POLICY REPORT ON HOW THE FUTURE CONNECTION OF THE TEN-T CORE NETWORK WITH THE COMPREHENSIVE NETWORK IN THE NSR COULD BE SHAPED AND DEVELOPED.

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Figure 1: Port of Hamburg

Port of Hamburg Marketing

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LIST OF ABBREVIATIONS

AFIR	Alternative fuels infrastructure rules
CCNR	Central Commission for the Navigation of the Rhine
CRPD	Committee on the Rights of Persons with Disabilities
CEF	Connecting Europe Facility
CNC	Core Network Corridor
BSR	Baltic Sea Region
EU	European Union
ERA	European Union Agency for Railways
ECA	European Court of Auditors
ERTMS	European Rail Traffic Management System
F/L/O Mile	First & Last Mile Operations
GDP	European Gross Domestic Product
GHG	Greenhouse gas emissions
HDV	Heavy-duty vehicle
ICT	Information and Communications Technology
IA	Impact Assessment
IPA	Instrument for Pre-Accession Assistance
IRU	International Road Transport Union
UIRR	International Union for Road-Rail Combined Transport
IWT	Inland Waterway Transport
ITS	Intelligent transportation systems
LDV	Light-duty vehicles
MoS	Motorways of the Sea
NDICI	Neighborhood, Development and International Cooperation Instrument Global Europe
NSR	North Sea Region
PRM	Persons with reduced mobility
RFC	Rail Freight Corridor
RRT	Rail-road terminals
RSS	River-Sea Shipping
SMM	Shared Mental Models

SUMPs	Sustainable Urban Mobility Plans
TEN-T	Trans-European Network-Transport
TMN-V	Trans-Mediterranean Transport Network
TFEU	Treaty on the Functioning of the European Union
TSI	Technical Specifications for Interoperability
UCC	Urban consolidation centers

1 INTRODUCTION

1.1 Background

The North Sea region (NSR) is one of the logistics zones in Europe: The largest seaports, but also many intermodal transportation nodes are in the NSR. Those intermodal nodes are outstanding for the transportation of goods to and from the supply and demand markets. To increase attractiveness of a location along with its market potential i.e., the achievable market, efficient, smart, and ecological transportation networks are needed. The intermodality should enable a concentration of transnational traffic and long-distance flows, and because of their integration, provide for a highly resource efficient infrastructure use.

Currently, the Trans-European Network-Transport (TEN-T) policy is putting a strong focus on the development of the Core Network, the major transport axes across Europe. The whole trade and business network is not only depending on its major nodes but also on its hinterland.

The Interreg VB North Sea region project CONNECTing North Sea Region's TEN-T nodes - Support intermodality growth in the North Sea Region through smart efficiency enhancements (NSR CONNECT) aims at raising the efficiency of transport flows in a holistic approach. The project will thus include both major and remoter transportation nodes to establish learning opportunities.

The overall project objective is to support smart intermodality growth in the NSR through efficiency enhancements. The detailed project objectives are:

- Implementation of new smart processes and tools (smart intermodality),
- Developing of strategies for smart efficiency enhancements (smart involvement)

The perspective of transportation is transnational. New are the instruments for implementation and involvement.

The NSR CONNECT's third work package (WP) fosters the identification of remoter areas' bottlenecks in the intermodal network. The main objective is to identify transnational barriers and bottlenecks in terms of connectivity, smart technologies, and logistics processes, which impede the implementation of the TEN-T Core and Comprehensive Network, more precisely the interface of the core and remoter nodes. The results of studies (e.g., TEN-T corridor studies) and projects (e.g., INTERREG) are considered with a focus on regional/remoter intermodal nodes, which are threatened of being detached from major hubs due to a loss of competitiveness i.e., due to lack of capacity. The paper on hand is one of three reports in the framework of this activity. It focuses on how the future connection of the TENT-T Core Network with the comprehensive network in the NSR could be shaped and developed. This paper as well as all project results will be published on the project's website.

NSR CONNECT

https://northsearegion.eu/north-sea-connect

#NorthSeaConnect

1.2 TEN-T Core Network Corridors

Over time, the TEN-T policy has evolved into a true "European project" that directs public and private investments to achieve long-term societal benefits such as state and regional accessibility and connectivity, as well as to support economic development and internal market exchanges. TEN-T offers the foundation for efficient, safe, and sustainable transportation operations within the European Union's transport policy. As a result, it is inextricably linked to a wide range of EU measures on sectoral transport policies, and it is a critical enabler of long-term strategic transport policy priorities.[1]

The TEN-T Guidelines determine which projects are eligible for EU funding, such as the Connecting Europe Facility and the Cohesion Fund. Goals for TEN-T development derived from the recommendations have been incorporated into the relevant funding laws and budget allocation procedures. In this regard, EU funding has been provided for both "traditional" infrastructure projects (cross-border projects, railway or inland waterway projects, transport terminals, etc.) and infrastructure elements that ensure the quality, efficiency, safety, and sustainability of transport systems (intelligent transport systems, charging/refuelling for alternative fuels, etc.).[2]

The TEN-T network has a two-layer architecture. The core layer of the TEN-T is the comprehensive network, which contains components for all forms of transport – rail, road, inland waterway, aviation, and maritime – but also their connecting points and traffic monitoring and management technologies.[3]

The core network is a subset of the comprehensive network that represents the trans-European transport network's strategically most significant nodes and links. It's multimodal, which means it takes into account all modes of transportation and their links, as well as traffic control systems. It was built by connecting the EU's most strategic nodes (urban nodes, seaports, inland ports, airports, and rail-road terminals) and following the associated significant traffic patterns.

The core network corridors are a tool for ensuring that the core network is implemented in a coordinated manner. They are intended to improve cross-border connectivity within the Union by covering the most essential long-distance transport flows on the core network. Corridors in the core network connect at least two borders and include at least three modes of transportation.[4]

1.3 Challenges in their implementation

Since November 1, 1993, the EU has overseen infrastructure policy in the areas of transportation, energy, and telecommunications. As a result, the Union will assist in the creation and development of trans-European networks (TEN-T).

In the transportation sector, Europe's TEN-T strategy is critical in preventing impediments to free movement of goods, services, and individuals across the EU's expanding territory without borders. Its goal is to improve economic, social, and territorial integration among all Member States and regions. It is increasingly becoming a transport infrastructure concept that stretches to EU neighbours and is part

[1] Public Consultation on Regulation (EU) No 1315/2013 on Union guidelines for the development of the trans-European transport network. URL: https://cpmr-northsea.org/download/nsc-response-to-ten-t-consultation/?wpdmdl=2473&ind=1569225367174.
[2] Ibid.
[3] Ibid.
[4] Ibid.

of international collaboration. Moreover, the TEN-T program is close to the hearts of European citizens: it improves access to their own regions while also connecting them to far destinations.[5]

Major innovations in transportation and other policy domains are interacting with TEN-T policy and posing challenges to the TEN-T core network corridors' development.

- “Global transport flows are changing in volume and direction;
- Interconnection and interoperability between the modes of transport but also with energy and telecommunication networks, projects of common interest with other third countries as well as the UK's withdrawal from the EU will change the EU's "internal transport landscape"
- The transport system is undergoing a fundamental transformation – In the context of a long-term climate strategy the wider deployment of automation, digitalisation and clean vehicles is becoming a reality”.[6]

Infrastructure will become more closely associated with issues such as infrastructure utilization, efficiency, enhancing mobility concepts, and new social questions in transportation because of these advancements. They will also advocate for increased collaboration between Member States and a variety of other public and private entities. Finally, there will be more synergies between transportation and the energy, digital, and telecommunications sectors.[7]

[5] Ibid.
[6] Ibid.
[7] Ibid.

2 ADAPTION OF THE CORE NETWORK CORRIDORS

2.1 The North Sea Region in the TEN-T network

The corridors, according to the European Commission, are the most significant tool for implementing the TEN-T core network. Following the completion of the defining of the TEN-T core network, which was determined by the European Commission using a unique technique, the planning and definition of the core network corridors began. It was attempted to combine the already existing European Rail Traffic Management System (ERTMS) and rail freight lines in this way. The core network corridors, according to the European Commission's vision, should make a significant contribution to the core network's completion by 2030. A coordinator will oversee each corridor. Work plans are developed and implemented in collaboration with the relevant Member States. The coordinators are also supported by corridor forums and working groups, to which infrastructure operators, regional leaders, and civil society representatives can be invited. Decisions, on the other hand, can only be made by the member states.[8]

The North Sea-Baltic Corridor is a 3200 km long route that connects the Baltic Sea region of Helsinki to the North Sea region of Belgium/Netherlands via Poland and Germany. It is located entirely in Northern Europe. It includes the five largest ports in Europe: Rotterdam, Antwerp, Hamburg, Bremen/Bremerhaven, and Amsterdam. The volume of traffic in the western half differs significantly from that in the north-east.[9]

The corridor idea was being examined for the funding period 2014-2020 in the context of TEN-T development through so-called Core Network Corridors. They are a tool for coordinating the core network's implementation (Regulation (EU) 1315/2013: article 42.1). Those corridors represent the most essential long-distance transport flows in the core network, which comprises of the elements of the EU's infrastructure network that are most strategically important for fulfilling the TEN-T policy's objectives. The Core Network Corridors will assist Member States in coordinating and synchronizing their national approaches and effectively managing their capacity. They must cross borders and address at least three modes of transportation. In brief, the corridor idea, which includes nine separate and partially overlapping Core Network Corridors, is a critical component of the TEN-T core network completion process by 2030.[10]

The corridors' involvement in the TEN-T network, however, extends beyond infrastructure development, interoperability, and modal integration. They are prototypes of 'green corridors where multimodal transport hubs are linked to innovative traffic management systems and emissions are reduced through smart multimodal solutions, the promotion of environmentally friendly modes of transportation, and low-carbon technologies (e.g., electrification in rail transport, alternative fuels).[11]

Corridors in the TEN-T network are multi-dimensional. They have far-reaching consequences that extend beyond transportation development, that is, beyond simply developing and updating physical aspects of transportation infrastructure. Transnational corridors also have different implications on several spatial scales, ranging from local to regional to national to transnational. Some impacts are specifically related to the Core Network Corridors, while others are more broadly related to transportation and infrastructure development. Some impacts are directly related to the formulation of TEN-T policy,

[8] Bundesministerium für Digitales und Verkehr: Korridormanagement. URL: https://www.bmvi.de/SharedDocs/DE/Artikel/G/transeuropaeische-verkehrsnetze-korridormanagement.html.
[9] Ibid.
[10] Zillmer, Sabine/Lüer, Christian: Transnational Cooperation along Core Network Corridors: The Role of Corridor For a (2019), p. 109.
[11] Ibid.

while others refer to actual implementation on the ground; some are specifically related to the Core Network Corridors, while others are more broadly related to transportation and infrastructure building.[12]

In the realm of transportation, particularly the Trans-European Transport Network, transnational territorial cooperation has been strengthened. The European Security and Defence Policy (ESDP) alluded to the necessity for efficient links between metropolitan centres in general, emphasizing that all regions should have enough infrastructure access, while congestion disadvantages must be avoided. The ESDP did not call for transnational action to solve these concerns; instead, it emphasized the need for complementary policies in many policy areas to assist regional development in conjunction with infrastructural improvements. Following that, in the Territorial Agenda 2020, the corresponding transnational needs for action became more specific by focusing more strongly on creating network linkages and developing different transport modes and an integrated network for minimizing infrastructure barriers.[13]

[12] Ibid.
[13] Ibid.

