification, alternative fuels (sustainable biofuels, biogas, synthetic fuels, hydrogen) and intelligent transport systems (ITS).

Policy Measure	Policy Measure Description
Support R&D to optimize the life cycle of vehicle batteries	Support the research to optimize the life cycle of batteries by improving their lifespan and developing optimal cost-efficient sustainable recycling solutions
Develop a Demand-driven Research Framework	Develop a demand-driven research framework by allowing experimentations at a local level and strong connections with research centers and universities to optimize the R&D process and enable identifying missing technologies
Toolbox: Communication	
Thematic Area: Consultation and Public Engagement	
Use Participatory Planning Methods	Use participatory planning methods, including creation of a website, to help communities propose interventions.
Promote Public Discussion on New Mobility Solutions	Promote public discussion with civil society about new mobility solutions to generate new ideas, innovations and tools.
Thematic Area: Promotion Campaigns and Public Awareness	
Label Products According to Environmental Performance	Label products and services according to their environmental performance, this includes adopting fuel economy labels clearly displayed on all cars and light trucks for sale, green freight labelling schemes for logistics service providers and eco-rating schemes that allow shippers to choose green freight practices, and labeling products based on their embedded energy use.
Make Information Publicly Available on Projects and Policies	Make information accessible to increase the public support to transport policies and projects.
Increase Awareness about the Real Cost of Mobility	Insert the topics of sustainable mobility into formal and informal education in order to increase population's awareness of the challenges of mobility (including externalities) and raise the willingness to pay and use efficient, safe and green transport services.
Thematic Area: Promotion Campaigns and Public Awareness	
Share Knowledge on Successes and Best Practices	Share successes and best practices with other agencies at the local, national and international level, based on a well-designed knowledge transfer framework.