Picture 1: © Ante Klečina

RAIL4REGIONS

WHITE PAPER

Summary of Work Package 1 results

D.1.3.3

SEPTEMBER 2024

Interreg CENTRAL EUROPE
Co-funded by the European Union
Rail4Regions

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Picture 2: © Maryam Chegeni

1. Overview and status of the project

The Project Rail4Regions is considered a follow-up project to REIF and was launched in February 2023 and will run for 3 years. This white paper reviews the completion of the first of three main work packages. In general, the project aims to enhance the utilization of rail freight transport. Although there have been investments in the main corridors, the regional lines have not received equal attention, resulting in goods being predominantly transported by road.

The **Rail4Regions** project aligns closely with the EU's Green Deal, which main goal is to make the European Union the world's first climate-neutral continent by 2050.

How?

It is priority to make the railway a sustainable transport and integrate regional rail lines into the broader European rail network. The use of railway transportation will lead to:

- **Reduce Carbon Emissions**:

Rail transport, being inherently more environmentally friendly than road transport, contributes significantly to reducing carbon emissions when goods are shifted from road to rail.

Rail4Regions project also aligns with TA 2030, which promotes sustainable digital and physical connectivity of places.

- **Optimize Existing Infrastructure**:

Revitalizing existing rail infrastructure, to minimize the need for new construction. This approach is both cost-effective and environmentally friendly.

- **Promote Modal Shift**:

Encouraging companies to choose rail over road transport is a critical aspect of sustainability and making rail freight transport an appealing choice for businesses.

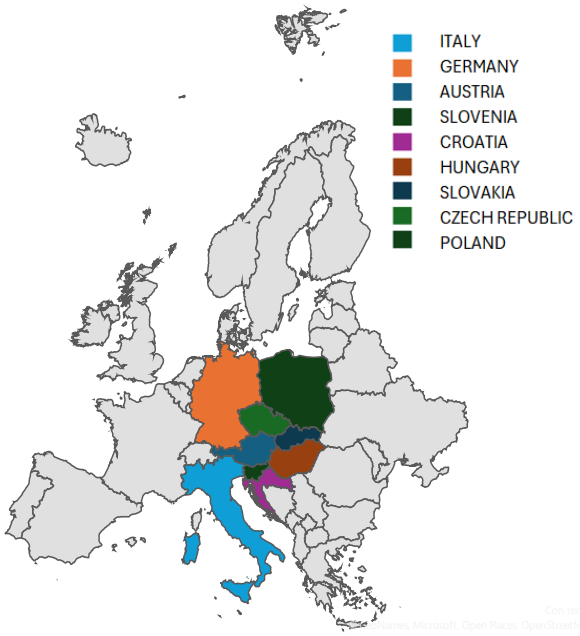
- **Local Solutions and Investment**:

Rail4Regions seeks to provide necessary tools for regional planners to enhance rail connectivity, increase economic viability, and support environmentally conscious transportation.

