United Nations

ECE/TRADE/C/CEFACT/2021/INF.2

Economic and Social Council

Distr.: General
8 March 2021

Original: English only

Economic Commission for Europe

Executive Committee

Centre for Trade Facilitation and Electronic Business

Twenty-seventh session
Geneva, 19-20 April 2021
Item 3 of the provisional agenda
Matters arising since the twenty-sixth session

UNECE Nexus: Sustainable Mobility and Smart Connectivity Executive Summary

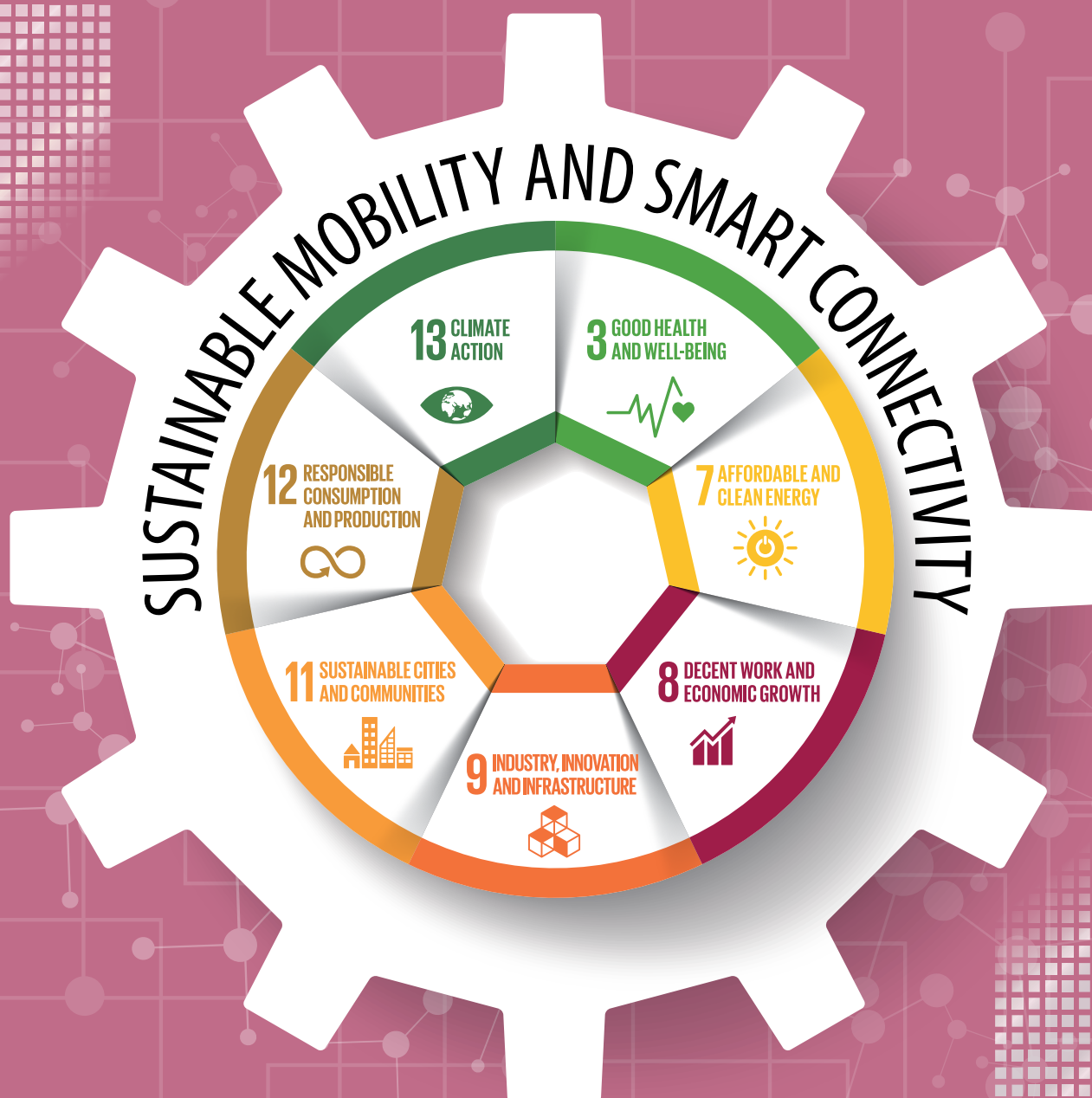## Submitted by the secretariat for information

Summary

The United Nations Economic Commission for Europe (UNECE) has put in place four nexus themes to encourage cross-divisional work and to better respond to the needs of its member States in pursuit of the 2030 Agenda for Sustainable Development. This document presents the executive summary of the flagship publication of the sustainable mobility and smart connectivity nexus area. The full publication is scheduled to be made public during the 69th UNECE Commission Session.

Document ECE/TRADE/C/CEFACT/2021/INF.2 is submitted by the secretariat to the twenty-seventh session of the Plenary for information.

1.   The United Nations Economic Commission for Europe (UNECE) has established four nexus areas to promote synergies between its subprogrammes while focusing on support for the United Nations 2030 Agenda on Sustainable Development. This was presented to the twenty-sixth Plenary in document ECE/TRADE/C/CEFACT/2020/INF.1.

2.   Much of the work of the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) is associated with the nexus on sustainable mobility and smart connectivity. The Trade Facilitation Section of the UNECE, which supports the secretariat of UN/CEFACT, therefore engages actively in the work of this nexus. Collaboration with other subprogrammes have been established for many years, most prominently with the Sustainable Transport Division. This is reflected in the UN/CEFACT standards for the electronic road consignment note (eCMR) and the Multi-Modal Transport Reference Data Model.

3.   Each nexus area has prepared their own flagship publication which identifies the strengths and weaknesses of the UNECE region and how the work of the UNECE could contribute to achieving the relevant Sustainable Development Goals (SDGs). These publications will be officially launched during the events around the sixty-ninth session of the UNECE Commission. The UN/CEFACT secretariat is sharing the executive summary of the publication on sustainable mobility and smart connectivity with its Plenary; this is annexed to this document. The full publication will be available after the official launch.

4.   The publication is divided into two parts for each half of the nexus theme: one on smart connectivity and one on sustainable mobility. The smart connectivity part of the publication indicates that for trade to be smart, it must first have a solid foundation of data exchange on which standards and quality infrastructure can be built. It also emphasizes the importance of having common, harmonized regulatory frameworks. The UNECE region has several well-established initiatives in these areas, and the publication underlines the areas where UN/CEFACT has played a key role. These include the following:

   • Recommendations on Single Window systems;

   • Recommendations on National Trade Facilitation Bodies and Consultation Approaches;

   • Semantic standards (e.g. UN/EDIFACT, the Core Component Library, Reference Data Models, etc.); and

   • Electronic business standards (the Cross Industry Invoice, eCMR, Transboundary Movement of Waste, eCert, etc.)

5.   The publication includes a matrix on "challenges and the possible role of the UNECE". This matrix also includes areas pertinent to UN/CEFACT.

6.   The recommendations propose that the UNECE

   • consider its continued role as focal point for electronic business, helping governments, stakeholders and other United Nations bodies to satisfy their needs for electronic messaging;

   • encourage the use of the UN/CEFACT semantic model of data for electronic business exchanges and encourage governments and stakeholders to contribute to its development and maintenance; and

   • consider a convention on the legal validity of electronic exchanges across borders.

Annex

UNECE

Sustainable Mobility and Smart Connectivity

UNITED NATIONS

ACKNOWLEDGEMENTS

ACRONYMS

ADR	European Agreement concerning the International Carriage of Dangerous Goods by Road
AETR	European Agreement concerning the Work of Crews of Vehicles Engaged in International Road Transport
AGC	European Agreement on Main International Rail Lines
AGN	European Agreement on Main Inland Waterways of International Importance
AGR	European Agreement on Main International Traffic Arteries
AGTC	European Agreement on Important International Combined Transport Lines and Related Installations
ASC	Accredited Standards Committee
B2B	Business-to-Business
B2C	Business-to-Consumer
B2G	Business-to-Government
BENELUX	Belgium, the Netherlands and Luxembourg
BRI	Belt and Road Initiative of China
CCL	UN/CEFACT Core Components Library
CCNR	Central Commission for the Navigation of the Rhine
CEF	Connecting Europe Facility
CEVNI	European Code for Inland Waterways
CIM	Uniform Rules Concerning the Contract of International Carriage of Goods by Rail
CIM-SMGS	Common railway consignment note for the area covered by CIM and SMGS
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CIVITAS	Clean and Better Transport in Cities (although not an acronym)
CLECAT	European Liaison Committee of Common Market Forwarders
CO & CoO	Certificate of Origin
CMR	Convention on the Contract for the International Carriage of Goods by Road
CNG	Compressed Natural Gas
COTIF	Convention concerning International Carriage by Rail
CTU	IMO/ILO/UNECE Code of Practice for Packing of Cargo Transport Units
CYRail	CYbersecurity in the RAILway sector
DINA	Digital Inland Waterway Area
DTLF	EU DG-MOVE Digital Transport and Logistics Forum
EATL	Euro-Asian Transport Links