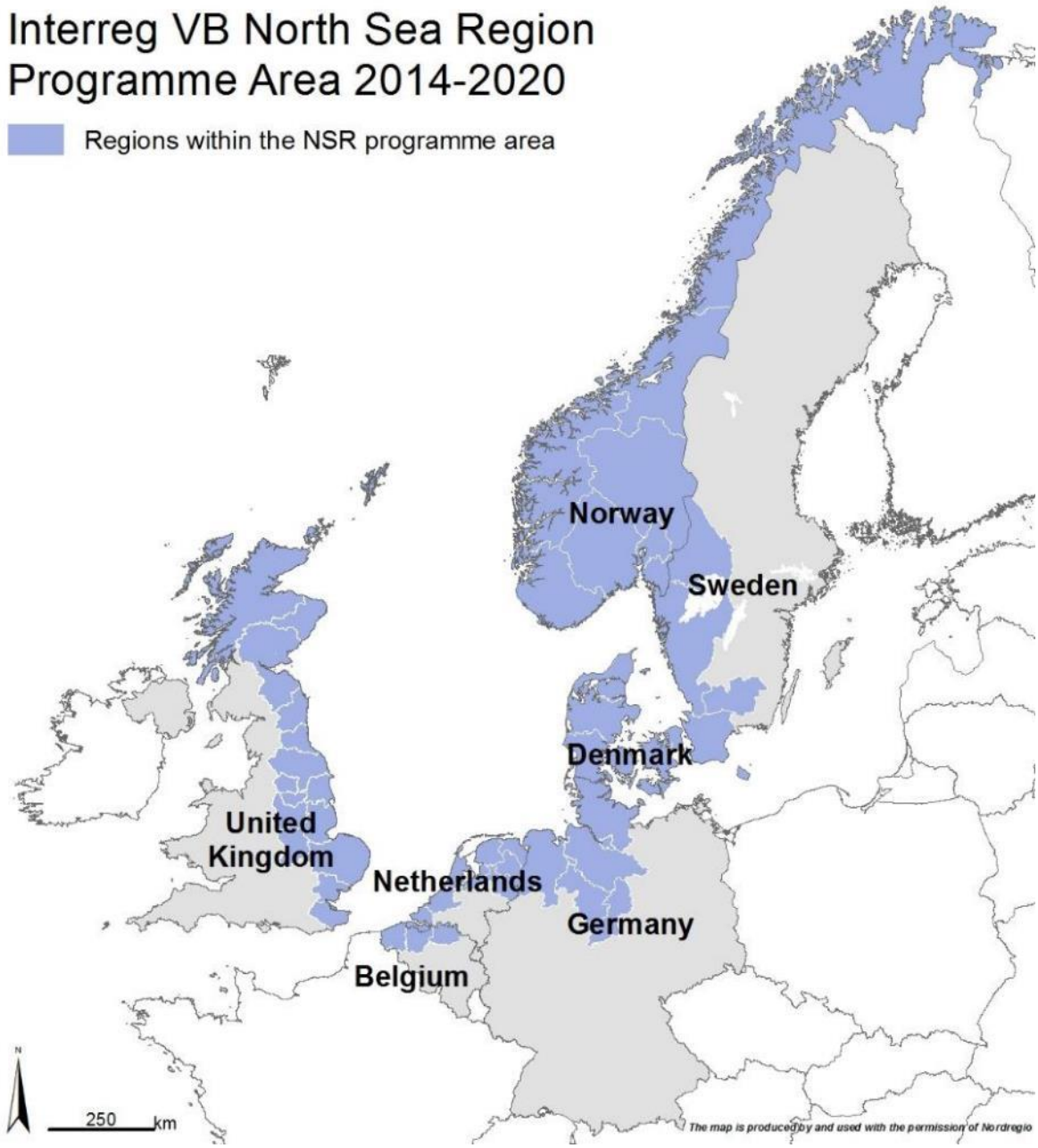

Figure 2: Interreg VB North Sea Region Programme Area[14]

2.2 Main focus of a transport infrastructure policy at EU level

The EU wants to create a modern integrated transport network that boosts the EU's international competitiveness while also addressing the issues of sustainable, intelligent, as well as inclusive growth. The first step towards such a goal is to ensure that the infrastructure is in good working order so that passengers and goods can be transported effectively, safely, and sustainably. In 2017, the physical infrastructure of the EU included over 217,000 kilometres of railways, 77,000 kilometres of highways, 42,000 kilometres of inland waterways, 329 major seaports, and 325 airports.

[14] Interreg North Sea Region: Programme area. URL: https://northsearegion.eu/about-the-programme/facts-and-figures/programme-area/.

The EU aspires to create an effective EU-wide transport infrastructure network through the Trans-European Transport Network policy.[15]

Infrastructure is a critical component of economic growth, inclusiveness, and job creation. Providing quality infrastructure that is economically, environmentally, and socially sustainable is therefore critical in the context of Sustainable Development Goal 9 (SDG 9) across all domains of energy, transportation, water, and sanitation. Using digitisation to its full potential and increasing climate-friendly investment in response to the EU's Priorities 2020-2024 – particularly the Green Deal – are critical components of this endeavour.

A country's ability to thrive and trade in the global economy is hampered by poor infrastructure. Because of its geostrategic and economic importance, connection is essential for reaching from rural to continental levels. Connecting inhabitants to healthcare, markets, jobs, and schools by building a road, a tunnel, or a bridge can dramatically enhance the lives and livelihoods of remote communities. These links will open up new possibilities for entire regions.[16]

If progress is to be done in the future, quality and quantity must coexist. Considering this, the EU bases its infrastructure cooperation on the G20's commitment to investing in and delivering high-quality infrastructure while also integrating economic, social, and environmental considerations.

These guidelines are used at all stages of the project cycle, including the provision of economic infrastructure and the necessary governance reforms to get rid of industry inefficiencies that limit the return on investments.[17]

Transport infrastructure serves as the foundation for the majority of economic and social operations and is crucial to the Green Deals' external dimension to provide a sustained level of connectedness. Under the 2019 Africa-EU Alliance for Sustainable Investments and Jobs, the EU devotes a sizeable portion of its budget for cooperation to this sector through a variety of modalities and expands on the work of the EU Transport Task Force:

“EU support for the transport sector encompasses a wide variety of aspects and is geared to:

- investments and asset management (roads, railways, urban infrastructure, ports, waterways, airports)
- transport facilitation (Connectivity, Corridor management, Platforms interface, Logistics, Legal and regulatory framework)
- mobility and transport services (road safety, urban mobility, rural mobility)
- crosscutting transport issues (air pollution, motorcycles, gender in transport, more green, resilient and inclusive investments, etc.).”[18]

[15] European Commission: Infrastructure and Investment. URL: https://transport.ec.europa.eu/transport-themes/infrastructure-and-investment_de#:~:text=In%202017%2C%20the%20EU's%20physical,EU%2Dwide%20transport%20infrastructure%20network.
[16] European Commission: Digital and infrastructure. URL: https://ec.europa.eu/international-partnerships/topics/infrastructure-and-transport_en.
[17] Ibid.
[18] Ibid.

2.2.1 Ensuring connectivity and accessibility of all regions of the Union

More than 10 million people are employed by the transport connection of European regions, which accounts for 5% of EU GDP. It is not just about building infrastructure and transportation linkages; it also connects people and businesses, promotes environmentally friendly travel, and shapes European culture.

To meet consumer and company expectations, modern transportation must be secure, effective, clever, digital, and clean. Transportation must address a range of issues in addition to sustainability and technical advancements, such as differences in economic and territorial growth models between EU regions and divergent infrastructure needs.[19]

We all care about mobility and transportation. Mobility is a necessary component of our social and economic life, enabling activities like daily commutes to work, trips to see family and friends, tourism, and the smooth operation of global supply chains for the products we buy at the store and for our industrial output. One of the core liberties of the EU and its single market is the unrestricted movement of people and products within its borders. Greater solidarity and a stronger European identity have resulted from travel within the EU. The transport sector, which ranks second in terms of household spending in Europe, provides 5% of the continent's GDP and directly employs almost 10 million people.[20]

The COVID-19 pandemic has amply shown how important it is for the EU to protect a healthy single market. The economic crisis has highlighted the crucial role that transportation plays as well as the social, health, and financial implications associated with restrictions on the free flow of people, commodities, and services. To overcome any crisis and increase the EU's strategic autonomy and resilience, supply chains must be preserved, and connectivity and transport activities must be handled in a coordinated European manner.

By creating a modern infrastructure network that makes travel quicker and safer while supporting sustainable and digital solutions, EU transportation policy supports the growth of the European economy.[21]

2.2.2 Supporting inner-European and global maritime transport through port infrastructure

Ports in Europe serve as crucial entryways into the rest of the globe by connecting its transportation lanes. Europe has some of the best port infrastructure in the world, and 74% of products entering or departing the continent are transported by sea. Ports are crucial for connecting remote and island regions with the continent of Europe as well as for facilitating the interchange of products inside the internal market. Ports serve as energy hubs for both conventional and renewable fuels, which makes them perfect for transporting goods. Every year, 400 million passengers board and exit ships in European ports. Ports are a source of employment; in Europe, 1.5 million people work in ports, and another 1.5 million are employed indirectly among the 22 maritime member states of the EU.[22]

[19] ECR Group in the European Committee of the Regions: Connecting European regions: Transport policy fit for XXI century. URL: https://www.ecrcor.eu/event/12-connecting-european-regions-transport-policy-fit-for-xxi-century.
[20] Sustainable and smart mobility: Putting European transport on track for the future, p. 2.
[21] Ibid.
[22] European Commission: Transport modes. URL: https://transport.ec.europa.eu/transport-modes/maritime/ports_en.

All of the EU's maritime areas require ports that operate efficiently. Due to poor infrastructure or services, bottlenecks in ports and their surrounding areas can increase congestion, emissions, and costs for shippers, transport companies, consumers, and society at large.

Along Europe's coastline, areas have been designated for inclusion in a unified network that will increase growth and competitiveness in the European Single Market under the new guidelines for the development of the trans-European transport network (TEN-T).[23]

On May 23, 2013, the Commission approved a plan to enhance port operations and links to other modes of transportation at the 329 major seaports that make up the trans-European transportation system.

A framework for port service delivery and standard guidelines for the financial transparency of ports are established by Regulation (EU) 2017/352 of the European Parliament and the Council of Ministers. The objective is to level the playing field in the industry, safeguard port operators from risks, and foster an environment that is more favourable to effective public and private investments.

The regulation outlines the terms and conditions that apply to the freedom to offer port services, such as the kinds of minimal standards that may be imposed for safety or environmental reasons, the situations in which the number of operators may be restricted, and the process to choose the operators in such situations. By ensuring that port users are consulted, it provides universal principles on the transparency of public funding and of charging for the use of port infrastructure and port services. It creates a new system for resolving complaints and conflicts amongst port stakeholders in each member state. Finally, all port service providers must make sure that their staff members have proper training.[24]

In the context of the competition policy, application and modernization of the State aid rules. Nowadays you can find the judgements that are pertinent to ports and that make up the decision case practice. When public investments do not include state aid, the Commission's Notice on the Concept of State, which was published in May 2016, provides guidance. On December 2, 2016, an analytical grid for ports was released to offer more clarification on the laws and case law that apply to the port industry. On May 17, 2017, the Commission also approved an amended version of the General Block Exemption Regulation. The new law allows Member States additional freedom to choose public funding for specific port developments without needing to first get the Commission's permission.[25]

The Commission has implemented ports into the corridor work plans specified by Article 46 of the regulations for the development of the Trans-European Transport Network (Regulation 1315/2013) to support better planning, financing, and funding of port infrastructure and their connections in the trans-European network. The Commission also uses Connecting Europe to provide targeted grants and other forms of financial support to port infrastructure projects. Since 2014, more than € 1 billion has already been granted to fund projects involving basic port infrastructure, innovation, and green ports, as well as rail or inland waterways that link ports with the hinterland.[26]

To maintain effective ship port calls and cargo throughput, attempts to streamline port procedures must improve digital information flows and lessen administrative load. The Commission created a European Maritime Single Window environment with technological and legal frameworks for the submission and re-use of regulatory reporting information, including the eManifest information for customs.[27]

[23] Ibid.
[24] Ibid.
[25] Ibid.
[26] Ibid.
[27] BSR Access Position Paper on multimodal and interoperable supply chains, p. 41 ff.

2.2.3 Enabling multimodal transport chains through seamless connections between modes

The transportation industry is incredibly dynamic, and as market competition rises, businesses must look for novel solutions. This is particularly true in order to assist the supply chain, raise the bar for customer service (value-added service to the customer), and improve the likelihood of distinction. Along with technology advancement and the complexity of supply chains in a worldwide society, customer requirements (such as shipper's requirements) are rising. Although sustainability has long been a priority, the announcement of the European Green Deal last year increased its importance. In the upcoming years, regulations that force the transportation industry to meet these new goals will bring opportunities as well as problems for the logistics industry.

The fact that combining modes of transportation adds another link to the supply chain and that adding a second link incurs additional costs is a crucial consideration when dealing with multimodal business models. This additional expense might be attributed to handling costs incurred during the unloading and loading of containers or pallets, which takes time, labor, and specialized handling tools. Pre- and post-carriage on roads for the first- and last miles should not be seen as a competitive aspect, but rather as a crucial connecting component that enables consumers who are not located close to a railroad line or inland waterway to connect to the rail/water network.[28]

The extremely complicated and siloed railway and waterway networks in Europe are largely to blame for the difficulties facing the multimodal sector today. Significant obstacles to developing efficient and profitable multimodal business models are posed by different standards for rail tracks and train systems. The most practical strategy for businesses to save costs and increase profits is to build economies of scale and synergies, making their supply chain as effective as they can.[29]

Waterways should be more integrated with other modes of transportation not only for regional and international flows, but also in urban areas where the majority of negative externalities are produced. To enable inland ports to serve as multimodal hubs and enablers of green logistics, green urban logistics and proactive spatial design are required in addition to sustainable urban mobility. Multimodal supply chains should be used for freight transport over short and medium distances (less than 300 km), which now mainly relies on trucks. In a perfect world, just the first and last miles would require the use of trucks powered by pure fuel. A network approach is necessary to provide infrastructure for clean onshore electricity and refueling along rivers and railroad tracks. At berths along waterways, at significant railroad hubs, in ports, and in dry port facilities, clean energy and refueling infrastructure must be present and easily accessible. The best tool for conducting coordinated planning within and between corridors using a clever combination of fixed and mobile facilities is the European corridors (including RFCs and MoS).[30]

[28] Federal Ministry of Transport and Digital Infrastructure: Rail Freight Masterplan, p. 27.
[29] Identifying the pros and cons of different business models in the multimodal transport sector has been part of the Interreg BSR project Scandria2Act. The report “"GoA Assessing Offers and Preconditions for Multimodal Freight Transport in the Scandria2Act Partner Regions"” presents different case studies, based on desktop research and in-depth semi-structured interviews with key stakeholders of different logistic companies from Hamburg, Örebro, Region Greater Copenhagen and Region Skåne.
[30] BSR Access Position Paper on multimodal and interoperable supply chains, p. 42.