Picture 3: © Maryam Chegeni

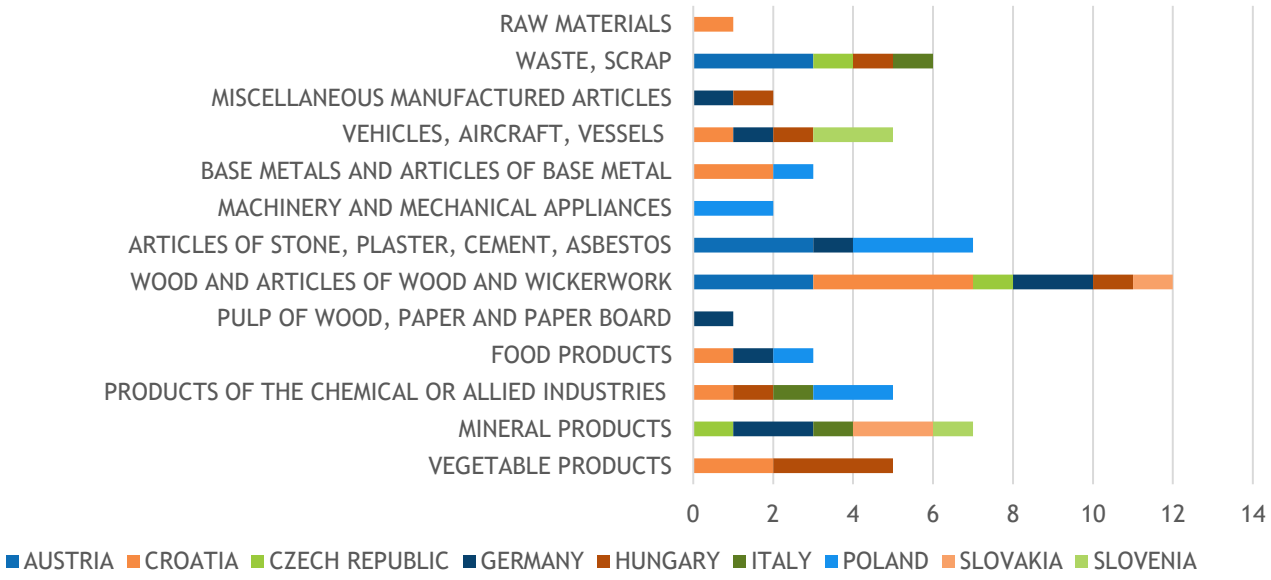
2. Procedure and Context of analysis

The project focuses on the connecting area between Scandinavia and the Mediterranean Sea. The area involved in the program represents one-third of the EU population and covers approximately 15% of the total territory. The countries that have been involved in the project are Germany, Italy, Austria, Croatia, Czech, Slovenia, Slovakia, Hungary, and Poland (see Graphic 1).



Graphic 1: Involved project countries

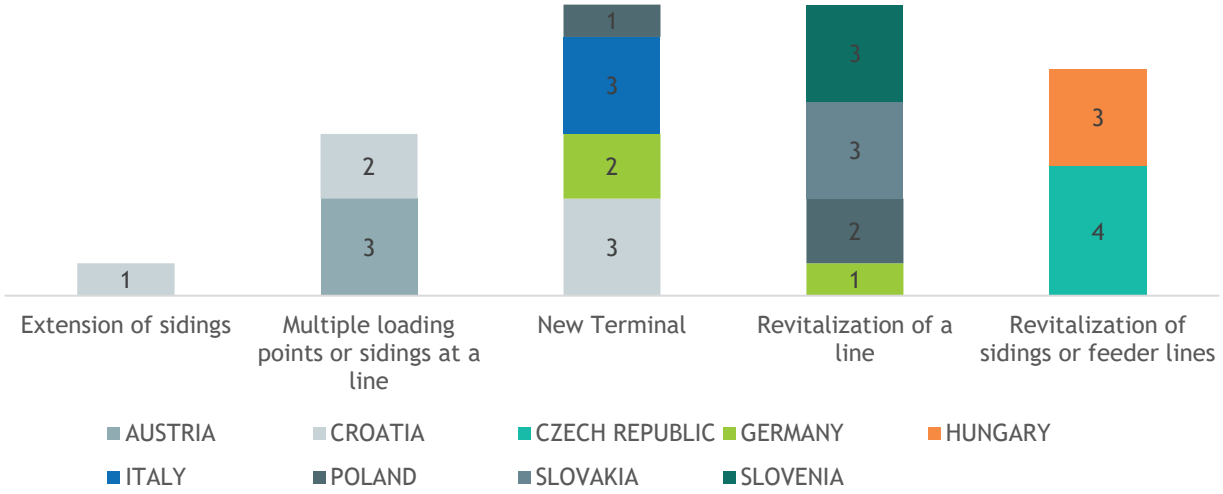
From an economic perspective, the area is considered the industrial core of the EU. Improving rail transport efficiency could significantly impact the global competitiveness of the EU. In fact, over 20% of companies are involved in transporting wood and articles of wood, 12% in mineral materials such as cement, sand, gravel, gypsum, and marble blocks, other 12% in transport building materials and 10% in waste and scrap of different materials. Graphic 2 gives an overview of the transported goods in the involved project countries.