EC	European Commission
eCITES	Electronic certificates issued under the Convention on International Trade in Endangered Species of Wild Fauna and Flora
eCO	Electronic Certificate of Origin
EDI	Electronic Data Interchange
EDINNA	Educational network of inland waterway navigation schools and training institutes
EEA	European Environmental Agency
EEU	Eurasian Economic Union
eIDAS	Electronic IDentification Authentication and trust Services
ELTIS	The Urban Mobility Observatory
ERA	European Union Agency for Railways
ERTMS	European Rail Traffic Management System
FAO	Food and Agriculture Organization of the United Nations
FMO	Fisheries Management Organization
ForFITS	For Future Inland Transport Systems
G2G	Government-to-Government
HS	Harmonized Commodity Description and Coding System of WCO
IATA	International Air Transport Association
ICT	Information and Communication Technologies
IEA	International Energy Agency
IoT	Internet of Things
IPPC	International Plant Protection Convention
IRTAD	International Traffic Safety Data and Analysis Group
IRU	International Road Union
ITF	International Transport Forum
ITS	Intelligent Transport Systems
IWT	Inland Waterway Transport
LNG	Liquified Natural Gas
MaaS	Mobility as a Service
NCTS	New Computerised Transit System
NTFB	National Trade Facilitation Body
OASIS	Organization for the Advancement of Structured Information Standards
OECD	Organisation for Economic Co-operation and Development
OFTP	Odette File Transfer Protocol
OSJD	Organization for Cooperation of Railways

OTIF	Intergovernmental Organisation for International Carriage by Rail
PIANC	The World Association for Waterborne Transport Infrastructure
PPP	Public-Private Partnerships
REIOs	Regional Economic Integration Organizations
RIS	River Information Services
S2S	Server to Server (i.e. computer to computer)
SafeFITS	Safe Future Inland Transport Systems
SDGs	Sustainable Development Goals
SECRET	SECurity of Railways against Electromagnetic aTtacks EU co-funded project
SMEs	Small- and Medium-sized Enterprises
SMGS	Agreement on International Railway Freight Transport
SMS	Short Message Services
SW	Single-Window
SWI	Single-Window Initiative
SUM4all	Sustainable Mobility for All
SUMPs	Sustainable Urban Mobility Plans
TAPA	TAPA: Transported Asset Protection Association
TEM	Trans-European Motorways (TEM) project
TEN-T	Trans-European transport Network
TER	Trans-European Railway project
TFA	Trade Facilitation Agreement (of the WTO)
THE PEP	The Transport, Health and Environment Pan-European Programme
TIR	The Customs Convention on the International Transport of Goods under Cover of TIR Carnets
TSI	Technical Specifications for Interoperability
TVWS	Television White Space (unused spectrum originally allocated for TV)
UBL	Universal Business Language
UIC	International Union of Railways
UNECE	United Nations Economic Commission for Europe
UN/CEFACT	United Nations Centre for Trade Facilitation and Electronic Business
UN/FLUX	United Nations Fisheries Language for Universal eXchange standard
UN/LOCODE	United Nations Code for Trade and Transport Locations
VAT	Value Added Tax
WCO	World Customs Organisation
WTO	World Trade Organization
XML	eXtensible Markup Language

EXECUTIVE SUMMARY

Background

The UNECE comprises 56 member States spanning from Central Asia, Europe and North America whose territory covers more than 47 million square kilometres. It includes some of the world's richest countries, as well as countries with a relatively low level of economic development.

Responsible for two-thirds of world trade, the ECE region has significant influence in how we can sustain the increasing demand from megatrends that affect every one of us and everything on the planet. From climate change, urbanization, globalization to the transformational use of innovation and technologies, we live in both challenging and opportunistic times. Sustaining our world requires, more than ever, interlinked, collaborative and resilient approaches and solutions to bring about a more prosperous future for all.

The SDGs are a call for action to promote prosperity while protecting the planet. Recognising that with the aim to end poverty, this will be linked with building economic growth and address a range of social needs including education, health, social protection, and job opportunities, while tackling climate change and to protect the environment.

To help drive and fulfil the SDG by 2030, ECE recognises that to meet these goals there is a need to re-examine and provide a further pathway to progress by focussing on key themes by:

- Assessing what is being done now and the current situation
- Identifying the main challenges and trends that the ECE region needs to address
- Supporting opportunities identified during this process.

To support member States in achieving their SDGs, ECE has identified four nexus areas where its programmes and expertise converge to help drive transformational change comprising:

1. Sustainable use of natural resources
2. Sustainable and smart cities for all ages
3. Sustainable Mobility and Smart Connectivity
4. Measuring and monitoring progress towards the SDGs.

The SDGs in themselves present significant challenges yet since the beginning of 2020, the COVID-19 pandemic is proving to be a stimulus for innovation and for forging ahead with the 2030 SDG agenda vital for a sustainable global recovery that leads to greener, more inclusive economies, and stronger, more resilient societies.

Approach and aims

This nexus is comprising the dual, interconnected themes of Sustainable Mobility and Smart Connectivity which underpin the progress for sustainable economic development, and now, recovery.

The key aspects of Sustainable Mobility and Smart Connectivity examine how to improve connectivity between people, companies, governments, economies and even goods as well as how to make mobility more sustainable. It is a very wide subject area and one which has tremendous advances but still has more to be developed if to be fully aligned with the SDGs.

By collating the aspects from the ECEs work on economic cooperation, energy, environment, trade, transport and urban development, the nexus outlines many of the key programmes, initiatives and innovations from across the region, with a view that more can be achieved with greater collaboration and potential for further UN support to help achieve the SDG aims.

More specifically:

- **Smart Connectivity** looks at trade and policy, and how to improve the economic and regulatory processes in support of economic growth and linking with other SDGs along with physically connecting infrastructure in a smart way

- **Sustainable Mobility** focusses on how to move people and goods efficiently, safely, securely, affordably and in an environmentally friendly manner using inland transportation.

For global trade to achieve its connectivity and efficiency aims, there is a high dependency on Sustainable Mobility and Smart Connectivity solutions to provide the means to adequately sustain its future growth. Meaning that trade and economic growth depend on the programmes, development and networks that enable any flow of goods according to sustainable objectives.

Within the focus themes of Sustainable Mobility and Smart Connectivity, the study examines the following dimensions by:

- Explaining the current situation of the theme in focus, describing initiatives in progress and identifying some of the challenges being experienced

- Considering trends that would affect the scope and scale of the themes discussed within the nexus and where future work activities can apply

- Recommending potential roles for UNECE in helping to address some of the key challenges identified in the report

- Recommending courses of action for member States to apply in meeting the 2030 SDG agenda.

Furthermore, the nexus identifies the strong, existing linkages for ECE and its sub-programmes to assist, support, recommend, guide and help address opportunities identified within the themes in a coordinated manner which will help advance the 2030 SDG agenda.

Throughout the study there are two recurrent themes: collaboration and harmonization. Here UNECE is uniquely positioned as a catalyst for both themes. Partnerships between stakeholders are key to the success of so many programmes which call for transformational change which this nexus is all about – changing people's lives for the better through the establishment of appropriate regulatory frameworks.

Also, the Sustainable Mobility and Smart Connectivity nexus has linkages with the following other nexus areas:

- **Natural resources**: where the impact of global trade and transport logistics are analysed in the context of their environmental impact. Transport and trade have a significant direct impact on natural resource use. Globalization has resulted in a global economy that is inherently interlinked and integrating supply chains across border comprising a complex web of integrations. Natural resources are traded and transported globally and without the means for efficient transport natural resources could not be traded globally. Transportation and trade are as enablers of natural resource use and as fundamentally relevant for the study of the Natural Resource Nexus

- **Sustainable and smart cities**: Sustainable Mobility is an integral part of smart sustainable cities in terms of the movement of people and goods. Mobility interlocks with sustainable and smart cities through innovatively digital transport technologies which provide options for city inhabitants to make more environmentally friendly choices, boosting sustainable economic growth and enabling cities to improve their service delivery

- **Measuring and monitoring progress towards the sustainable development goals**: where trade and transport activities are quantitatively and qualitatively measured against progress targets for the 2030 Agenda SDG.

Sustainable development

The dual, interconnected, themes within this nexus offer some practical examples of where UN programmes support the SDGs and targets, and also, where the UN special qualities and characteristics can help to deliver change where, for example, it does not yet have a part to play or where it can extend its roles to help achieve the future goals.

The blended 2030 Agenda for Sustainable Development outlined in full under Figure I, requires an assessment of not only the linkages but also of the potential compatibility issues between different SDGs and their targets. Many other policy instruments and commitments recognise the interlinkages between individual sectors.

This nexus directly supports several SDGs and has the potential to support many more. Links are provided to specific SDGs throughout this summary where the impact of Sustainable Mobility and Smart Connectivity can be the greatest and where there are related initiatives.

Figure II illustrates the alignment of the nexus themes with the SDGs. The study and reports explain where certain UNECE projects, programmes, initiatives, collaborations, and partnerships align with the goals. Where there is scope for further support or a role for UNECE, then these are identified throughout the report.

Figure I: 2030 Agenda for Sustainable Development Goals

Figure II: Nexus alignment with SDGs

Sustainable Development Goals	Smart Connectivity	Sustainable Mobility
3. Good health and well-being		👍
5. Gender equality	👍	👍
7. Affordable and clean energy		👍
8. Decent work and economic growth	👍	👍
9. Industry, innovation and infrastructure	👍	👍
11. Sustainable cities	👍	👍
12. Responsible consumption and production	👍	👍
13. Climate action		👍
17. Partnership for goals	👍	👍

COVID-19

Throughout 2020, the effects of COVID-19 on every aspect of life has changed for everyone. Yet while universal in its effect, the pandemic does not affect everyone in equal measures, and discriminates against certain sectors of societies especially those who are most vulnerable.