Figure 3: Making the Green Deal work with inland waterways[31]

Fast mobile broadband coverage is a requirement for the future network to support a smart digital infrastructure that is planned, operated, and structured using open data. Railway transport and IWT are simple to utilize in synchro-modal operations since all cross-border transport modes are paperless and data is compatible across transport modes on a "one record, once only" basis.[32]

With the added option of integrating light rail and bus, walking and cycling, multimodality can offer a sustainable method for determining the ideal transportation mix. The implementation of Sustainable Urban Mobility Plans (SUMPs) has been highly supported by the European Commission and will be continued as effective instruments for sound policy coordination in the context of sustainable urban development. These plans work best when they incorporate the demand for both freight and passenger mobility into the larger urban and territorial development strategy.[33]

The shared European transport policy, which supports all means of transportation, should be viewed as having its foundation in the European infrastructure policy. As a result, the plan created at the European level should be built upon and strengthened by the transport and infrastructure policies of the Member States. Only then, a seamless, completely linked European transportation network can be created. The

[31] Inland Navigation Europe: Annual Report 2020-2021, p. 9.
[32] Ibid.
[33] Results of the responsible project partners will be available on the BSR Access website shortly. Urban nodes are a central element of the TEN-T Network. To better integrate urban nodes into CNCs, it is not only important to remove bottlenecks and missing links on TEN-T infrastructure. A stronger connection with SUMPs can contribute to improving first-/last mile connections for people and freight.

same is true for rail transportation, inland navigation, and river-sea commerce, all of which can reach their full potential if the necessary prerequisites are established and put in place.

2.2.4 Enhancing "first/last mile legs" from/to origin/final destination

The development and provision of effective, healthy, and ecologically sustainable transportation is a challenge for all cities. Compared to persons who live outside of metropolitan regions, city dwellers are more frequently exposed to air pollution, noise, and high traffic. Cities are a significant source of the greenhouse gases that cause climate change. These emissions are largely a result of transportation.

One method to lessen these societal burdens is to abandon inefficient and polluting means of transportation. Exploring "first mile" and "final mile" mobility choices, such as those that can be utilized to finish a trip on public transportation, can aid in bringing about this transformation by boosting the allure and effectiveness of sustainable forms of transportation. Options like "only mile" can be useful when traveling over relatively small distances.[34] Regarding those options, there are a few challenges to face in the upcoming time.

Transportation has a cost to society in the form of congestion, accidents, and environmental damage in addition to offering major advantages to its users and society at large. Society has significant challenges in several areas. Environmental effects include the appropriation of land and habitat fragmentation, as well as climate change, air pollution, noise pollution, and other problems with the living environment. These effects also have a direct or indirect impact on health problems.

These issues with urban mobility are generally exacerbated by the crowding of people and activities that is characteristic of cities. However, the same concentration of people and activity offers the possibility of reducing the negative consequences of transportation.

Cities account for between 60 and 80 percent of global energy use and at least 70 percent of carbon emissions (United Nations Development Programme, 2019). The growth of urban mobility is crucial to resolving this issue since it enables cities to consume less energy and release fewer greenhouse emissions.[35]

It is realistic to expect that some of these challenges may evolve over time as cities and the demand for mobility both continue to grow. At the same time, the environmental performance of vehicles will also improve. In this case, the transportation system will need to modify.

Confront transport users with the costs created by their mobility choices

Congestion, excessive air pollution and greenhouse gas emissions, excessive noise levels, habitat fragmentation, and issues with the quality of the environment in particular locations are all difficulties that our urban mobility system is currently dealing with. The best method to address these issues is to make transport users aware of the societal costs they contribute to that are not yet reflected in their own costs. For any form of transportation, this entails internalizing its external expenses. Users can better understand the societal cost of their mobility behaviour by internalizing external costs. They are thus in a better position to weigh their options for mobility. There are estimates for the external costs of

[34] European Environment Agency: The first and last mile — the key to sustainable urban transport, in: Transport and environment report 2019, p. 6.
[35] Ibid. p. 10.

pollutants, mishaps, traffic, noise, and habitat fragmentation.[36] Quantified estimates for other external costs, such the effects on the standard of living, are much more challenging to find. Reducing the number of street-parking spots, raising parking fees, implementing road tolls, or more broadly "getting the price right" can all serve to lessen the societal burden of the transportation system and internalize some of the external expenses. These are the first actions in the direction of a sustainable transportation system.

Provide sufficient and comfortable alternatives

If the use of non-sustainable modes of transportation needs to be decreased, providing adequate and comfortable alternatives is another aspect of sustainable urban mobility. Therefore, it is critical that viable alternatives exist. Such enticing sustainable alternatives can be provided by public transportation with good First & Last Mile Operations (F/L/O mile) possibilities. However, it's crucial to understand that merely offering options won't always result in a more sustainable transportation system. The overall expenses of unsustainable (typically the car) and sustainable (often public transportation) means of transportation are frequently comparable. The possibility of a modal shift occurring is high when the sustainable mode (typically public transportation) is made more alluring under certain conditions, for example by offering F/L/O mile options. A change toward a more sustainable mobility system will also be aided by raising the average cost of the unsustainable alternatives.[37]

The monetised journey time costs and the money charges make up the generalized cost. Most of the time, it's not the expense of public transportation that prevents it from being as affordable as driving a car. The time expenses are frequently more crucial. The perceived time costs of unpleasant travel experiences including transfers, delays, and having to move quickly to make a transfer are higher. When calculating the generalized cost, these are penalized more.

F/L/O mile options can be quite helpful in minimizing the worst part of the travel. The goal of "good" F/L/O mile alternatives is to make the entire transportation process as smooth, quick, and comfortable as feasible.

This entails preventing delays, waiting times, and transfers to the greatest extent possible; if they are unavoidable, making them as comfortable as possible; and offering real-time, integrated, and accurate travel information.[38]

Promote active modes as first/last/only mile options

As stated above, F/L/O mile options make public transport more attractive and contribute to a modal shift. From a societal point of view, active modes are very attractive F/L/O mile options:

- “Active modes provide considerable health benefits for their users, thanks to the physical activity that they provide. Active modes are the only modes with (nearly) no external costs and with substantial external benefits. Each kilometre walked or cycled provides benefits to society. As a consequence, the promotion of active modes is a no regret option.
- Cycling can also be successfully introduced into cities that do not already have a cycling culture. Political will is however necessary. The city of Seville succeeded in increasing the modal share of cycling from 1 to 9 % in 5 years. The key to this success was a massive investment in cycling infrastructure and a reduction in road space for cars. Other factors such as the relative price

[36] DG MOVE, 2019, Handbook on the external costs of transport, Publications Office of the European Union, Luxembourg.
[37] European Environment Agency: The first and last mile — the key to sustainable urban transport, in: Transport and environment report 2019, p. 67.
[38] Ibid. p. 67.

increase of car use due to the 2008 financial crisis could also have played a role (Marqués, et al., 2014). This case illustrates that measures that make cities and streets more attractive places also enable F/L/O mile options."[39]

Align technology with sustainable mobility goals

Technology has made a variety of new mobility options possible. Different sharing systems, including free-floating systems, station-based systems, and the sharing of automobiles, bicycles, electric kick scooters, etc., are made possible by technology. Additionally, it makes it possible to develop apps and platforms that offer ride-hailing services or that may more effectively combine several mobility services into one more practical service. This opens up numerous possibilities for a more sustainable transportation system.

A positive mobility impact is, however, not guaranteed, as was illustrated in the Transport and environment report from 2019. The key findings were:

- "The effectiveness of new shared modes in making the mobility system more sustainable is variable. Based on current studies, the best performing sharing systems from a sustainability point of view are station-based systems. Station-based car sharing reduces vehicle-km by 18 to 80 % for current users (who, however, do not necessarily have the same profile as the general public). Bicycle sharing systems realise a shift away from car use for between 5 and 20 % of the rides. Most users of bicycle sharing systems use the shared bicycle instead of public transport. This may, however, relieve some capacity for public transport.
- Ride hailing services appear to have a negative impact on the urban mobility system. Several studies indicate that a majority of ride hailing trips replace a public transport trip. These studies also indicate that vehicle-km increase by 50 % in certain parts of the city, which contributes to congestion. In San Francisco for example, 25 % of congestion can be attributed to ride hailing.
- A good public transport network that offers trustworthy services with limited delays, a minimum number of transfers, comfortable transfers, and easy and integrated payment possibilities needs to be the priority. In addition, mobility-as-a-service can increase the positive user experience. It cannot, however, compensate for bad physical transport services or unpleasant transfers.
- Shared autonomous vehicles can improve the urban mobility system as long as there is a regulatory framework that seeks to maximise their environmental benefits. In the absence of an appropriate regulatory framework, simulations indicate that congestion could get worse, as these vehicles might replace public transport. Therefore, public policy should make sure that:
    - space that is freed up thanks to a reduced need for vehicles is proactively managed in order to lock in benefits;
    - the public transport system remains the backbone of the urban transport system."[40]

[39] Ibid. p. 67 f.
[40] Ibid. p. 68.

Freight transport: create conditions to make last mile logistics profitable

From an environmental and transportation standpoint, last mile logistics and the urban consolidation centers (UCCs) required to support last mile logistics are an intriguing possibility. By lowering the number of miles driven for urban logistics and, in some situations, by utilizing environmentally friendly vehicles, they lessen their influence on the environment.

The number of UCCs in Europe is, however, low. The fundamental issue is that these efforts' economic feasibility is frequently uncertain and difficult to predict. The UCCs that are in use today are examples that back up the generalization. This difficult economic outcome is mostly because a consolidation center requires an additional movement of commodities (from vehicle to consolidation centre and from there to another vehicle). It takes time and money to do this.

This sets it apart from F/L/O mile choices in passenger transportation fundamentally. F/L/O mile options for passenger transportation by definition enhance public transportation services, however for freight transportation they necessitate an additional transfer and lengthen the initial trip. In other words, F/L/O mile alternatives reduce the overall cost of transportation while typically raising the overall cost of logistics.[41]

Policies and circumstances that favour economic sustainability of first/last/only mile options in freight transport

Despite the F/L/O alternatives and UCCs' positive social effects, it is challenging to build long-term business cases because of economic reasoning. Finding methods to pay the additional expense for the trans-shipment at the UCC or micro-hub is always a challenge. However, some factors or practices do support UCCs' long-term economic viability.

- “A high concentration of delivery points in combination with many small deliveries made by different carriers. A profitable consolidation centre can emerge, especially if a further increase in deliveries is anticipated. The case study on Gothenburg's shopping centre illustrates this.
- A strong engagement of all the stakeholders and close cooperation between senders, receivers, carriers, logistics providers, etc., increases the likelihood of finding solutions to the challenges.
- Providing added value for the clients and making clients pay for it can make a UCC viable. This added value can consist, for example, of improved return logistics, inventory control, changes in delivery frequencies to meet receiver's needs or an attractive fee charged to the senders for transporting the last mile. One of the only larger successful examples of a UCC in Europe, 'Binnenstadservice', succeeded in providing and selling added value to its clients.
- Authorities can change the socio-economic framework so that it takes better account of societal costs and value creation. If external costs can be internalised, F/L/O mile freight options will become relatively cheap compared with classic delivery.

[41] Ibid.

- It is difficult to internalise external costs completely and some of the most effective measures for doing so, such as taxation, are not usually controlled by cities. However, other measures can have a similar effect as long as they give a competitive advantage to environmentally friendly delivery vehicles and methods. These can take different forms, such as congestion charges, road user charges, time-based access restrictions and access rules. Alternatively, the provision of a subsidy may encourage the use of a UCC based on the reduction in external costs."[42]

The fact that combining modes of transportation adds another link to the supply chain and that adding a second link incurs additional costs is a crucial consideration when dealing with multimodal business models. This additional expense might be attributed to handling costs incurred during the unloading and loading of containers or pallets, which takes time, labor, and specialized handling tools. Pre- and post-carriage on roads for the first and last miles should not be seen as a competitive aspect, but rather as a crucial connecting component that enables consumers who are not located close to a railroad line or inland waterway to connect to the rail/water network.[43]

2.2.5 Connecting the TEN-T with neighbouring countries and where appropriate ensure interconnection and interoperability with other third countries.