While the nexus was aimed with specific objectives in mind aligning to the core principles of the SDG agenda, the critical issues they address across so many differing dimensions, are ever more relevant to help with the sustainable global recovery when the world has a clearer picture what can be done and how to counteract this crisis.

The nexus study and report for Sustainable Mobility and Smart Connectivity is orientated towards a situation pre-COVID-19, however most of the challenges and solutions identified in this study remain relevant and are of greater importance in the post COVID-19 recovery. As an example, within the Sustainable Mobility domain, the push for the use of sustainable transport solutions as identified within this nexus is something that is even more important now, along with ensuring that these transport options are safe. Also, within the Smart Connectivity analysis for this nexus, the dematerialization of paper throughout the supply chain is being accelerated as the paper itself is also seen as a biohazard and this can potentially reduce direct human contact.

Much of the emphasis has been dealing with the immediate effects of the pandemic and developing control measures such as the use of testing kits for virus detection, provisioning of Personal Protective Equipment (PPE) for protection and vaccine research and development for prevention. Innovations will follow, such as using smarter technologies to deliver the "touchless office" or increased use of robotics to take over some of the "handling" job activities within the supply chain. Also, the UN Innovation Network (UNIN) has multiple initiatives[1] addressing COVID-19 across a wide range of dimensions including health and well-being, education, food and agriculture, employment and economics, government support and, data and information.


© ADOBE STOCK / RAUL MELLADO

---

1   https://www.un.org/sites/un2.un.org/files/2020-06_-_unin_quarterly_innovation_update_-_second_covid-19_special_edition.pdf

Smart connectivity

We have been living through several decades of advancements in the exchange of data between trading partners, governments, and people. Transformational innovation backed by technology has driven the digital economy as we know it today. Underpinning these advancements has been the need for connectivity – it must be "smart" and continue to get smarter. To be fully effective also requires simplifying, streamlining, standardizing connections along three dimensions:

Figure III: The three dimensions of Smart Connectivity
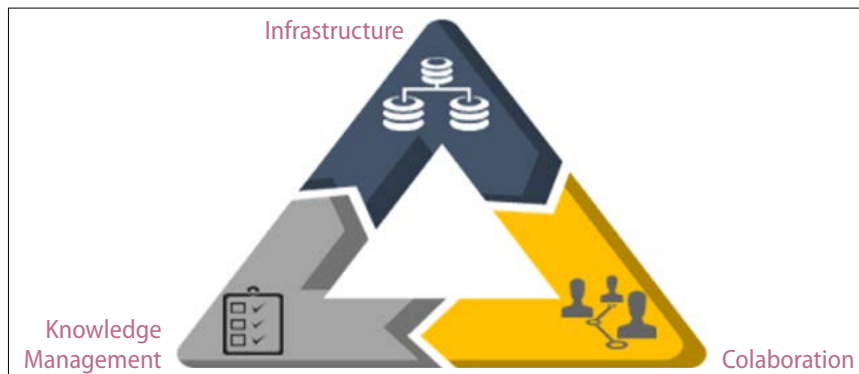
Source: UNECE Nexus Sustainable Mobility and Smart Connectivity

- Infrastructure: the foundation of the connectivity
- Knowledge Management: free and openly available standards
- Collaboration: bringing together public service needs with private sector know-how.

Within this nexus, the effect of Smart Connectivity on global trade is examined and how the data and information is becoming essential in meeting the SDG objectives across global supply chains.

Smart Connectivity comprises the following topics:
- Smart Trade
- Smart Support for a Better Environment
- Future Trends and Opportunities.

While all themes have their part to play, the study examines Smart Trade as the principle area for assessment.

Smart trade

Smart Trade is a major pillar of Smart Connectivity. It is a complex and highly "orchestrated" process comprising many actors from the seller to the buyer of goods and all stakeholders in between, including transport service providers such as forwarding agencies and carriers, the communities of common interest such as the ports, or regulating bodies such as customs and other government agencies. All play their part, and all need information which comes from data exchange.

Key for progress in making global trade more efficient, safe, secure, and predictable is the current trend of transformational change. As global trade continues to evolve and adapt to new models of supply, demand, transport and logistics, the need for process efficiencies is accelerating at a pace which will outstrip the capabilities of the supply chain. Whether it is in how increasing amounts of data is managed, the infrastructure supporting the processes, the people managing the business or the legislative frameworks which have been, and to some extent still are, based on the paper-based principles.
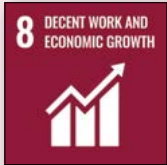
The need to eliminate paper has become an imperative for the future efficiencies to sustain global trade, further requiring the operational aspects of managing the process to move quicker towards this digital transformation.

Some of the major challenges facing the future efficiencies comprise:

- Infrastructure limitations due to expensive and difficult to replace legacy systems,
- Emphasis on dematerializing individual documents instead of considering data exchange in a wholistic approach of supply chain transaction, and
- Persistent problems of data quality exacerbated by multiple actors requesting the same semantic data potentially in slightly different formats.

While the situation is improving, much more can be achieved, and here the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) is accelerating change across the ECE region with initiatives that harness the power of data blended with the comprehensive, expert driven cross-domain open standards free for all to use.

Foundation data exchange: a high level of electronic information exchange supports the transport and logistics cycle from purchasing to transportation and through to fulfilment. While multiple standards exist, and some are specific to certain modes of transport, UN/CEFACT has been instrumental in defining harmonised standards for cross-industry trade, multi-modal transport and regulatory compliance. While the standards and usage exist, there is still scope to extend the usage and uptake of digital data exchange as still 90% of transactions involve paper documents.

Recommendations: Member States and trade stakeholders from all modes of transport should increase their uptake and implementation of UN/CEFACT electronic data exchange standards, and also participate in and contribute to their development.

Foundation standards and quality infrastructure for smart trade: standards in the quality and regulatory conformance of products and services produced within the supply chain are still a barrier to progress especially for smaller enterprises and producers from low-middle income countries. This is exacerbated by lack of collaboration and coherence which add cost to some markets.

Recommendations: Goods producers/sellers, associations, non-governmental organizations, governments and ruler makers within member States should identify barriers to trade and adopt more resilient, safer and sustainable standards to support economic development. For example, those of the International Trade Centre (ITC) and ECE quality standards, including the recommendations developed by the UNECE Working Party on Regulatory Cooperation and Standardization Policies.

Smart identification for trustworthy trade: trustworthiness is a crucial element in international trade. Current operations rely on paper or documentary evidence to ensure authenticity. To eliminate paper and increase the efficiencies harnessed by digitalization, the challenge especially with regulatory processes, is to have robust standards that can be accepted and have legal recognition by regulators.

Recommendations: To remove obstacles for dematerialization of paper documents, member States need to adopt legal procedures for cross border trade to recognize and accept electronic signatures as, for example, provided by model legislation on electronic authentication, its recommendations and guidance from the Organisation for Economic Co-operation and Development (OECD). Member States should also align with legal instruments the UN Commission on International Trade Law's (UNCITRAL's) Model law on electronic signature and the UN Convention on the Use of Electronic Communications in International Contracts.

Smart authentication of trade documents: multiplicity of authentication standards and approaches adds both cost and complexity to trade. Counteracting these drawbacks is the uptake of electronic signatures progressing through several initiatives supporting the use of electronic alternatives to paper. Within the ECE region progress by the European Union (EU), Eurasian Economic Union (EEU), the United States of America (USA), and supported by the UN Electronic Communications Convention, has led to the increasing use of eAuthentications which is a major step forward. But more needs to be done to help eliminate "islands of trustworthiness in a sea of uncertainty" meaning that the universal confidence in a digital authentication is not yet there.

Recommendations: Member States should accept electronic authentication methods and mutual recognition programs for their governments to legally adopt ECE Recommendation Nos 14 and 34 for the acceptance of electronic signatures to eliminate the need for paper and offer supportive frameworks such as through the development of Single Windows.

Starting the Smart Trade Process: Electronic Purchasing: the process of trade purchasing involves multiple documents. Most of the data from these documents can be exchanged using some form of electronic exchange but still 90% of the documents are required in a paper form. There are multiple examples of States and communities supporting eInvoicing, but the overall lack of electronic data capture at source results in efficiencies throughout the information chain.

Recommendations: Member States should accelerate the use of common standards for the electronic exchange of structured eInvoices such as the UN/CEFACT Cross Industry Invoice, as opposed to using paper documents or niche standards devised unilaterally, to help facilitate customs processes and to improve tax collection.

Smart Goods Movement in Trade: Transport and Logistics: the transport sector has had a long history of electronic data exchange predominantly of commercial data. While Business to Business (B2B) transactions have dominated an increase in demand for Business to Government (B2G) has come notable advancements such as in the road electronic Consignment Note (eCMR) developed by UN/CEFACT and the electronic use of the customs Transport Internationaux Routiers / International Road Transport (TIR) form.

For over forty years, the transport industry has been heavily reliant on the UN/EDIFACT messages, especially in land and maritime transport. These messages developed by UN/CEFACT and its predecessor are still very much in use today and cover all aspect of information exchange linked to transport and logistics. This work is being reinforced with a Multi-Modal Transport Reference Data Model (MMT RDM) providing clear semantic anchors and linking to the rest of the global supply chain; this also provides links to other message exchanges like eXtensible Marked-up Language.