The European Commission evaluated the current TEN-T Regulation, and the Commission Impact Assessment (IA) provides a clear summary of its key findings and connections to it. The TEN-T guidelines should be reviewed to solve the flaws that were found during the evaluation and the requirement to address new political priorities and targets, including the European Green Deal, the sustainable and smart transportation strategy, and the zero-pollution action plan. A number of audits and evaluations of TEN-T and policies relating to transportation infrastructure have been conducted by the European Court of Auditors (ECA), including sets of recommendations that are mostly addressed in the IA.[44]

The IA points out several issues with the TEN-T, including capacity bottlenecks for all modes of transportation, inadequate network connectivity that impedes efforts to improve multimodality, and persistently weak connectivity in some regions (particularly the remote regions). The IA provides a few examples of current bottlenecks, including significant bottlenecks in and/or around cities (road transportation), capacity bottlenecks primarily brought on by port calls (transport in maritime ports), and the inability of some TEN-T sections to handle the volume of traffic that users and operators anticipate (rail and inland waterways).[45]

On the other hand, joint network planning initiatives with neighbouring nations that result in suggestive TEN-T extensions are appropriate for creating a secure foundation for focused transportation infrastructure investment funded by EU sources and international financial organizations. Once more, current international developments (such the advancement of the accession discussions and the signing of the Transport Community Treaty for the Western Balkans region) indicate that this strategy is still applicable for the 2030–2050 perspectives and might be enlarged.[46]

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[42] Ibid. p. 69.
[43] BSR Access Position Paper on multimodal and interoperable supply chains, p. 41 ff.
[44] European Parliament: Revision of the Trans-European Transport Network (TEN-T) Regulation, p. 1.
[45] Ibid. p. 2.
[46] European Commission: Evaluation of the Regulation (EU) N° 1315/2013 on Union Guidelines for the development of a trans European transport network, p. 89.

The quantitative analysis for the transport sector in the EU, candidate, and neighboring countries, covering activity, equipment, energy, and emissions, may therefore be provided using the PRIMES-TREMOVE transport model. Since each country is considered separately by the model, both individual country-specific and aggregate long-term outlooks are available (e.g., EU level).[47]

The extension of the TEN-T policy outside of Union borders outlines two overarching goals: To ensure the consistency and efficacy of an interoperable and multimodal network between Member States and their close partners and neighbours; and to concentrate Union involvement, including financial support, in these regions. Furthermore, the expansion of the TEN-T serves as a tool for more closely integrating and, correspondingly, preparing candidate nations and potential candidates for potential EU accession from the larger viewpoint of the European Neighbourhood Policy and the EU Enlargement Policy. Finally, the TEN-T integration of neighbouring and enlarging countries' transport networks speeds up the Union's convergence with them by facilitating trade and, in turn, economic integration.[48]

The Union's ambition of creating an interoperable and multimodal transport network has made the expansion of the TEN-T policy to neighbouring nations crucial. The TEN-T strategy has been a crucial tool for integrating the new member states, improving transportation connectivity, and facilitating trade while promoting the Union's convergence. This communication, which is accompanied by a proposal for a revised TEN-T Regulation, intends to strengthen the Union's contacts with the outside world while considering the objectives of the European Green Deal and the Commission's strategy for sustainable and intelligent mobility.[49]

There is an urgent need to speed up the development of the suggested TEN-T for the Western Balkans and the Eastern Partnership to significantly enhance transport connectivity with the Union. In these locations, it is necessary to increase project implementation coherence, sustain sound project pipeline development at a faster rate, articulate clearly defined prioritizations of the most crucial projects, and give precedence to projects situated on the indicative core network.[50]

In addition, there is a pressing need to maintain current assets and bring outdated infrastructure up to code. The projected TEN-future T's development should focus on creating a high-quality standard network. In addition, it ought to support the creation of a resilient infrastructure that can survive the effects of climate change. In view of this, the Commission will undertake to:

- “Achieve a compliant indicative core network, which is multimodal, sustainable, and resilient.
- Speed up the construction of new transport infrastructure, bridging missing links and removing bottlenecks, in particular, across borders, and upgrade existing infrastructure to reach compliance with the TEN-T requirements and ensure alignment with the European Green Deal.
- Support the promotion and deployment of digital technology to enable the interoperability of networks, in particular, ERTMS, ITS and multimodal freight information systems and 5G infrastructure. The deployment of digital technology should ensure high performance across the network and reach higher levels of automation.

[47] Ibid. p. 150.
[48] European Commission: Communication from the Commission to the European Parliament and the Council on the extension of the trans-European transport network (TEN-T) to neighbouring third countries, p. 3.
[49] Ibid. p. 10.
[50] Ibid. p.11.

- Encourage partners to take in due consideration, and implement, optimal maintenance and operation of existing and new assets.
- Give priority to TEN-T projects of strategic interest to the Western Balkans and the Eastern Partnership regions and to the Union, to better link enlargement and other neighbouring countries with the Union.
- Assess the need to review the existing indicative TEN-T network in the enlargement and other neighbouring countries and, where necessary, initiate the process to update it."[51]

2.3 Need for improvement/development in transport infrastructure policy

The TEN-T planning process has also been updated and improved by the Commission, who has also described how it will approach extensions to neighbouring third countries. This initiative, which was included in the Commission work program for 2021 as one of the new initiatives, is based on Articles 170-172 of the Treaty on the Functioning of the European Union (TFEU) (Annex I). In three phases, the proposed regulation creates updated guidelines for the TEN-T development:

1. "a core network to be completed by 2030 at existing TEN-T standards;
2. an extended core network to be completed by 2040 according to new standards; and
3. a comprehensive network to be completed by 2050."[52]

European transportation corridors are now a new instrument for planning. The most significant long-distance transport flows are covered, at least two borders are crossed, and at least three transport modes are utilized. They incorporate the core network corridors, and the rail freight routes. The core network and the expanded core network are among them (priority sections of the comprehensive network).

[51] Ibid.
[52] European Parliament: Revision of the trans-European transport network guidelines, p. 5.

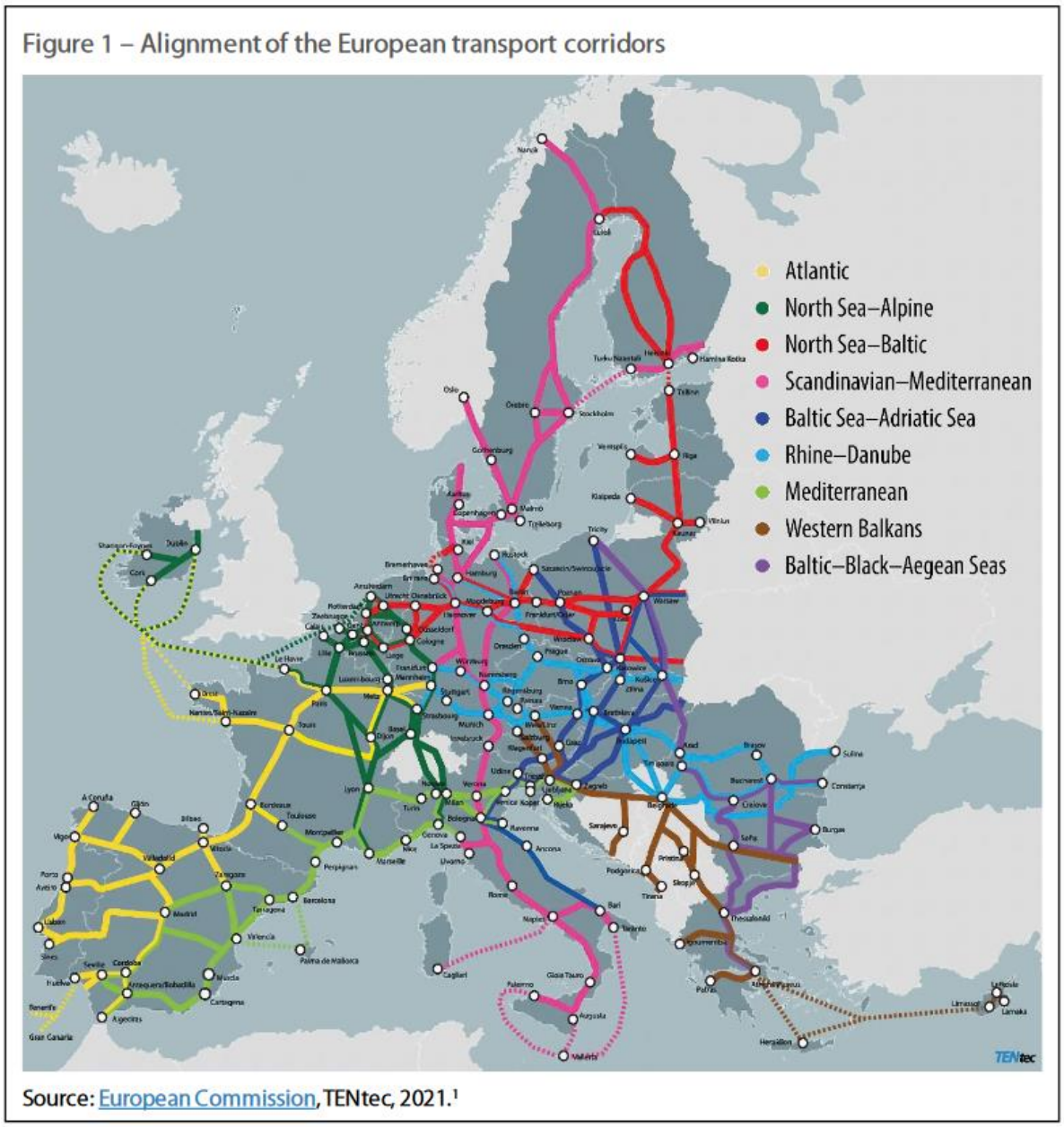

Figure 4: Alignment of the European transport corridors[53]

The two horizontal priorities that now exist - ERTMS and Motorways of the Sea - remain in place, but the maritime component is to be expanded and renamed "European maritime space." To maintain investment stability and meet the 2030 completion target, changes to the core network are kept to a minimum. Which parts and cities are to be added to or removed from the network is detailed in an overview by nation.[54]

The proposal identifies projects of shared interest and details the requirements for creating and implementing the TEN-T infrastructure for each mode of transportation. These consist of additional priorities, the description of infrastructure components, and infrastructure requirements for the extensive, core, and core network. Additional specifications are laid forth for urban nodes and

[53] Ibid.
[54] Ibid. p. 6.

multimodal freight hubs. The extended core network, which is a component of the European transportation corridors, must be finished by 2040, as well as new core network standards. The coordination between infrastructure planning and the provision of transportation services is strengthened by new operational requirements.[55]

The introduction of the P400 loading gauge, which permits the movement of semi-trailers on railroad wagons, higher train speeds across the core and extended core networks (160 km/h for passenger trains, 100 km/h for freight), and a maximum dwell time at border crossings of 15 minutes for freight trains, are all new requirements for rail. The ERTMS must be installed throughout the TEN-T by 2040 (core network by 2030), while previous systems (class B) must be retired.

The highest standards for environmental preservation and safety will need to be used in the design, construction, or renovation of TEN-T roads. The deployment of infrastructure for alternative fuel refueling and charging must occur every 60 kilometers in both directions. TEN-T roads will need to have weigh-in-motion systems, safe and secure parking spaces for commercial vehicles, and rest places. The adoption of cutting-edge technology like 5G communication infrastructure and intelligent, automated enforcement tools are additional goals for the road.[56]

Inland shipping improvements for the waterborne sector have included minimizing lock wait times and guaranteeing adequate navigation status on inland waterways of the core network. The recently established European maritime space includes short-sea shipping routes to or from neighbouring ports in enclosed seas or maritime ports on EU territory. Inland waterway vessel handling capacity will need to be provided at TEN-T marine terminals that are connected to them. Requirements for connectivity and commitments to provide alternative fuels have been amended for inland and maritime ports as well as airports.

The 424 cities designated as TEN-T urban nodes will be required to develop sustainable urban mobility plans by 2025, even though local governments still retain the primary responsibility for urban mobility. Measures to integrate various modes of transportation, lessen air and noise pollution, support clean transportation and logistics, and handle long-distance TEN-T transport flows must all be included in SUMPs. Additionally, these communities will be required to gather and report to the Commission information on urban mobility. Additionally, they will need to build nearby multimodal freight terminals with adequate transhipment capacity, as well as multimodal passenger hubs to promote first and last mile linkages.[57]

[55] Ibid.
[56] Ibid.
[57] Ibid.

2.3.1 Ensuring interoperability throughout the TEN-T

The TEN-T program consists of hundreds of projects – defined as studies or works – whose ultimate purpose is to ensure the cohesion, interconnection and interoperability of the trans-European transport network, as well as access to it. TEN-T projects, which are in every EU Member State, include all modes of transport:

- road
- rail
- maritime
- inland waterways
- air
- logistics
- co-modality
- innovation

In the following section, however, the focus is only on the main modes of transport: road, rail, and water.