Recommendations: Member States should increase their ratification and adoption of transport and logistics standards such as the UN/CEFACT eCMR for road freight transport, with support from ECE building on its eTIR experiences to facilitate freight movements and reduce barriers at border crossing points.

Smart trade: regulatory fulfilment and enforcement: multiple submissions of data throughout the supply chain process between traders and/or regulators is required often with the same data elements being duplicated for different parties. This brings inefficiencies, cost, potential for loss of data quality, and places undue burden on all stakeholders.

Recognising these inefficiencies and the complexities of differing country regulations, UNECE conceptualised a trade facilitation framework (Rec 04) calling for a National Trade Facilitation Body (NTFB) to harmonize standards and

apply measures to help ease international trade. UN/CEFACT complemented the framework and published the first international guidance for establishing a SW (Rec 33) offering a common, harmonized, and consistent entry point between trade and government, and continues to be a focal point in the development SW projects.

In 2017 the WTO Trade Facilitation Agreement (TFA) came into force to improve global trade flows which promotes the establishment of "single windows". The UNECE region is at the forefront of SW implementations with 45 countries, representing 87% of ECE member States ratifying the TFA, and 38 establishing an NTFB. This has been a major milestone in the advancement of trade facilitation and compliance.

Reducing paperwork as well as physical barriers is essential for trade and transport efficiencies and a key objective of both Sustainable Mobility and Smart Connectivity is to improve the process based on cross-border collaboration between authorities such as the Harmonization Convention (1982). This is designed to reduce formalities between States and coordinate control procedures. In practise this opens opportunities to share more electronic data for example certificates, trade documents, dangerous goods data etc, where joint border controls can help reduce transit times and improve efficiencies.

Recommendations: To improve the flows of cross-border goods using harmonized standards, member States should increase the adoption of conventions, recommendations and best practises for implementing trade and transport facilitation. By working with ECE, member State government departments and the private sector should implement Recommendation Nos. 4 and 40 and be supported by cooperation between UN Conference on Trade and Development (UNCTAD) and the International Trade Centre (ITC) for implementation guidance and assistance.

Single Window for Import, Export and Transit-Related Regulatory Procedures: UN/CEFACT published the first international guidance for establishing a Single Window (SW) offering a common, harmonised, and consistent entry point between trade and government. This is echoed as an integral part of the WTO TFA. There are numerous SW initiatives in progress, and yet challenges still exist, such as the coordination necessary between government agencies.

The TFA also opens opportunities for the use of electronic certificates such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora and Fauna (CITES) and certificates covering other classes of special goods transported under phytosanitary and veterinary regulations. The increased use of these certificates helps to streamline the cross-border process with an immediate benefit that border crossing times and processes are reduced. This then helps the environment by reducing the levels of CO_2 produced by trucks queuing with their engines idling at the border crossing points waiting to complete their formalities.

Recommendation: Member States should establish Single Windows for trade defined through ECE SW recommendations Nos. 33, 34, 35 and 36 to streamline passage of goods across international borders. While building their capacity for increased facilitation, member States should legally validate the use of eDocuments and eCertificates as defined by UN/CEFACT standards.

Smart support for a better environment

The impact of global trade on the environment is a primary concern. The collaborative approach combining Sustainable Mobility and Smart Connectivity sets a pathway aligned to the SDGs to help address those concerns.

Smarter provision and use of data under the connectivity theme is helping to improve the sustainability of resource use whether consumable as food or as energy. While nationally provisioned that can also be exported as "products" to be traded between international partners.

Smart conservation of both natural resources and trade: The smarter use of data is also helping to conserve natural resources such as the provision of food. Traceability of food, its sources and ingredients has become important for consumers to have insight to the food chain from farm to table. One such case applies to the fishing industry.

Overfishing has brought a need for conservation, so intelligence derived from fishing industry data is helping to track and manage fisheries and fish stocks which until recently was managed via hand-written logs. The UN/FLUX standard developed by UN/CEFACT is being used for the exchange of electronic fisheries information as an industry-wide development including data exchanges of all fishing activities and to monitor legal activities and detect damaging illegal ones.

Recommendations: To sustain fisheries with legal instruments for regulatory traceability, member States need to adopt the UN/FLUX standards to move from a paper-orientated business to one supported by improved data-driven intelligence through the uptake of electronic standards developed by UN/CEFACT.

Smart energy management: Without energy we cannot capture data, refine it into information and use it to drive a digital world. Electricity is essential for international trade and the inter-connectivity between electrical grids, both within and across countries, supporting the supply of both affordable and secure energy. In 2014, the ECE region accounted for 42% of the world's GDP, 39% of the world's total primary energy supply and 34% of the world's CO_2 emissions from fossil fuel combustion.

Figure IV: ECE region energy sources as % of supply 2014
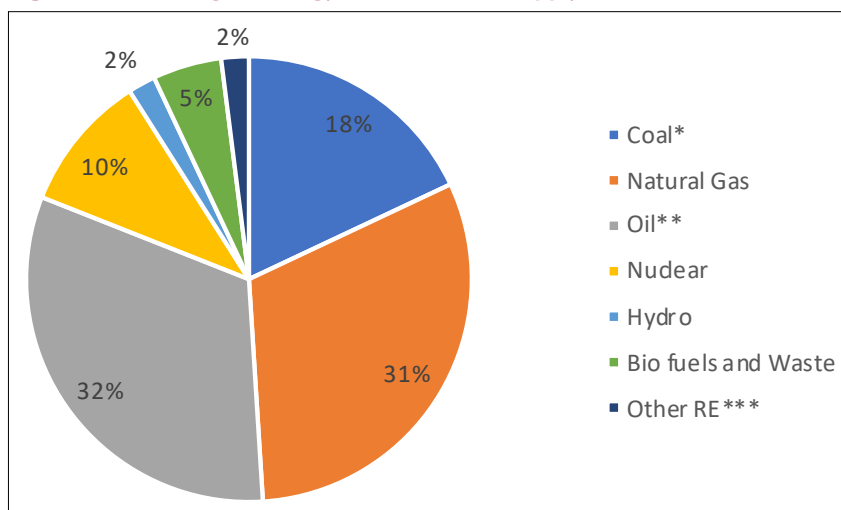
* Includes Coal, peat and oil shale
** Includes Crude, NGL and feedstocks and secondary oil products
*** Geothermal, solar/wind/other, heat electricity
Data Source: IEA World Energy Balances.

Figure IV shows the situation that in 2014 saw the predominance of fossil fuel supply at 81% in the generation of electricity, with bio and renewables only accounting for 9%.

However more recent developments to harness renewable and thus more sustainable energy sources such as in the development of Variable Renewable Energy (VRE) is being enriched and augmented by smart grid strategies. These are founded upon the availability of reliable telecommunications networks capable of interconnecting energy generation sources, with network sensors and smart monitoring devices integrating them into the power utilities operating processes.

Faced with such challenges the practical work of ECE's sustainable energy strategy to support planning and its work on Public-Private Partnerships (PPP) for renewable energy (RE) with the development of new infrastructure pose opportunities to facilitate and accelerate the process.

Recommendations: Member States need to invest in, and develop smarter, more sustainable and renewable energy strategies supported by policies, technologies and infrastructure aligned with the practical approach defined within the ECE sustainable energy strategy and, where applicable, investments follow ECE standards for PPP in RE.

Future trends and opportunities

Innovation and inventive new technologies fuel an environment to create and evolve new process models and supportive activities. The study explores the trends and opportunities for further work throughout the ECE region.

Digital based technologies have seen and continue to see the trends fuelled by vast and ubiquitous amounts of data with the potential to develop adaptive new models in infrastructure, knowledge sharing and management and nurturing relationships both old and new in the spirit of collaboration. While the future of Smart Connectivity can be foreseen as a reality it is not without challenge as there are barriers to new technological deployment as evidenced through the dimensions of infrastructure, knowledge management and collaboration.

Particularly important is developing an awareness and understanding of appropriate uses for new technology as well as identifying and fulfilling the needs for new standards. These will be achieved through knowledge management and collaboration to develop business models disrupted by the new capabilities, which may be driven by technology as opposed through business.

Smart Connectivity only happens when the capacity provided by the infrastructure is efficiently implemented thanks to the existence of recommendations, guidelines, and shared standards, deployed in a collaborative manner. The opportunities are numerous and so the study focusses on a limited number within the scope of what may be open for the future while also being tightly coupled with the assessment of future trends.

Infrastructure: advances in technology and future trends are accelerating at a rapid pace, and the impact they are having and will be profound.

Key to the advancement of technologies will be the supply of energy. Significant advances in energy generation such as with the developments of microgrids and improved grid storage coupled with the distribution of energy from renewables is bringing vital energy to areas which until recently have been devoid of consistently reliable and cost-effective electricity.

In this framework, transport infrastructure also needs to be at the forefront of innovation and harmonization exercises to ensure that it provides the connectivity for the movement of goods and people. The development of the international agreements setting out the E-Road, E-Rail and E-Waterway networks for the pan-European region is key to this.

Further advances in telecommunications such as with 5G networks and radio based Television White Space (TVWS) extend the availability of the internet with higher speed broadband essential to handle the continuous flow of data to/from devices and the support for cloud-based data storage. This data storage can be vast and needs to be processed in massive amounts using Big Data techniques with further advancements to capitalise on the data which is captured, refined and distributed. These include Distributed Ledger Technology (Blockchain), Artificial Intelligence (AI), Internet of Things (IoT), quantum computing and edge computing. These new technologies will help us to find new and more effective solutions to old problems and therefore have a key role in future developments.

Such advances in communication technologies have paved the way for alternative "smarter" means of capturing and exchanging data as in the case of mobile devices extending their capabilities with uses far beyond the person to person communication. Mobiles and smarter devices such as data loggers using IoT technologies open up new sources of data such as with intelligent assets used to precisely track the location of goods in transit and report on the condition of the goods inside them.

The "smart" in Smart Connectivity is gaining in "intelligence" and capacity every day. At the same time, organizations change much more slowly than technology. Many managers who make decisions about technology today were trained and gained experience in environments where change took place at a much slower pace. The challenge will be to bring the latest and most appropriate technology to all to avoid the connectivity limitation constrained by the weakest links.

Most SDGs involve elements of infrastructure. Within the scope of this nexus, future advancements to support SDG aims will depend upon a combination of technology and physical infrastructure to meet the digitally driven needs for trade within Smart Connectivity, and the necessity to develop communication networks, roads, rail and buildings within Sustainable Mobility. This can involve investment on a massive scale: developing, implementing, and supporting infrastructure can cost trillions of dollars. To assist with development costs of the physical infrastructure as well as innovation, the UN has devised Roadmap for Financing the 2030 Agenda for SDG and is promoting a Public Private Partnership (PPP) for investment with guidelines for action.

To help ensure the best possible support from PPPs for the SDGs, ECE has pioneered the revision of the model as a "People First" PPP and its rebranding from a "Value for Money" to a "Value for People" approach to include social and environmental standards.

While technological infrastructure is transforming trade, good transport infrastructure and services are fundamental to the successful functioning of economies.

Sustainably efficient inland infrastructure is essential for the ECE member States ability to meet travel, trade, and their transport demands for the future. The convergence of digital technology with transport infrastructure such as with Intelligent Transport Systems (ITS) illustrate the future potential for not only "smarter" transport solutions but those which can improve transport efficiency in an environmentally sustainable way.

With the trend for utilising alternative transport modes such as rail or inland waterway, significant funding will be required to design, develop and deploy the infrastructure necessary to sustain such alternatives. Any future development will require a blend of digital technologies with physical infrastructure.

The blend of improved and efficient transport system infrastructure within Sustainable Mobility supporting the needs of Smart Connectivity for effective global trade demonstrate the interdependency of the two themes. A good example of this blend within the ECE region is the combined efficiency improvements at border crossing points and the transport networks serving them to reduce time, cost and environmental impact of travel and trade. The flow of cross-border goods can be facilitated digitally through data and eased through the border with good quality infrastructure providing improved road and rail networks including transit and border control facilities. This is facilitated through the coordinated development of the pan-European "E" transport networks mentioned above, improving cross-border efficiency by combining transport agreements with connectivity and supported by the physical infrastructure to meet future transport demand.

Recommendations: With so many diverse technological and infrastructure options available and already accelerating change, member States are facing difficult and sometimes conflicting pressures where Smart Connectivity is limited by the weakest stakeholder. To help redress this situation, member States should adopt ECE principles and standards, reinforced by its convening role particularly through the UN/CEFACT Advisory Group on Advanced Technology. Member States should continue the efficient development of transport infrastructure to facilitate connectivity and ensure that they can be at the forefront of technology, such is in the development of ITS, and orientate funding to a "Value for People" model aligning with the UN PPP approach considering social and environmental standards.

Knowledge management: knowledge management provides the tools for meeting trends and new challenges, and within Smart Connectivity its three main components comprise understanding and guidance through the provision of standards, and legal instruments through the provision of recommendations.

A key aspect of collaboration and to achieve the 2030 SDG Agenda will require an "all hands-on deck" approach with different sectors and actors working together in an integrated way by pooling financial resources, knowledge and expertise to work in a PPP. The PPP concept as used within the UN and development banks merging the positive elements of the public and private sectors together bringing together investment capacity and technical expertise with both sides sharing the financial risks.

Sustainable mobility

Sustainable Mobility addresses the physical world of moving people and goods efficiently, safely, securely, affordably, accessibly in an environmentally supportive way. While all modes of travel and transport have their part to play in sustainability, the nexus focuses on inland transportation, namely road, rail and inland waterway, and with a specific focus looking at urban transportation within smart cities.

Good transport infrastructure and services are fundamental to the successful functioning of all economies. They are essential for ensuring a high degree of connectivity both within and between countries as well as to ensure that mobility for people and goods is provided in the most sustainable manner possible.

The nexus shows that each inland transport mode has elements that may challenge as well as contribute to achieving sustainability. As a result, transport needs to be considered as a holistic system which supports economic and social activities at country, regional and local levels by providing mobility for people and goods.

Sustainable Mobility comprises the following focus areas:
- Transport efficiency
- Transport safety
- Transport security
- Transport and the environment.

Transport efficiency

Efficiency is the first transport pillar supporting Sustainable Mobility and Smart Connectivity to ensure people and goods can move from their origins to destinations in the most effective way with the least possible cost, time and use of resources whether human, natural or man-made.

Providing the right infrastructure, capacity and services, supported by new technologies to help improve performance are vital to link economic centres, and to ensure efficiencies in the transport networks are sustainable.

While the physical transport system itself needs to be as efficient as possible, the processes using them defined by Smart Connectivity, also need to be fully effective. By offering a high level of facilitation where possible in the case of international transport so that the promised delivery of service (connectivity) can be delivered a promised (mobility) by the transport systems.

Part of the effectiveness of any transport system can be to offer a choice or an alternative means of transport across the same connection thereby offering options for cost, connectivity, accessibility, speed, security, capacity, and sustainability.

One such approach can be seen in the E-Road, E-Rail and E-Waterways networks developed through pan-European agreements that extend into Asia providing the infrastructural connectivity necessary for international traffic. As a further example, within the EU, these have been adopted as the basis for the EU Trans-European Network for Transport (TEN-T). Based on these "E" networks, connections have been extended beyond the ECE region through the Euro-Asian Transport Linkages (EATL) project.

Recommendations: Member States should ensure that their transport sectors are composed an optimum mix of transport modes that facilitates the efficient move of transport domestically and across borders while ensuring minimal environmental impact. The different modes should run on technically harmonized and integrated infrastructure networks such as those identified in the pan-European "E" networks.

Road transport: is central to passenger mobility and freight transport throughout the ECE region where it holds the largest modal share for most movements.

To be efficient, road transport needs suitable infrastructure of high quality, supporting passenger vehicles that can carry people comfortably and safely and for haulage vehicles with sufficient capacity to make goods transport economically efficient. It also needs appropriate regulations to ensure that both the infrastructure and services are managed to high standards that balance high capacity with high performance.

The development of Intelligent Transport Systems (ITS) is particularly useful for efficient road transport: managing traffic, tackling congestion and delivering increased safety. ITS is the application of information and communication technologies to road transport and to interfaces with other modes of transport. Benefits of a wider application of ITS have been highlighted by the ECE and include increased road safety and efficiencies, higher rates of travel time predictability, energy savings, lower pollution, and faster emergency response time, and interlocks with automatic toll fee collections.

While the road networks are extensive throughout the ECE region, there are challenges to extend the network of "E" roads and increase the use of technologies to help improve traffic flows, along with ECE backed programmes designed to break down administration barriers for improved performance and sharing of knowledge.

Recommendations: Member States need to prioritize efficiency with well maintained, high quality and safe networks to assure that each road segment can sustain the traffic volumes they need to carry. Coupled with investing in the development and deployment of ITS, further efficiency gains can be achieved where member States actively break down barriers to cross-border trade and travel, through such things as acceding to and implementing Conventions such as the CMR, eCMR, TIR, eTIR and the International Convention on the Harmonization of Frontier Controls of Goods. Member States should also look to build capacity with regulatory frameworks for future efficiencies offered by new and emerging technologies such as the use of autonomous vehicles (while mitigating risks from cyber-threats) defined within UNECE Conventions WP.29 and WP.1.

Rail transport: is becoming an increasingly important alternative to other means of transport for the movement of goods between Asia and Europe. As identified in the Phase II study for the EATL project, these flows are cheaper and, in many cases, faster than sea movements. For this to be effective though border crossing efficiency needs to be improved and harmonization of rules and, where possible, infrastructure and rolling stock needs to be implemented.

For passenger transport the rail sector remains a key mode for short, medium and long-distance travel. With increased efficiency, as seen in several countries identified in this study report, use and market share can increase further.

Several initiatives in the ECE region are aimed at redressing issues such as lack of interoperability between national networks are in progress for example as in progress by the EU Agency for Railways (ERA). These include improved facilitation at border crossing points where, for example, the Brest border cross point for Asia-Europe routes has been reduced from 36 to 10 hours. Of significant importance is also the work being carried out by ECE member States on Unified Railway Law which will create one legal regime, one contract of carriage and one liability regime for the transport of freight between Asia and Europe, removing one of the most important administrative barriers at borders.

Recommendations: Member States should focus their policy and regulatory initiatives on reducing barriers at border crossings to facilitate the movement of goods and people through the accession to and implementation of relevant UN Inland Transport Conventions and the harmonization efforts undertaken by UNECE through EATL, the development of Unified Railway Law and similar activities.