The perfect chance to make sure that the TEN-T infrastructure functions properly for **rail freight** is presented by the ongoing revision of the TEN-T Regulation to update the technical specifications for the Trans-European Transportation Infrastructure Network. This is especially important because the European Green Deal calls for a doubling of the market share for rail freight. Door-to-door Long-distance trucking can be replaced with Combined Transport, which relies heavily on rail freight and has a carbon footprint that is 60–90% smaller than that of road haulage. Combined Transport's pro rata energy efficiency is 40–70% better than long-distance trucking.[58]

The TEN-T Regulation revision processes have come under fire from transportation organizations like ERFA and UIRR, particularly for problems like the inadequate track capacity allocation for freight trains, the lack of alternate routes provision during construction periods, or the lack of boosting initiatives for long-distance rail freight traffic. However, UIIRR claims that this time the EU appears to be headed in the correct direction. The association stated, "We strongly support the European Commission's proposed TEN-T Regulation amendment", highlighting the importance of three pillars for intermodal transportation.[59]

In terms of the TEN-T Regulation modification proposed by the European Commission, it has the full support of UIRR, in particular:

- "The obligatory rail infrastructure parameters for train length (740m), axle load (22,5t), P400 loading gauge, electrification and interoperability of signaling systems (ERTMS) along the entire core and comprehensive network.
- The creation of adequate railway infrastructure capacity (i) to ensure a definite number of train paths for 740-metre-long trains per hour on every TEN-T line, (ii) to elevate the punctuality of

[58] UIRR: Position Paper: TEN-T Infrastructure for Combined Transport, 2022, p. 1.
[59] ReilFreight.com: TEN-T revision is on the right track for intermodal transport. URL: https://www.railfreight.com/railfreight/2022/04/14/ten-t-revision-is-on-the-right-track-for-intermodal-transport/?gdpr=accept&gdpr=accept.

freight trains to 90%, as well as (iii) to enable the crossing of an internal railway border of the European Union within 15 minutes.

- The mandatory modernisation of existing intermodal transhipment terminals, the obligation to study the available capacity of intermodal terminals and the construction of intermodal terminals where capacity is found to be lacking."[60]

Furthermore, in 2019, intermodal trains represented 50% of the EU's rail freight traffic. This necessitates specific consideration for this method of transportation, which combines truck for pre- and post-carriage terminal excursions with rail for most of the voyage. The emphasis was on a dedicated network where significant expenditures are made in capacity, modernization, and signaling rather than dispersing funds throughout the European Union. Through nine corridors across Europe, the Trans-European Network for Transport (TEN-T) has been formally established. The TEN-T Regulation is the legal framework through which the EU Member States agree on the railroad network's technical specifications and accept EU funding.[61]

The well-known P400 loading gauge is one of the crucial technical specifications that intermodal operators seek. According to this nomenclature, a semi-trailer can only be transported by rail up to a height of 4 meters. The suspension must be airless to comply with the height restriction, which is measured from the bottom of the wagon to the top of the semi-trailer.[62]

The truck height limit of 4 meters was instituted at the request of the road industry to fully utilize the official European road and motorway dimensions. For instance, Ewals Cargo Care created the Megatrailer trailer type in the 1990s after consulting and working with the European car sector. The goal was to create a trailer with a cargo capacity of 100 cubic meters. When compared to the then-standard trailers, that represents an increase of about 25%. These semi-trailers have a free height of 2.70 meters and can transport 33 euro pallets.

Even though this height might match some demand, not all transporters will experience this, as the image below illustrates. Due to the weight of the bags and the durability of the packing, many pallets rarely utilize the entire height that is provided. Trucks that carry between 10% and 30% spare room are therefore typical, and occasionally even substantially more! One can question the need for all trucks to be 4 meters tall. Unfortunately, these measurements have turned into marketing and sales gimmicks: the more cubic meters, the more environmentally friendly the conveyance. As is frequently the case, if the railways wish to gain market share in intermodal transportation, they will have to adapt, which is a very heavy adaptation.[63]

However, due to this Megatrailer's gauge in some nations, significant track upgrades are needed for passes under bridges and in tunnels. This is why a connection that is a part of the TEN-T network is crucial since Europe can assist. Some nations, such as Great Britain, cannot employ the P400 loading gauge because to their historically more constrained rail networks. This nation, which likewise favors short-sea shipping, prefers to use swap bodies, a container-like unit modified to fit the larger proportions of road transportation. The P400 gauge requires various, occasionally expensive modifications. This is where incorporating a national railway line in the TEN-T corridor makes sense because it allows Europe to interfere using specific methods. Apart from the fact that decisions must be made, there are numerous

[60] Ibid.
[61] UIRR: Intermodal: the increasing importance of P400. URL: https://www.uirr.com/news/mediacentre/1846-intermodal-the-increasing-importance-of-p400.html.
[62] Ibid.
[63] Ibid.

lines connecting, for instance, industrial or port sectors that are not part of the TEN-T and do not receive funding from the European Union. As a result, groups like the International Union for Road-Rail Combined Transport (UIRR) and Railnet Europe (RNE) are requesting that the P400 gauge be taken into consideration throughout a country, not simply on its main lines.[64]

Furthermore, the European Union Agency for Railways (ERA) is preparing, based on a mandate from the European Commission (January 24, 2020), the recommendations for the TSI[65] package 2022 to ensure interoperability.[66]

Beside the rail freight transport, the Trans European Transport Network (TEN-T proposal) rules amendment by the European Union (EU) will have a substantial impact on the **road transport** industry as well. To successfully conduct everyday business operations and connect with other modes of transportation, commercial products and passenger transportation require a strong and reliable road infrastructure network. The vital role that road transportation plays in promoting economic success should be acknowledged in the TEN-T principles. The International Road Transport Union (IRU) specifically calls for the following:

"Road transport infrastructure

- Respect the deadline for the completion of the core network without delay and complete the extended core and comprehensive networks by 31 December 2035.
- Plan and build new road links on the TEN-T Network that includes connections to multimodal transport hubs.
- Establish a European road transport mobility space as foreseen for other transport modes.

Alternative fuels infrastructure targets

- Ensure full compatibility between the TEN-T guidelines and the alternative fuels infrastructure rules (AFIR). The ambition for more electric recharging stations and hydrogen refueling stations along the TEN-T corridors and in urban nodes should be consistent.
- Ensure the presence of electric recharging stations in multimodal goods and passenger terminals and hubs dedicated to heavy-duty vehicles (HDVs) by 31 December 2025.

Allow vehicles transporting abnormal loads and high-capacity vehicles on the TEN-T network

- Allow vehicles transporting abnormal loads to make use of the road infrastructure network dedicated to dual civil-military use. A mapping exercise should be carried out to identify the most suitable locations and corridors for such vehicles.
- Allow high-capacity vehicles, including Eco-trucks, to operate on the core, extended core and comprehensive networks.

[64] Ibid.
[65] About **TSIs**: A technical specification for interoperability (TSI) is a common (harmonized) technical standard standard that describes those elements of the essential requirements that must be harmonized in order to achieve interoperability must be harmonized. Essential Requirements: Safety, reliability and availability, health, environmental protection, technical compatibility, accessibility.
[66] European Union Agency for Railways: Neue Ziele und rechtliche sowie technische Vorgaben der EU für den Bahnsektor. URL: https://www.eba.bund.de/SharedDocs/Downloads/DE/Vortraege/FET_2022/2022-03-15_02-01_Neue_Ziele_und_rechtliche_sowie_technische_Vorgaben_der_EU_fuer_den_Bahnsektor.pdf?__blob=publicationFile&v=2.

Urban nodes

- Ensure the presence of goods terminals and multimodal passenger hubs in urban nodes by 31 December 2025.
- Sharing business-generated data through multimodal digital mobility services should always be voluntary and the data collected used for a specific purpose only."[67]

A strong and trustworthy infrastructure network across the EU is necessary for a competitive commercial road transportation sector. According to Eurostat, 76.3% of all inland commodities were transported by road in 2019, with 17.6% and 6.1% of those transported by rail and inland waterways, respectively. 1 Similar data from Eurostat in 2019 reveals that after private passenger automobiles, collective passenger transport by road is the second most popular mode of transportation in the EU. 2 Without favoring any particular modes, the new TEN-T proposal ought to have encouraged improved synchronization, coordination, and compatibility between the initiatives taken by different Member States to connect and improve multimodal hubs and terminals. To provide a uniform availability of alternative fuels infrastructure across the TEN-T Network for both goods and passenger transport, the plan should have also been in line with the conditions outlined in the European Commission's AFIR proposal. Maintaining consistency between the TEN-T standards and the AFIR plan is crucial for the implementation of the European Green Deal.[68]

The EU's data governance measures should not be ignored by the TEN-T proposal, and efforts should be made to align them. The digitalization of transportation operations must also be encouraged as digital freight transport documentation (as defined by Regulation (EU) 2020/1056 on electronic freight transport information) must be accepted throughout the EU;

In particular, the following demands are made by various institutions:

- "Respect the deadline for the completion of the core network without delay and complete the extended core and comprehensive networks by 31 December 2035
- Plan and build new road links on the TEN-T network that includes connections to multimodal transport hubs.
- Establish a European road transport mobility space as foreseen for other transport modes."[69]

Even throughout the transition period, a wide variety of alternative fuel infrastructure needs to be made available on the core, extended core, and comprehensive networks for various commercial road transport activities. The TEN-T and AFIR recommendations should consider the market's reality, which is that the commercial road transportation sector will experience additional difficulties in converting to the usage of alternative fuel cars due to the lack of alternative fuel infrastructure. For instance, this can lead to plans where only a few transit companies offer services in urban regions. As a result, this will deter investments in the expansion of alternative fuel vehicle use. Therefore, adequate infrastructure for alternative fuels and a level playing field in the market are crucial.[70]

[67] IRU: The European Commission proposal to revise Union guidelines for the development of the Trans-European Transport Network, p. 1 f., URL: https://www.iru.org/system/files/The%20European%20Commission%20proposal%20to%20revise%20Union%20guidelines%20for%20the%20development%20of%20the%20Trans-European%20Transport%20Network.pdf.
[68] Ibid. p. 2.
[69] Ibid. p. 2 f.
[70] Ibid. p.3.

IRU further emphasizes the need for the AFIR regulations to incorporate targets for alternative fuel infrastructure pertaining to light-duty vehicles (LDVs) on urban nodes. LDVs are widely employed in the transportation of both goods and people, including taxi services and chauffeur-driven hire cars. Their contribution to local and regional transportation is crucial. It is vital to coherently extend this requirement to LDVs to achieve conformity between the TEN-T guidelines and the AFIR rules because both proposals include alternative fuels infrastructure targets for HDVs on urban nodes.

Also here, various demands are made on the policy:

- "Ensure full compatibility between the TEN-T guidelines and the AFIR rules. The ambition on electric recharging stations and hydrogen refueling stations along the TEN-T corridors and in urban nodes should be consistent.
- Ensure the presence of electric recharging stations in multimodal goods and passenger terminals and hubs dedicated to HDVs by 31 December 2025."[71]

When it comes to allowing vehicles transporting abnormal loads and high-capacity vehicles on the TEN-T network, the TEN-T concept considers the option of adding further highways to the TENT Network to improve synergies between civilian and military transport use. This could be a chance for the EU to establish a cross-border road network that high-capacity vehicles, such as vehicle combinations used for the transportation of unusual loads, such as Eco-trucks, could employ. Increased coordination between current Union programs, particularly the TENT Network and military requirements, is mentioned in a recent joint report by the European Parliament and the Council on the implementation of the Action Plan on Military Mobility. The TEN-T proposal does not, however, outline how it intends to incorporate more highways to improve the synergies between civilian and military transport networks. The geographic location of the extra roadways is also not mentioned.[72]

The requirements for EU policy are as follows:

- "Allow vehicles transporting abnormal loads to make use of road infrastructure network dedicated to dual civil-military use. A mapping exercise should be carried out to identify the corridors for use of such vehicles.
- Allow high-capacity vehicles, including Eco-trucks, to operate on the core, extended core and comprehensive networks."[73]

Adopting sustainable urban mobility plans should consider actions like expanding the use of Information and Communications Technology (ICT) tools and Intelligent transportation systems (ITS) to enable commercial vehicles to have optimized routes, have priority at traffic lights, and have real-time information about the availability of alternative fuel infrastructure. Risks associated with a dispersed implementation of SUMPs still exist because urban nodes will each have their own strategy. To support multimodality without favoring one mode of transportation over another, urban nodes should enable a sustainable, smooth, and safe link between road, rail, and air transport. Since it frequently completes the first and last miles of a journey for both products and passengers, the role of road transportation should be strengthened.