Inland waterways: provide an important alternative to other transport modes as they do not suffer from the same congestion levels and waterborne transport costs less. They also have advantages in terms of high safety levels and energy efficiency. These features contribute to reducing transport and logistics costs, as well as congestion on road networks, impacting several SDGs. However, transport by inland waterways needs further development as its potential remains largely untapped.

The sector already benefits from a strong regulatory framework thanks to the seven ECE administered Conventions and legal instruments currently in force, accompanied by the over 100 ECE administered resolutions that underpin the functioning of the sector. On this foundation, the development of inland waterway transport requires improvements/extensions in waterway navigation, overall enhancement of facilities, construction of linkages, further development of information services for navigation such as River Information Services RIS, and digitalization of the sector.

The potential for further development was identified in the recent White Paper on the Progress, Accomplishment and Future of Sustainable Inland Water Transport published by UNECE. This document highlights the main areas of focus for the sector and the role for ECE going forward.

Recommendations: Where member States have an option to utilize and enhance their transport options via inland waterways, they should build capacity where this mode of transport offers a viable alternative to other modes in line with UN Inland Transport Conventions on Inland Waterways.

Intermodal transport: All these modes of transport cannot operate individually as there is always a leg that needs to be done on road, or a section of journey that can only be done efficiently by rail. This is why intermodal transport is essential to ensuring that freight and passenger movements can be undertaken in the most efficient manner. In terms of freight transport this usually (but not always) involves the movement of containers which are swapped between different modes of transport. This form of transport also needs to be accompanied by advanced logistics solutions which act as the glue binding together different transport operations, including the pertinent data exchange solutions.

In terms of passenger journeys, efficient intermodal transport means ensuring that passengers have good connections between and within transport modes to ensure that they can have a seamless journey, for example, from their home to their place of employment.

Efficient freight and passenger intermodal transport solutions are fundamental to achieving wider environmental and sustainability goals and the work that is currently being done at UNECE in relation to intermodal infrastructure and policy is essential in achieving this.

Recommendations: Intermodal transport provides a cross sector solution that optimises the use of different transport modes to provide an efficient use of relevant resources. Member States should encourage the use of intermodal transport, where possible shifting a large part of the freight journey away from the road in order to achieve wider sustainability objectives. While extending the development of intermodal transport and logistics solutions, member States should accede to UN infrastructure agreements and develop relevant policy initiatives through the UNECE relevant working party. In addition to the physical needs of intermodal transport, member States should align their electronic systems developments with the UN/CEFACT Multi-Modal Transport Reference Data Model data exchange solution to help assure electronic interoperability using standards specifically designed to facilitate the exchange of data between different modes of transport in the most efficient way possible.

Urban transport

Urban transport comprises road and rail and sometimes waterway transport. Nonetheless, it is normally treated separately because it includes some specialized infrastructure and planning considerations. Rail and bus transport may have its own infrastructure, while other transport modes use road space that is part of urban living environments and, in historical city centres, was not intended for use by modern transport means.

The performance of transport in a city shapes the performance of that urban area. Making available and developing sustainable transport options, and options that are best suited to each person's needs and abilities as well as to city constraints is central to ensure it is accessible to all and can help to promote healthy living.

Figure V illustrates the utilization of different transport types for selected urban environments. This sample clearly shows the predominance of motorised types with "soft" modes such as walking and cycling quite prominent for many cities.

Figure V: **Modal share in main cities (2017)**

Main cities	% soft modes	% public transport	% rest of motorised modes
Amsterdam	59	16	25
Barcelona	45	34	21
Berlin	42	25	33
Bilbao	66	22	12
Birmingham			
Budapest	37	37	26
Copenhagen	56	17	27
Frankfurt	48	24	29
Helsinki	36	34	31
London	27	37	36
Lyon	48	25	27
Madrid	37	38	25
Mallorca	41	13	46
Manchester	30	18	52
Montreal	18	25	56
Oslo	35	33	33
Paris	55	31	13
Prague			
Rott/Hague	46	13	41
Stockholm	33	40	27
Stuttgart	37	23	40
Turin	37	24	39
Valencia	48	21	31
Vienna			
Vilnius	26	24	50
Warsaw	21	47	32

Source: EMTA 2019.

Proportionally, the use of public transport is lower although for some with good/extended public transport systems utilization shows a reasonable amount of comparative uptake. With still a high proportion of journeys taken by car this adds to congestion with the negative environmental and social effects that reduce the efficiency of movements in the urban environment.

Several cities are introducing solutions to tackle this inefficiency through activities such as: promoting bicycle use (seeking to reach the levels found in Amsterdam and Copenhagen); creating appropriate infrastructure and incentivizing an active mobility culture. Car use has been discouraged through penalties such as congestion charging and higher road taxes. Finally, significant investment is being ploughed into public transport to make it more attractive across the region.

While measures had been developing to encourage the use of public transport, personal mobility such as cycling and reduced dependency on private motor vehicles, the effects of the COVID-19 pandemic have had a rapid and profound impact for both urban and rural transport networks.

Measures restricting non-essential travel not only reduced demand for public transport services during lock-down periods, but as restrictions are relaxed, demand has decreased in line with a sizeable proportion of people not travelling socially nor for commuting as home-working continues to be the norm for so many businesses.

As COVID-19 evolves and its full and longer-term effects are still hard to predict, urban and rural transport strategies will inevitably have to be adaptive to whatever the future demand will be.

Technology has a large role to play in improving efficiencies within urban transport systems. ITS and automation are now widely used for public transport and information managed by such systems. With the abundance of mobile devices, usage of these offers the chance to help kick-start a sharing economy across the ECE region such as in the development of cycle sharing schemes to encourage greater use of bicycles.

While attaining higher level of urban transport efficiency through reduced congestion which benefit the environment and the overall health of the urban population (whether resident or commuter), further efficiencies will be felt in other uses of transport around the city such as in freight. Urban transport and logistics are an extremely large sector and growing with the exponential rise in e-Commerce and small parcel delivery services. While economically vibrant this rise on smaller van, personal car and petrol scooters for delivery services adds to the increase in pollution levels. Policies concerning urban logistics are often hard to develop due to the multiplicity of stakeholders with differing goals.

To promote efficient urban transport across all dimensions, the ECE member States along with the World Health Organization (WHO)/E are collaborating under the Transport, Health and Environment Pan-European Programme (THE PEP) with a focus on making this type of transport more sustainable and have developed a number of studies and policies on such things as green and healthy jobs in transport, cycling promotion masterplan, mobility management and eco-driving.

Recommendations: To address the multi-facetted demands from urban transport environments, member States need to take a holistic approach for the uptake of sustainable mobility solutions, and fully support the introduction of policies aimed at facilitating the switch to more sustainable means of transport. By building capacity through programmes such as THE PEP, member States can plan for and develop and then implement sustainable transport solutions in a manner which ensures integration with land-use planning, health and the environment.

Transport affordability and accessibility for people and society

For mobility to be sustainable it also needs to be affordable and accessible, as such affordability (both for the private individual and for the public sector financing it) must be seen from the point of view of society as a whole and considered for public as well as private transport.

Accessibility is of relevance primarily to people but is also important to businesses for accessing markets.

Affordable mobility for individuals and households: without affordable and adequate mobility options individuals may be marginalized or excluded from day to day activities, potentially risking livelihoods. Transport affordability is also linked with housing affordability which affects the choice of housing location i.e. closer or further from urban centres where there are potentially more prospects for work and where for some there is a trade-off between the cost of transport as opposed to the cost of housing.

Affordability is one of the key parameters in discussions undertaken under THE PEP as well as in sustainable urban mobility plans that are a requirement within EU member states.

Transport affordability for public authorities: where transport services and infrastructure are provided by public authorities suitable funding needs to be guaranteed to ensure that services function effectively as fares rarely cover the entire cost of production. Therefore, public authorities need to ensure that the solutions that are provided are the best value for money for them as decision makers serving the community.

In some cases, the private sector can help with this affordability problem. For example, the tendering of some rail services that are now run by the private sector have led to savings of 30% in costs or increased services for the same amount of funds. To help public authorities decide on whether PPP is for them or not, the ECE concept of People First PPP schemes involves guidance and how to assess setting-up such a venture.

Recommendations: Member states should work towards making sustainable transport solutions affordable for the users and the funders by choosing options that encourage modal shift as well as identifying alternative forms of financing public transport infrastructure. Coordinated activities through THE PEP can facilitate knowledge sharing and the development of best practice policies in this respect. Furthermore, member States are encouraged to apply UNECE best practises and consider the differing finance options such as the UN People-first PPPs which comprise all aspects of funding whether environmentally sustainable or promoting equality for people which can scale-up to meet the 2030 Agenda.

Accessibility for people and businesses: transport is the tool by which people and businesses have access to the goods and services they need. This involves making sure that there are transport solutions (primarily public transport solutions) for people to get from their place of residence to their place of work easily. It also involves ensuring that the transport vehicle and related infrastructure can be accessed easily with such things as step free entry and exit, and provisions for vulnerable users and people with reduced mobility. Similar accessibility requirements are necessary for the transport of goods. Accessibility is also about ensuring that alternative forms of mobility (cycling for example) are allowed for the transport environment and that due consideration is made in the planning of cities to ensure that they can be a key component of the transport mix.

Recommendations: Accessibility must be a key consideration for member States when planning, designing and developing mobility solutions, with diverse factors to consider such a rural versus urban geographies, public transport provision and the support for vulnerable people, advocated as one of the cornerstones of THE PEP activities. Outside the urban environment, member States need to ensure long distance accessibility through such things as the Inland Transport Infrastructure Agreements.

Transport safety

Sustainable mobility and smart connectivity must be safe and seen to be safe, too many accidents, and related fatalities and injuries continue to affect mobility. The largest safety gap to close is in road transport as it is clearly the largest with 1.35 million fatalities on the road worldwide per annum. While railways and inland waterways are much safer in terms of accidents, there are still improvements to be made for those modes of transport.

An effect of the COVID-19 pandemic has been that during the most restrictive periods, the use of public transport has been in some areas at a virtual standstill. Even when travel and work restrictions have been relaxed, people's concerns over safety in the public or "shared" transport systems has meant it has been the least utilised method for travel. Depending upon how the pandemic evolves, safety for those passengers who must travel and the transport workers will be a primary concern and it may take a long time before confidence in public transport as a completely safe method of travel returns.

Road: By far the largest challenge as the sector combines all road users whether travelling by car, bus, truck, van, motorcycle or scooter, bicycle or on foot. Through the UN Road Safety Conventions and Legal Instruments a framework has been developed to address in a holistic manner the reduction of road safety risks through an appropriate governance structure, the adherence to traffic rules, the safe transport of dangerous goods, the limitations on driving times and the use of safe, homologated and road worthy vehicles. Unfortunately, not all UN member States have become contracting parties to the conventions and/or effectively implemented the requirements of this framework. This has led to a continued high number of fatalities on our roads. In 2010 the UN set the goal of halving the number of road fatalities by 50% by 2020. Although significant progress was made in this period, the 50% target was not reached.

A major drive towards road safety are the regulations to make vehicles safer for their occupants and other road users such as pedestrians and cyclists. All vehicles are made according to safety standards developed by ECE (not the EU, EU legislation refers directly to ECE standards). If you use a car, get on a bus, or drive in a truck, you will see the "E" symbol on everything from side windows, to brakes, airbags, and seatbelts. The standards also extend to helmets (it is now illegal in the EU to sell helmets without ECE markings) and child seats for example.

These standards ensure a vehicle is safe being constructed according to ECE agreed regulations using only approved components and verified through periodic technical inspections. Adherence to these standards is a fundamental aspect for the road worthiness and safety of vehicles throughout their design and manufacture.

While the standards bring rigour into road safety, they form part of a wider approach which acknowledges that vehicles are driven by people, and people make mistakes. This "safe system" approach combining the design and manufacture of safer vehicles and improved road systems combine to help minimise the impact of mistakes and reduce accidents.

A major challenge is that not all ECE member states adhere to the safe system approach, so while some vehicles look the same, they may have been constructed to differing safety standards. To drive home the importance of road safety the UN Secretary General has a Special Envoy on road safety to promote the implementation the UN Road Safety Conventions to make the roads safer for all to use. This has been recently supplemented by the creation of the UN Road Safety Fund.

Road safety also has a direct correlation with efficiency as the congestion, delays and the effects of even minor collisions can have a knock on and detrimental affect especially occurring on heavily used routes causing delays, jams and increase in CO_2 due to drivers idling while queuing in tail backs.

Recommendations: Member States should renew their efforts in improving road safety, seeking to ensure that they adopt a system approach in line with recommendations and processes enshrined in UN Inland Transport Conventions, with the support of the UN Secretary General's Special Envoy for Road Safety as well as contributing to and drawing on the resources of the UN Road Safety Fund.

Rail: Accidents and fatalities are significantly lower than for road where the trend for passenger fatalities on the railways is and has declined over recent years but is affected by significant one-off incidents or by non-railway users such as trespassers or incidents at level crossings.

A number of recent initiatives have helped the improvement of safety in the sector including efforts to remove level crossings across the region and the introduction of improved safety critical signalling systems such as the European Rail Traffic Management System (ERTMS) in the EU and similar systems in other parts of the ECE region.

Recommendations: Member States should seek to invest in solutions that maintain the high level of safety experienced in the railways through such things as improved signalling, reduced interferences and upgraded level crossings.

Inland waterway: As with rail, accidents and safety incidents are less common with waterway transports. The scope of waterway safety covers: navigation rules, vessel technical requirements, crew qualifications, rules for the transport of dangerous goods. Safety could be improved by the technology enhancements concerning automated navigation. Many of these aspects are dealt with in the Inland Waterways Conventions and Legal Agreements administered by UNECE.

Further harmonization across the river basins is necessary to facilitate the development of safe solutions for the sector, including in relation to crew qualifications.

Recommendations: Member States should build on work carried out at international level to increase safety on inland waterways through the introduction and extension of use of new technologies such as RIS.

Intermodal: The increasing use of intermodal units for international transport requires a common set of rules and standards to consistently manage safety risks. Safe packing and handling of intermodal freight transported in Cargo Transport Units (CTUs) irrespective of their content, are essential to ensure safety for all workers and the public from accidents and to avoid damage to cargo or transport equipment.

Common safety standards need to apply whether CTUs are transported by road, rail, or inland waterway, and when handled for transhipment through intermodal terminals. The ILO/IMO/UNECE Code of Practice on the Safe Handling of Cargo Transport Units (CTU Code) is the reference document and standard which is increasingly being used around the world and has become the basis for national legislation in some countries.

Recommendations: Member States should seek to apply the provisions in the CTU Code to make the handling of containers, and thus making working in the sector, safer.

Transport security

Security is all about identifying threats, mitigating risks and handling incidents if they occur. It continues to be a major concern as the threats to transport and the supply chain are ever evolving as those who perpetrate them find ever more inventive ways to disrupt, damage or destroy the normal and legitimate flow of goods and travel of people.

For inland transport, each mode has its own security challenges ranging from attacks on people, infrastructure and systems, theft of assets and goods to the illegal trafficking of people, endangered species and contraband cargoes. Overlaying these is the omni-present threat of terrorism and terror related crime. These security threats have a strong impact also on connectivity. Sustainability will depend on managing the risks where multiple challenges lie for example, most infrastructure and vehicles are unprotected or have limited protection, many stakeholders are involved and require coordinating, multiple security regimes can apply, trade and traffic flows must not be disrupted.

Security also relies on the trustworthiness of those involved in international trade and transportation. As discussed within Smart Connectivity, the authenticity of digital documents and their legal accepted by regulators is essential not only to effectively remove paper from the transport chain but to make it more secure. Increased levels of stakeholder trustworthiness reduce security threats and mitigates the risks from illegal and illicit activities in transport chain.

Prevention of theft in road, rail and intermodal transport: a major concern as the incidents of thefts are increasing especially for road with theft of or from the vehicle, theft of/from trailer and hijacking with the cost of thefts running in millions. Helping to mitigate the risks to road are the Transported Assets Protection Association (TAPA) standards for secure parking of trucks citing an average loss rate from theft in Europe running at over EUR 300,000 per day. For rail, the isolation of (long) stretches of infrastructure also leave the rail mode vulnerable to theft especially of copper wire which also has a strong impact on safety.

Recommendations: Transport security transcends all modes of transport and across all borders. member States governments and stakeholder communities are encouraged to share information about thefts and other security incidents whether cyber or physical in nature, across all modes. Also, member States should provide secure and safe parking/resting facilities for road transports and their drivers aligned with existing guidelines and best practices.

Cybersecurity: with so much reliance on systems, digitalised data and the ubiquitous availability of information, cyber security poses a major issue. From government, to corporates, small and medium business, to the individual protection against malicious actors is a constant threat. Each mode of transport deploys its own measure to counteract cyber-threats and the ECE is providing the legislative framework on how to protect autonomous vehicles and all connected elements of vehicles.

Recommendations: To counteract the growing cyber-threats, member States should establish regulated policies on transport systems for all modes of transport and where appropriate certify manufacturers and suppliers for compliance. Member States are encouraged to adopt and apply harmonized cybersecurity standards within a legal framework, such as those developed within the ECE Working Party on Automated/Autonomous and Connected Vehicles (GRVA, part of WP.29).

Protection of transport infrastructure: terror attacks across transport modes have had a direct impact on the way security is treated for infrastructure with a direct impact on rail and inland waterways. Dissemination of information about security methods, standards and norms in all transport modes is key as multiple actors are engaged in the security approaches can be fragmented while the best approach is for coordination to meet and mitigate against the range of threats whether from theft, terror or cyber-attack.

Recommendations: To assure transport safety, security and continuity, member States must place a high priority on protecting transport infrastructure from all possible threats. While risk assessment is part of national responsibility, member States are encouraged to share information more widely about security incidents, threats and the risks they pose, for example by contributing to the UNECE Rail Security Observatory and similar initiatives.

Transport and the environment

Critically important to sustainability and directly consequential of mobility is the effect of transport on the environment. Environmentally sustainable transport entails ensuring mobility while ensuring efficient energy use that reduces all forms of emissions and land use.

Transport accounts for more than 25% of CO_2 emissions within the EU. As shown in Figure VI below, in comparison to other modes of transport, road transport accounts for most of inland transport's polluting emissions and shows the need for promoting a modal shift, where possible, as well as the introduction of alternatively powered vehicles, energy saving driving methods and emission control methods.