Given that various forms of transportation continue to function in isolation, urban nodes will need to carefully consider how to synchronize multimodal mobility services. Transport operators are reluctant to

[71] Ibid.
[72] Ibid. p. 4.
[73] Ibid.

disclose the data they generate because of a lack of openness and the absence of a legally mandated framework recognizing the rights of business data generators. Additionally, the rights of the data generators should be openly acknowledged, and the obligations and liabilities of parties (such as transport operators, intermediaries, and public organizations, for example) involved in the exchange of business data should be clearly stated. Transport companies should only voluntarily exchange data, and any information gathered by government agencies or other third parties should only be used for that reason.[74]

IRU makes the following demands on EU policy in this regard:

- "Ensure the presence of goods terminals and multimodal passenger hubs in urban nodes by 31 December 2025.
- Sharing business-generated data through multimodal digital mobility services should always be voluntary and the data collected used for a specific purpose only."[75]

When it comes to Inland Waterway Transport, the European Commission is now proposing an "Inland Waterway Transport Action Plan 2021–2027," in accordance with the new multiannual financial framework, focusing on two main goals: shifting more freight transportation to inland waterways and putting the sector on an irreversible path to zero emissions. This is done to address the challenges faced by the inland waterway transport sector and deliver on the goals of the European Green Deal and the Sustainable and Smart Mobility Strategy.

As shown below and in more detail in the Annex - Action Plan, achieving these key goals will need an integrated strategy and a package of policies that incorporate transportation, environmental, digital, energy, and fiscal policies. There are eight flagships known so far:

"Flagship 1: Helping waterway managers to ensure a high level of service (Good Navigation Status) along EU inland waterway corridors by 31 December 2030.

Flagship 2: Updating the EU's legal framework for intermodal transport to stimulate Inland Waterway Transport (IWT)

Flagship 3: Speeding up certification procedures for innovative and low-emission vessels

Flagship 4: Guaranteeing IWT investments take into account climate and environmental objectives

Flagship 5: Developing inland ports as multimodal alternative fuels infrastructure hubs

Flagship 6: A roadmap for digitalisation and automation of IWT

Flagship 7: Smart and flexible EU crewing rules

Flagship 8: Supporting the sector and Member States in the transition to zero-emission vessels"[76]

The European Union, the Central Commission for the Navigation of the Rhine (CCNR), the Danube Commission, and the United Nations Economic Commission for Europe are the primary regulating bodies pertinent to the EU's inland waterway transportation industry. Free passage on each of their particular basins, including with nations outside the EU, has been made possible for more than a century

[74] Ibid. p. 5.
[75] Ibid.
[76] European Commission: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, NAIADES III: Boosting future-proof European inland waterway transport, p. 3-12.

by international river commissions like the CCNR or the Danube Commission. Because of the complexity of this governance structure, its simplification could result in more harmonization of EU policies, lessen the administrative burden on the EU and Member States, and boost the efficiency of the sector. The European Commission will keep collaborating with the CCNR, the Danube Commission, and the Permanent Secretariat of the Transport Community to ensure, as necessary, the coordination between EU policies and those of these international organizations' policies and to highlight the potential for support through Connecting Europe Facility (CEF).[77]

To achieve the EU's climate neutrality and zero pollution goals, the European Green Deal and the Sustainable and Smart Mobility Strategy explicitly state that their goals are to increase the contribution of inland waterway transportation and to make all modes of transportation more sustainable. In order to significantly raise the proportion of inland freight transported by inland waterways and to significantly improve their capacity in the next years, bold efforts must be taken that necessitate a fundamental restructuring of the industry. NAIADES III lays out a plan to make this change possible, achieving the sector's goals for the green and digital transition while providing desirable and long-lasting jobs. To accomplish these challenging but essential goals for the industry and to contribute to its long-term survival, growth, and resilience, the Commission will keep working closely with Member States, stakeholders, and international organizations engaged in inland waterway transport. [78]

2.3.2 Future development of the Trans-European Transport Network

Building an EU-wide multimodal transport infrastructure network including roads, rail, inland waterways, and sea connections is the goal of the EU guidelines for the construction of the TEN-T. This ought to be connected to metropolitan hubs, ports, airports, and other terminals located throughout the EU, creating the infrastructural network needed to carry out sectoral actions.

It consists of a core network that contains the most crucial components of the comprehensive network, which provides the accessibility and interconnectedness of all regions in the EU. By 2030, the core network should be operational, and by 2050, the entire network. There are various established and updated guidelines for national and EU investments in transportation infrastructure. Three projects have received targeted money under the CEF and other funding instruments to supplement national support. Several EU-level investigations and evaluations examined how the present rules were being implemented and how far along they were. The initiative is a part of both the European Commission's work program for 2021 and the Commission, Council, and Parliament's joint declaration on the top objectives for EU legislation in 2022.[79]

An important EU statute for enhancing accessibility of transportation infrastructure for people with impairments, those with decreased mobility, and older people is the TEN-T Regulation. The original law recognized accessibility of the trans-European transport network for all users, including for people with disabilities, despite the fact that it has been challenging to evaluate the performance of accessibility criteria in practice.

This revision is welcomed because it offers a strong foundation for enhancing the accessibility of intermodal transportation for people with disabilities. However, for the revised law's final version to be useful and effective, it must include more specific guidelines for creating and funding TEN-T projects, such as:

[77] Ibid. p. 14.
[78] Ibid.
[79] European Parliament: Revision of the Trans-European Transport Network (TEN-T) Regulation, p. 1.

- “Quantitative or qualitative indicators, targets, and timelines for improving accessibility of the TEN-T network.
- Clear references to relevant EU accessibility law such as the Rail Accessibility Regulation (TSI-PRM) or the European Accessibility Act, the EU Digital Rights Strategy 2021-2030, and the UN CRPD.
- Accessibility and disability-related requirements when setting additional priorities for inland waterway, maritime, air transport, multimodal transport infrastructure, or for urban nodes.
- Accessibility and interoperability requirements for vehicles, vessels, aircrafts, and rolling stocks which use the TEN-T infrastructure.
- Requirements to earmark funding and prioritization of projects to improve accessibility of the TEN-T network, as well as increase transparency how TEN-T spending is affecting accessibility (improving or creating more barriers).
- Requirements for publishing accessible data on accessibility of TEN-T projects.
- Assurances for meaningful involvement of organizations with disabilities in setting priorities for the TEN-T network development and involvement in projects.
- Accessibility requirements for development of infrastructure in third countries supported by EU that connects to the TEN-T network.”[80]

It is possible to make the TEN-T future-proof by revising the TEN-T Regulation and coordinating the network's growth with the goals of the European Green Deal and the EU Climate Law. The transportation sector must reduce greenhouse gas emissions by 90% from 1990 levels by 2050 to become climate neutral by that time.

In order to achieve such significant emission reductions, a modern, fully-fledged European transport network is required that: (1) makes all modes of transportation more sustainable by establishing strict incentives and requirements for the development of transportation infrastructure and by better integrating the various modes into a multimodal transport system; (2) makes sure that new infrastructure projects on the network are climate-proof and in line with environmental goals; and (3) provides the infrastructural support necessary to support these projects.[81]

The TEN-T revision will also strengthen the governance and monitoring mechanisms already in place to guarantee network completion on schedule and take advantage of synergies between infrastructure development and transportation operations. This includes legally required work schedules to remove additional barriers to more rapid and effective rail freight and passenger services.

2.3.3 Enabling attractive, sustainable, and efficient transport and mobility services

The European Commission endorsed four recommendations that will modernize the EU's transportation infrastructure to facilitate the shift to cleaner, greener, and smarter mobility, in line with the goals of the European Green Deal. The proposals will put the transportation industry on track to cut emissions by

[80] EDF: The European Union will update rules on the development of the trans-European transport network (TEN-T), URL: https://www.edf-feph.org/the-european-union-will-update-rules-on-the-development-of-the-trans-european-transport-network-ten-t/.
[81] European Commission: Questions and Answers: The revision of the TEN-T Regulation, URL: https://ec.europa.eu/commission/presscorner/detail/en/qanda_21_6725.

90% by improving connectivity, moving more people and goods to rail and inland waterways, supporting the deployment of charging stations, alternative refuelling infrastructure, and new digital technologies, putting a stronger emphasis on sustainable urban mobility, and making it simpler to select various modes of transportation within an effective multimodal transport system.

Frans Timmermans, executive vice president for the European Green Deal, remarked, “Europe’s green and digital transition will bring big changes to the ways we move around. Today’s proposals set European mobility on track for a sustainable future: faster European rail connections with easy-to-find tickets and improved passenger rights support for cities to increase and improve public transport and infrastructure for walking and cycling, and making the best possible use of solutions for smart and efficient driving.”[82]

424 major cities are connected to ports, airports, and train stations by the TEN-T. Travel times between these cities will be shortened once the TEN-T is finished. For instance, travellers will be able to travel by rail between Copenhagen and Hamburg in 2.5 hours rather than the current 4.5 hours.

Today's plan aims to fill in the gaps and update the entire network:

- “Requires that the major TEN-T passenger rail lines allow trains to travel at 160 km/h or faster by 2040 thus creating competitive high-speed railway connections throughout the Union. Canals and rivers must ensure good navigation conditions, unhindered for example by water levels, for a minimum number of days per year.
- Calls for more transhipment terminals, improved handling capacity at freight terminals, reduced waiting times at rail border crossings, longer trains to shift more freight onto cleaner transport modes, and the option for lorries to be transported by train network-wide. To ensure infrastructure planning meets real operational needs, it also creates nine ‘European Transport Corridors’ that integrate rail, road, and waterways.
- Introduces a new intermediary deadline of 2040 to advance the completion of major parts of the network ahead of the 2050 deadline that applies to the wider, comprehensive network. So new high-speed rail connections between Porto and Vigo, and Budapest and Bucharest – among others – must be completed for 2040.
- Requires all 424 major cities along the TEN-T network to develop Sustainable Urban Mobility Plans to promote zero-emission mobility and to increase and improve public transport and infrastructure for walking and cycling.”[83]

Since rail is still one of the cleanest and safest modes of transportation, it is at the core of our strategy to increase the sustainability of EU mobility. Along with today's TEN-T proposal, there is also an Action Plan on Long-Distance and Cross-Border Rail that outlines future steps the EU can take to achieve its goal of tripling high-speed rail traffic by 2050 and doubling it by 2030.

Despite an increase in recent years in railway ridership, only 7% of rail miles travelled between 2001 and 2018 involved cross-border transit. The Action Plan outlines specific steps to lower barriers to cross-border and long-distance travel and increase the allure of rail travel for passengers in an effort to persuade more individuals to consider taking the train for international travel. The acts consist of:

[82] European Commission: New transport proposals target greater efficiency and more sustainable travel. URL: https://transport.ec.europa.eu/news/efficient-and-green-mobility-2021-12-14_en.
[83] Ibid.

- a multimodal legislative proposal in 2022 to boost user-friendly multimodal ticketing;
- allowing passengers to find the best tickets at the most attractive price and better supporting passengers faced with disruption, and a commitment to investigating an EU-wide VAT exemption for train tickets;
- the repeal of redundant national technical and operational rules;
- an announcement of proposals for 2022 on timetabling and capacity management, which will boost quicker and more frequent cross-border rail services;
- guidelines for track access pricing in 2023 that will ease rail operators' access to infrastructure, increasing competition and allowing for more attractive ticket prices for passengers."[84]

Our mobility is more sustainable thanks to smart mobility. In order to take into account, the development of new road mobility options, mobility apps, and linked and automated mobility, the Commission is proposing to update the 2010 ITS Directive. By suggesting that certain essential road, travel, and traffic data be made available in digital format, such as speed limits, traffic circulation plans, or roadworks, along the TEN-T network and eventually covering the entire road network, our proposal will encourage the quicker deployment of new, intelligent services. Additionally, it would guarantee that drivers traveling along the TEN-T network have access to crucial safety-related services.[85]

Transport users and everyone around them will benefit from the new Urban Mobility Framework. Millions of people live in cities. Congestion, pollution, and noise are a few of the mobility issues brought on by this bustling economic activity that are addressed in today's proposal. The Sustainable Urban Mobility Plans are one method mentioned in the Urban Mobility Framework for cities' ability to reduce emissions and increase mobility. The use of walking, cycling, and public transportation will be prioritized. The proposal prioritizes the final mile of urban deliveries, the construction and modernization of multimodal hubs, innovative digital solutions and services, and zero-emission solutions for urban fleets, including taxis and ride-hailing services. The financing alternatives for local and regional authorities to carry out these priorities are outlined in the proposal. The Commission will recommend to EU Member States in 2022 the creation of national plans to help cities create their mobility plans.[86]

2.3.4 Enabling low carbon and clean transport

Europe and the rest of the globe are under existential threat from climate change and environmental deterioration. The European Commission introduced the European Green Deal, a package of measures aimed at making the economy of the EU more sustainable, to address these issues. The European Green Deal, a new growth strategy, aspires to make the EU into a just and wealthy society with a cutting-edge, resource-effective, and competitive economy where there are no net greenhouse gas emissions in 2050 and where economic growth is unrelated to resource use.[87]

[84] Ibid.
[85] Ibid.
[86] Ibid.
[87] European Commission: The European Green Deal, p. 2.

Figure 5: Figure 1: Elements of the Green Deal[88]

To achieve the European Green Deal's primary objective, emissions from all sectors must be reduced by 80% below 2005 levels by the year 2050. While the economy expanded by 61% between 1990 and 2018, greenhouse gas emissions were reduced by 23%. By 2050, greenhouse gas emissions are only expected to be reduced by 60% under the existing policy.[89]

The EU's overarching goal of climate neutrality is constantly being updated and modernized so that the European economy sets a good example in terms of climate protection worldwide.