Figure VI: Share of greenhouse gas emissions from transport and detail on the emissions by road transport for the EU28
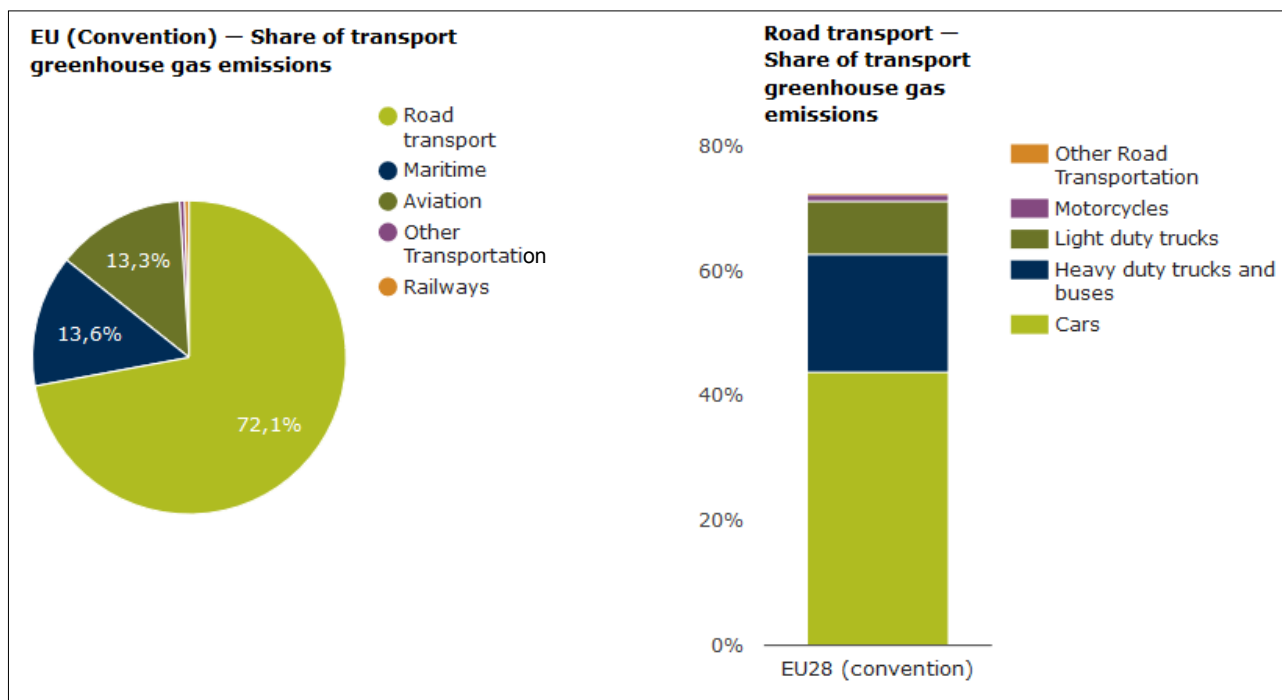
Source: EEA, Inventory 2019.

Emissions are not limited to CO_2 though as other pollutants, including particulate matter, have a severe impact on human health. In addition, most motorised transports emit noise and cause vibration which also have a negative effect on people's health and well-being.

Transport also has an environmental impact on land use which can lead to loss of biodiversity. Large expanses of land used for road, depots and terminals change the surface areas encroaching on natural landscapes and in some cases contribute to other forms of pollution such as contaminated rainwater run-off from roads into streams and rivers. This requires careful and considered planning from the outset to assess environmental impact of development.

The challenge is to promote the use of the most environmentally friendly transport mode suitable for each transport need, also considering the type of energy used with a strong focus on ensuring a switch to the use of renewable energy.

Road and urban transport: while contributing most to pollution (emission and noise) from the effects fossil fuel supplied internal combustion engines, the paradox is that it also provides the opportunities for greener alternatives such as cycling and electric/alternative fuelled vehicles.

Efforts are ongoing to reduce emissions of vehicles thanks to the introduction of stricter emissions testing regimes as developed by member States in the UNECE World Forum for the Harmonization of Vehicle Regulations.

Recognising the increased urgency of climate change and of environmental protection, there has been a discernible shift to public transport and cycling in urban areas. Public transport requires about 3 times less energy than cars, comparing well with cars for all kinds of emissions. The increased and higher use of electrification in public transport also enables it to use more renewable energy. According to the WHO, one million deaths per year in Europe can be attribute to inactivity so an increase in active mobility such as cycling and walking positively contribute overall health, wellbeing while being highly sustainable.

Several initiatives comprising alternative means and modes of transport are progressing:

- Increased optimization of freight transport with the use of intermodal transport to deliver goods, reducing the road component to the first and last mile and making full use of rail and inland waterway solutions for the remaining legs
- Incentive schemes for the use of electric cars is helping to ensure their use is on the rise
- Eco-driving to promote responsible, safer and more considerate driving are being run by several countries and falls under THE PEP scope.

At the base of these policy decisions is the legislative framework aimed at ensuring that road vehicles emit as little as possible. This framework is developed at ECE through the vehicle regulations that establish the standards by which emissions are assessed and vehicles homologated.

Recommendations: To reconcile environmental and economic targets and in meeting international environmental commitments (including support for SDGs), member States should ensure the full implementation of UN Vehicle Regulations related to the pollution emission standards to reduce the environmental impact of road transport. In developing a holistic approach to protecting the environment, member States should participate in the UNECE Environmental Performance Reviews (EPRs) as well as contribute to, and learn from, the experiences within THE PEP on minimising the environmental impact of transport.

Rail transport: usually more environmentally friendly than road transport as a large part of rail transport is electrified. Better environmental performance may be obtained through further electrification including the use of battery power, using alternative fuels, encouraging eco-driving and reducing noise and vibrations especially when traversing built-up areas. Noise reduction measures applied to tracks and rolling stock can be expensive and may only be possible when routine repair, maintenance or replacements are scheduled.

Recommendations: Member States should continue to support the shift to rail to reduce transport's environmental footprint. In doing this it should also consider investing in the electrification of the railways to further reduce its emissions.

Waterway transport: compares well in environmental terms with other transport modes due to low emissions per tonne of goods transported and to the high capacity of the vessels which allows the removal of significant freight traffic off of roads and the freeing up of capacity on railways. A number of challenges remain to be tackled to ensure

the environmental sustainability of inland waterway transport including the use of fossil fuels for propulsion with limited possibilities for changes in the short run, use of rivers and lakes and treatments and disposal of waste. The use of low sulphur fuels is a potential remedy.

Recommendations: Building on the reduced emissions of the waterways sector, member States should seek to encourage the shift to inland waterways where possible while, at the same time, seek to improve the environmental performance of the sector with the introduction of cleaner fuels and newer, more efficient vessels. This should be coupled with efforts to minimise the impact of waterway transport on the wider environment by applying UNECE Resolution No. 21 on Pollution Prevention.

Resilience to climate change effects: acknowledging that transportation is a major contributor to climate change, adverse climatic events are also threatening transportation. Erosion, tidal surges, fires and flooding all pose a hazard to the safe and efficient operation of transport systems.

ECE is already helping to building resilience to these hazardous events by identifying climatic hotspots where adverse weather could cause disruption to transport systems. For effective and timely intervention to counteract the negative impact of these events, all stakeholders require access to information about risks and the mitigation steps to counteract them.

Conclusion, challenges and the role of the UNECE

The Sustainable Mobility and Smart Connectivity nexus covers several areas that are essential for the achievement of the 2030 Agenda for Sustainable Development within the member States of the region.

The challenges within this nexus are vast, and so are the opportunities. The world is already set on a pathway to progress SDGs and much has been achieved already. However, progress according to the pre-2020 expectations is currently unpredictable due to the continuing and accelerating effects of the COVID-19 pandemic.

Both Sustainable Mobility and Smart Connectivity themes have been affected by COVID-19, and it is still too early to confidently say what will be normal. Nevertheless, this along with the other nexus' will have a major part to play in helping define a pathway to recovery and to set the direction which eliminates an environmental crisis upon a health and well-being crisis from the pandemic.

ECE is already supporting some of the SDGs and many of the themes covered by the Sustainable Mobility and Smart Connectivity Nexus by generally facilitating the development of a sound legal framework, offering support, guidance, encouragement and to advise on the use of standards and best practise to help build capacity. Most of these activities and actions remain relevant in the current and post-COVID-19 situation focused on collaboration and harmonization.

The numerous synergies that already exist between the various sub-programmes of ECE come together within this nexus for example in relation to electronic documentation, infrastructure development, reducing environmental impact, safety and security. The extensive joint work within ECE on these aspects sets a solid foundation for further efforts in these areas to help member States recover from the COVID-19 pandemic.

Therefore, to meet the challenges identified in this document and facilitate member States in implementing the recommendations identified above, ECE should consider the following for:

Smart Connectivity: continue as a focal point for electronic business, helping all stakeholders meet their needs for data exchange and use by applying the UN/CEFACT semantic model, while defining the legal framework to help member States to facilitate the cross border exchange of electronic data. This should be coupled with encouraging the further dissemination of electronic documentation for trade and transport and a coordinated development of infrastructure and border crossings to facilitate international connectivity.

Sustainable Mobility: continue development of a robust legal and regulatory framework for the sustainable mobility of passengers and freight, through existing and future Conventions, legal agreements, regulations and resolutions to help member States to harmonize cross border transport services, drive transport innovation via the use of innovative technologies and improve efficiency, safety, security, and environmentally friendly and sustainable solutions for all modes and means of inland transport.

© ADOBE STOCK / SINA ETTMER