The second greatest generator of greenhouse gas emissions (GHG) in the EU now is the transport industry. Road freight is expected to expand by over 40% by 2030 and by just over 80% by 2050 as the demand for freight transport services grows (compared to 2005). To achieve the goals outlined by the Green Deal, solutions must be developed in the upcoming years to lower GHG emissions from freight transport while also managing the anticipated expansion in transport volume.

The European Commission has begun a follow-up on the EU Green Deal exactly one year after the initial publication, at the end of 2020. The EU Strategy on Sustainable & Smart Mobility was released on December 9, 2020. This document details the first concrete steps in the impending transformation, the significance of which is made clear by the following milestones:

- By 2030, rail and waterborne-based intermodal transport will be able to compete on equal footing with road-only transport in the EU.
- Rail freight traffic will increase by 50 % by 2050.

[88] Ibid. p. 3.
[89] Ibid. p. 4 f.

- Transport by inland waterways and short sea shipping will increase by 25 % by 2030 and by 50 % by 2050.[90]

The strategy is based on three pillars for further actions under ten flagship actions:

- make all transport modes more sustainable,
- make sustainable alternatives widely available in a multimodal transport system and
- put in place the right incentives to drive the transition.[91]

Land freight transportation in Europe is a significant economic industry with profound effects on the environment and society. According to the chart below, the sector's transportation performance reached 2,385 billion tkm² in 2015, or 19 billion tons of products transported, accounting for nearly 6% of the European Gross Domestic Product (GDP). The modal share for road, rail, and inland canal freight transport stayed mostly stable between 1996 and 2016 despite a rise in freight quantities. 75% of all transportation (in tkm) was completed by 4.2 million trucks on European roadways. With a fleet of 40,000 locomotives and 880,000 carriages, rail accounted for 18% of transport (in tkm), while barges made for 7% of inland waterways in Europe.[92]

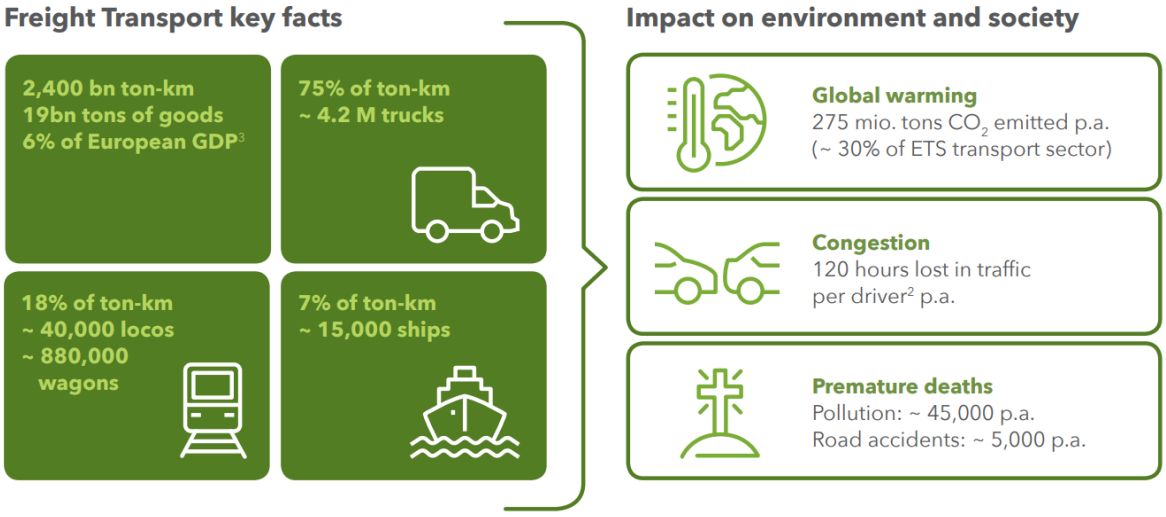

Figure 6: European land freight transport facts and impact, 2015[93]

Additionally, the European Commission has created a plan for intelligent and sustainable mobility that emphasizes the value of multimodal transportation. According to the Commission, a significant portion of the 75% of internal freight traffic that is currently transported by road should be switched to rail and inland waterways as a matter of priority.

A sustainable transport policy is necessary to achieve important goals like decarbonization and congestion relief. However, given the anticipated expansion, the current transport policies fall short of properly satisfying these needs. Environmental issues have undeniably grown in importance over the

[90] European Commission: Sustainable and Smart Mobility Strategy – putting European transport on track for the future.
[91] BSR Access: Position paper on multimodal and interoperable supply chains, p. 7.
[92] Ibid.
[93] Rail Freight Forward: 30 by 2030 Rail Freight strategy to boost modal shift, p. 6.

past few years, but according to assessments of transport costs, they are still only considered as a secondary factor when making decisions.[94]

- Developing and deploying new and sustainable fuels and propulsion systems.
- Optimizing the performance of multimodal logistics chains, including by making greater use of more energy-efficient modes.
- Strengthening of rail and inland waterborne transport (30 % of road traffic to be shifted by 2030 and more than 50 % by 2050) facilitated by efficient and green freight corridors.
- A fully functional and EU-wide multimodal TEN-T core network shall be attained by 2030, with a high-quality and capacity network.
- A European multimodal transport information, management, and payment system because of the increase in efficiency of transport and of infrastructure use with information systems and market-based incentives.

The various Core network corridors (CNCs), which were included in the recommendations in 2013, are essential and directing for the effective execution of the TEN-T dimensions. The corridors serve as a potent weapon to promote and show the accomplishment of the EU's broader transport policy objectives as well as to induce investments. There are many chances to promote comprehensive transportation solutions along every route. In order to provide efficient, futuristic, and high-quality transportation services for people and business operators, the main goal of infrastructure development along the corridors and on the core network is to provide seamless and continuous linkages.[95] With the development of the corridors through standardized TEN-T standards, increased share of a stable dominant position of inland waterway transport, modal shift from road to rail, and further deployment of alternative fuels infrastructure, all CNCs have set themselves the common goal of lowering emissions. Significantly lowering transportation-related CO_2 emissions is anticipated because of the implementation of the TEN-T core network.[96] Currently, the Commission is reviewing the TEN-present T's rules to update the regulation by 2021. This amendment intends to make sure that the transportation system and cross-border infrastructure networks are prepared for the Green Deal's goals of carbon neutrality and climate resilience. Additionally, the redesign will consider how to set up the network for linked and smart mobility.

It is crucial that the transportation industry transitions to sustainable forms of transportation like railroads, inland waterways, and river/sea shipping to accomplish the goals established by the Transport White Paper and the Green Deal. This may assure logistics that are efficient, safe, and free of congestion while also modernizing the fleet and infrastructure that are already in place. Making effective use of a multimodal network that is integrated and intelligent is also crucial for the transportation sector. Without the political will and support to establish the same terms and conditions for all transport modes, particularly inland navigation, and river-sea shipping (RSS), will scarcely be able to develop further. They also offer a great deal of potential to significantly improve the sustainability of transport chains.[97]

[94] BSR Access: Position paper on multimodal and interoperable supply chains, p. 8.
[95] Ibid. p. 9.
[96] European Commission: The impact of TEN-T completion on growth, jobs and the environment, p. 19.
[97] BSR Access: Position paper on multimodal and interoperable supply chains, p. 8 f.

2.3.5 Strengthening the integration of TEN-T development and transport service-related policy action

The aim of the TEN-T policy is to ensure seamless, sustainable, and effective transport throughout the Union, while at the same time at the same time strengthen social, economic and territorial cohesion.

The TEN-T represents the highest level of infrastructure planning within the Union. The TEN-T core network, to be completed by 2030, will include high-quality multimodal connections of all capitals and major arteries of the Union as the cornerstone of the Single European Transport Area. However, transport flows extend beyond the borders of the Union. With increasingly globally interconnected value and supply chains, the provision of cross-border connectivity with third countries has long been of growing importance to the Union.

TEN-T policy has been a central element in projecting the Union's transport policy to third countries. Based on the Lisbon Treaty, which emphasized that priority should be given to cross-border cooperation with the European Neighborhood (Article 8 TEU), the elaboration of Article 8 of the Regulation, which sets the framework for cooperation with third countries, focused specifically on cooperation with the neighboring countries that belong to the group of third countries covered by the Enlargement Policy, the European Neighborhood Policy, the European Economic Area and the European Free Trade Association.

Since the adoption of the TEN-T Regulation, the Union has extended the indicative TEN-T to the following areas:

- “The European Economic Area and European Free Trade Association;
- The Western Balkans (Albania, Bosnia and Herzegovina, Kosovo*, The Republic of North Macedonia, Montenegro and Serbia);
- The Eastern Partnership (EaP) (Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine);
- Turkey: the comprehensive network of Turkey as incorporated in the TEN-T Regulation.”[98]

As far as the Mediterranean is concerned, the identification of an overall network to define a Trans-Mediterranean Transport Network (TMN-V) has not yet been completed. This action will be carried out jointly with the Southern Mediterranean partners.

This indicative network will enable the Union to better target EU engagement, including financial support, in a more targeted manner. “The Neighborhood, Development and International Cooperation Instrument (NDICI)-Global Europe and the Instrument for Pre-Accession Assistance (IPA) III support an enabling environment to facilitate sustainable infrastructure investment and allow the EU to leverage public and private investments through International Financial Institutions to support connectivity objectives.”[99]

The extension of the TEN-T policy beyond the Union's borders has two overarching objectives: i) to ensure the coherence and efficiency of an interoperable and multimodal network between Member States and their immediate neighbors and partner countries; ii) to focus the Union's engagement

[98] European Commission: Communication from the Commission to the European Parliaments and the Council on the extension of the trans-European transport network (TEN-T) to neighbouring third countries, p. 1 f.
[99] Ibid. p. 2.

(including financial support) in these regions. Moreover, in the broader context of the European Neighborhood Policy and the EU Enlargement Policy, the extension of the TEN-T is a tool for closer integration or preparation of candidate or potential candidate countries for possible EU accession. Finally, the inclusion of the transport networks of the enlargement countries and other neighboring countries in the TEN-T will facilitate trade and economic integration and thus also accelerate alignment with the Union.[100]

The Union's involvement can take the form of both "hard" infrastructure development and "soft" measures to improve transport connectivity. As far as hard infrastructure is concerned, the extension of the TEN-T to neighboring countries aims at identifying infrastructure projects and consolidating a network that is in line with the TEN-T parameters and objectives in order to contribute, among other things, to the decarbonization of transport. An agreed and stable network in neighboring countries with partners leads to more reliable connections with better transport services for citizens and businesses. In view of the Union's strong political commitment to its neighborhood, it will also allow the EU to better target funding and financial resources and provide the necessary certainty to mobilize investments in infrastructure projects. In addition, stable infrastructure planning and strategic development will help attract support from international financial institutions. When investing in new infrastructure, particular attention should be paid to ensuring that the TEN-T meets the highest standards and requirements, and that the protection of this high-quality infrastructure is guaranteed in the long term.

The extension of the TEN-T policy to neighboring countries is crucial in terms of building an interoperable and multimodal transport network for the Union. The TEN-T policy is an important tool for the integration of enlargement countries, providing better transport connectivity and serving as a pathfinder for trade facilitation, accelerating convergence with the Union. This Communication, presented together with the proposal for a revised TEN-T Regulation, aims to further deepen the Union's external relations, considering both the priorities of the European Green Deal and the Commission's strategy for sustainable and smart mobility.

2.3.6 Enhancing the efficiency of infrastructure use through improved investment coordination among corridors

The competitive advantage of locations, which is typically referred to as accessibility, is determined by the quality of the transportation infrastructure, including capacity, connection, speed of travel, etc. between corridors. The quality of various sites might alter as a result of investments in transportation infrastructure, which can also affect the patterns of spatial growth.

Three crucial factors—economic strength, general accessibility, and connectedness—describe the pattern of accessibility and connectivity in the EU.[101]

The TEN-T core network should be created, as indicated in the 2011 White Paper, to provide effective multimodal linkages, ports, airports, and vital land border crossings, with a focus on filling in any gaps (e.g., cross-border sections, bottlenecks, and bypasses). It expressly says, “for multimodal freight transport (i.e., E-freight), an appropriate framework for tracing goods in real time, ensuring intermodal liability and promoting clean freight transport can be put in practice through the concepts of “Single Window” and “one-stop-shop” by creating and deploying a single transport document in electronic form (electronic waybill).”[102]

[100] Ibid. p. 3 f.
[101] European Parliament: Research for TRAN Committee - Modal shift in European transport, p. 46.
[102] Ibid. p. 102

The map below shows the locations of railways (for freight), ports, and rail-road terminals (RRTs) on the TEN-T CNCs in the EU Member States, demonstrating the multimodal interconnection of the TEN-T core network. The map gives a broad overview of multimodal connectivity within the EU as well as in the North Sea Region and Baltic Sea Region, where the network is less developed.[103]

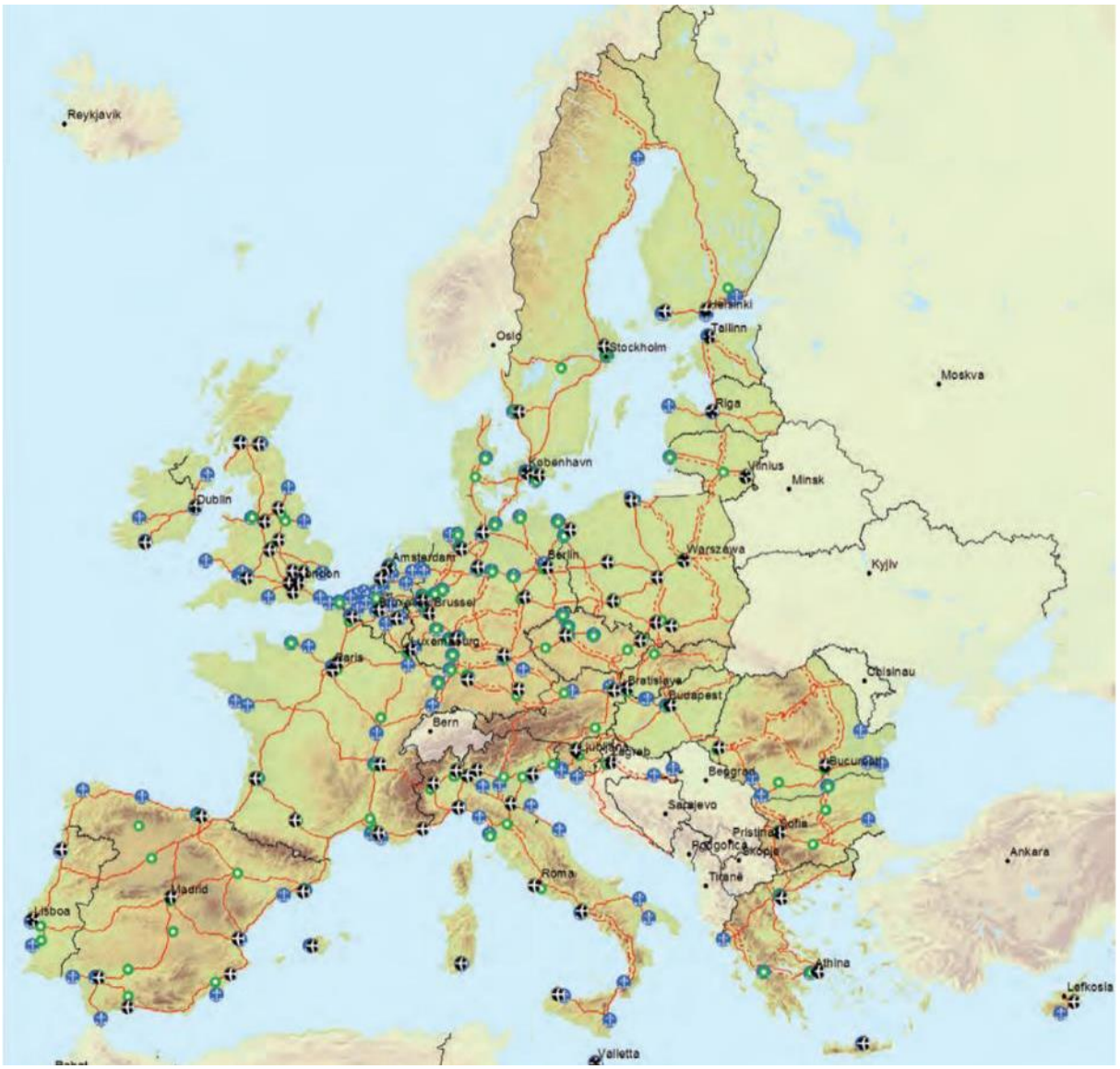

Figure 7: Railways (freight), ports and RRTs in the EU Member States (core network)[104]

On the one hand, the adoption of CNCs has a significant impact on the mode choice and accessibility to the working transportation system. If public transportation operators guarantee an appropriate service offer, improved commute options, expanded labor markets, and improved cross-border interoperability cause changes in the modal choice for passenger travel. Wider mode and route selection alternatives are produced for freight owners and forwarders in managing supply chains because of the corridor's improved reliability, decreased time, and cost for freight transit. The deployment of CNCs, on the other

[103] BSR Access: Position paper on multimodal and interoperable supply chains, p. 18.
[104] Ibid. p. 53.

hand, faces several difficulties that could jeopardize the achievement of objectives from a time perspective (2030).[105]

According to data given by the Member States in 2015, the graph below provides a summary of the infrastructure completion progress on the core network per mode.

Core network	Completed	Under construction/ Ongoing	Planned	Under study/Preparation
Road	75%	4%	19%	2%
IWW	89%	1%	10%	1%
Conventional Rail	73%	4%	22%	1%
High Speed Rail	61%	0%	39%	0%

Figure 8: Categorized TEN-T core network infrastructure (2015)[106]

Possible delays in the execution of crucial infrastructure projects along the corridors brought on by poor coordination of investment planning across borders and lower priorities set by Member States in terms of national funding are just two of the difficulties. Although cross-border initiatives typically show a high level of European added value, they may have less evident direct economic effects as compared to solely national ventures. The lack of a comprehensive strategy for planning the corridor investments is evident not only across administrative boundaries. The Issues Papers identify silo-thinking, which is still prevalent, and the lack of synergies with current projects as a problem with implementing the significant infrastructure expenditures on corridors. According to the European Coordinators, the TEN-T planning process is excessively supply-driven and should consider the market's actual needs for freight transportation (demand-driven approach). Relevant stakeholders must be mobilized, cooperative, and coordinated to accomplish this.[107]

[105] BSR Access: Position paper on multimodal and interoperable supply chains, p. 19.
[106] European Commission: The Trans-European Transport Network: Common Progress Report of the European Coordinators, p. 55.
[107] TENTacle: Realizing benefits from the TEN-T Core Network Corridors – how, where and by whom?, p. 7 f.

3 RECOMMENDATIONS AND CONCLUSIONS

The TEN-T revision must unavoidably address a variety of issues in the North Sea Region, as well as in the Baltic Sea Region, because of its extremely broad policy scope, which can be divided into four main categories:

- Problem area 1: Lack of standards for alternative fuel infrastructure on the TEN-T and insufficient or inadequate TEN-T infrastructure standards prevent more people from using environmentally friendly types of transportation.
- Problem area 2: Multimodality is hampered by capacity limitations and a lack of network connectivity across all locations.
- Problem area 3: Insufficient safety and reliability of the TEN-T infrastructure
- Problem area 4: Insufficient TEN-T governance mechanisms and TEN-T network architecture

The issue of insufficient and incomplete TEN-T infrastructure standards, as well as the absence of requirements for alternative fuels infrastructure, is likely to persist without further legislative action at the EU level. As it said before, the current standards are in fact insufficient to address the problems with the TEN-T system of today and to assist the accomplishment of the Shared Mental Models (SMMs)[108] objectives.

The **problem area 1** and its solutions can be divided into several sub-items of the transport mode.

Rail freight

The 740 m criterion's slow implementation would continue. Without further clarification, Member States would continue to use various methods to meet this criterion, which would restrict the network's ability to communicate with one another. Furthermore, since traffic frequently does not originate or terminate on the core network and since the need to reroute traffic during disruptions of the core network necessitates adequate infrastructure on the comprehensive network, the lack of pertinent requirements on the comprehensive network would continue to reduce the appeal of rail freight transport. Last but not least, by omitting a criterion that would enable the movement of P400 intermodal loading units throughout the network, a substantial opportunity for a paradigm shift of freight to rail would be lost. The work plans for the coordinators reveal substantial variations between the corridors in terms of the infrastructure's ability to support such loading units. As a result, multimodal transportation's market potential is diminished.[109]

Inland waterways

Inland waterway transportation is extremely vulnerable to the effects of climate change and is the topic of environmental concerns, while being the safest mode of transportation and having a great capacity to absorb extra traffic from other, less environmentally friendly modes. It won't be possible to absorb more volume if there are rigid standards for draught and height under bridges that consider the hydrography of the inland canal. On the other hand, as is the case for all forms of transportation, if

[108] Shared mental models (SMMs) help groups make better decisions. Clinical competency committees (CCCs) can benefit from the development and use of SMMs in their decision-making as a way to optimize the quality and consistency of their decisions.
[109] European Commission: Proposal for a regulation of the European Parliament and of the Council on Union guidelines for the development of the trans-European transport network, amending Regulation (EU) 2021/1153 and Regulation (EU) No 913/2010 and repealing Regulation (EU) 1315/2013, p. 24.

environmental issues like biodiversity and climate change are ignored, an exaggerated picture of IWT's potential would be presented.[110]

Short Sea Shipping

The attractiveness and consequently the potential of this transport mode for modal shift would be undermined without a more coherent and integrated concept towards short sea shipping covering the entire logistics chain, better integrating the maritime links into the TEN-T, as well as more stringent standards with regard to the quality of the last mile connection of ports.[111]

Alternative fuels

The chance to offer a true network view for the deployment of alternative fuels across Europe would be lost without an integration of the Alternative Fuels Infrastructure Regulation (AFIR) standards into the TEN-T. More crucially, the infrastructure required to provide complete cross-border transport connectivity on the TEN-T for alternative fuel cars would not be available. This won't guarantee that the TEN-T Regulation promotes the transportation sector's decarbonization and cleaner air goals, in line with the SSMs goal.

Regarding the **problem area 2**, without further action, capacity bottlenecks will persist and worsen because the comprehensive and core network's passenger and freight transit volumes are generally rising but capacity is not keeping up.

Infrastructure-wise, the lack of capacity in multimodal transport terminals, the sluggish adoption of digital instruments like ERTMS, and the tardy implementation of some standards (or the absence thereof) on the TEN-T are the key obstacles to capacity and multimodality. If these problems are not resolved, they will continue to have a severe impact on both smooth cross-border transport flows and other flows, particularly those near metropolitan nodes where TEN-T facilities are frequently congested. Furthermore, if certain standards are not also extended to specific portions of the comprehensive network and last mile sections to transport nodes where the majority of the traffic originates or finishes, greater capacity and operational efficiency will not be obtained.[112]

Regarding network connectivity, there would be a significant risk that systems and (new) applications would not be applied coherently and at the same speed across the EU, potentially posing new barriers to interoperability and seamless transport operations. This is because the term "telematics applications" has not been clarified to include digital systems, applications, and services beyond those already covered by the TEN-T Regulation. A huge opportunity to expand the capacity and efficiency of these facilities, which are crucial enablers of the multimodal logistics chain, would also be lost by not imposing minimum criteria on digitalization, for instance in terminals or ports.

When it comes to the **problem area 3**, one of the key opportunities for ensuring better interoperability and enhanced capacity on the railways is the regular usage of ERTMS. A large potential for capacity increases without the construction of new infrastructures will not be achieved if the slow acceptance of this technology, particularly the track side deployment, is not addressed. A precise timetable should be established for the decommissioning of the country's old systems or improvements in operational effectiveness, interoperability, and cost savings will go unused.

[110] Ibid. p. 25.
[111] Ibid.
[112] Ibid. p. 25.

Likewise, both man-made and natural or climate-related occurrences have an impact on the TEN-T reliability. These occurrences are becoming more frequent, especially in light of climate change. Therefore, it is essential to consider such potential occurrences while developing infrastructure and to plan and create the infrastructure so that it is resistant to such effects.[113]

Lastly, there is an increase in foreign direct investments. It would be problematic if investors chose, for instance, to replace the technical infrastructure standards or IT systems of a port, airport, or infrastructure facility with non-EU or non-TEN-T standards because this could affect the continuity of the TEN-T network, which would then affect the public's sense of security and the safety of vital infrastructures.

To find target-oriented solutions for **problem area 4**, it can be stated that without further action from the EU, the issue of insufficient TEN-T governance mechanisms and TEN-T design would continue. This would jeopardize the timely implementation of the TEN-T by the established timeframes. In addition, without a strengthened and expanded role for the European Coordinators, newly emerging (policy) objectives like those on greening and digitalization would not be addressed. Similar to how the work of the European Coordinators on the CNC and the work of the RFC would always diverge, there would be underused synergies (such as those resulting from overlapping tasks) that would continue to exist.[114] In terms of prioritization, there is a chance that national priorities will continue to take precedence over European priorities, or at the very least that they won't be completely in sync. It would not be possible to lessen the current workload and administrative burden on Member States and the Commission by reporting and monitoring the TEN-T implementation. Many of the suggested policy changes (such as the development of the European Transport Corridors) would not be possible to implement in terms of the TEN-T design without an adjustment to the TEN-T maps.[115]

[113] Ibid. p. 26.
[114] Ibid. p. 26.
[115] Ibid. p. 27.

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