Graphic 2: Overview of shipped goods by participating project countries, indicating the number of case studies related to specific category of good (case studies 2024)

Methodical Procedure

To investigate the obstacles in each region and enhance access to rail transport, the project considered 31 case studies, grouped into five different clusters. Each cluster hosts the case studies that share common strategies to promote rail usage in the freight transport system. This includes inactivated lines, terminals, and sidings. These case studies highlight the potential impact of rail freight transport in rural areas. In graphic 3, the number of case studies belonging to each cluster is illustrated, the specific characteristics of each case study can be viewed in Deliverable 1.1.2.



Graphic 3: Number of studies per project country classified into clusters

3. Bottlenecks in railway transport

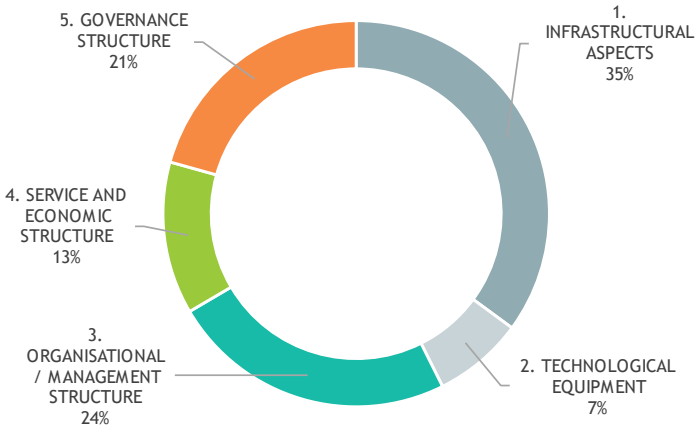
Identifying bottlenecks in freight rail transport system is crucial to address the focus of planners and decision makers towards the main challenges of rail logistic system. Therefore, a deep analysis has been conducted through different case studies and stakeholders to specify the **type**, **ranking level** and **intervention body** and **time** needed to overcome the bottlenecks.

a. General assessment

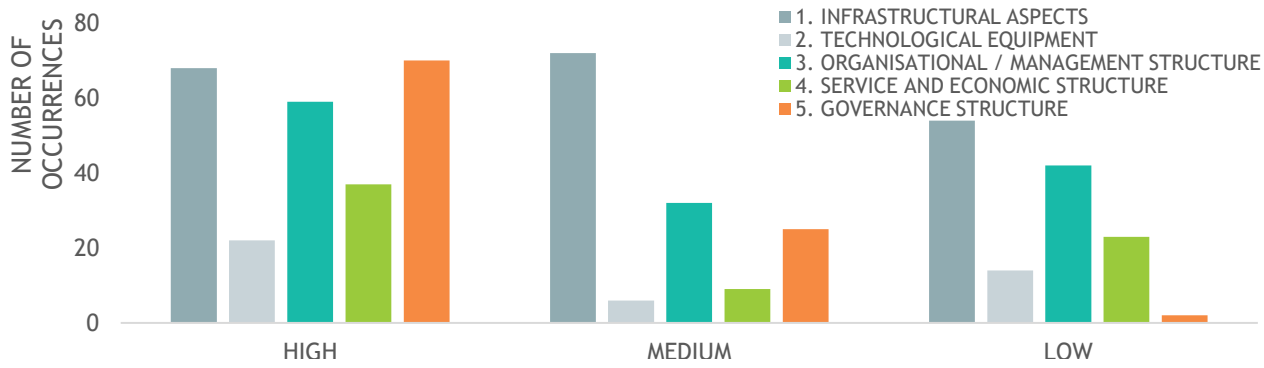
The general assessment of the bottlenecks considers the following macro categories:

1. **Infrastructural aspects**
2. **Technological equipment**
3. **Organisational / management structure**
4. **Service and economic structure**
5. **Governance structure**

From the discussions at the workshops with stakeholders, the project partners were able to use a tool developed by T Bridge to prioritise the five different macro-categories and various obstacles they are facing. The two most significant results of the survey conducted for the case studies results in 35% of the obstacles associated to infrastructure-aspects and, nearly 24% to organizational or management structure.



Graphic 4: Stakeholder survey results regarding the categorization of existing problems

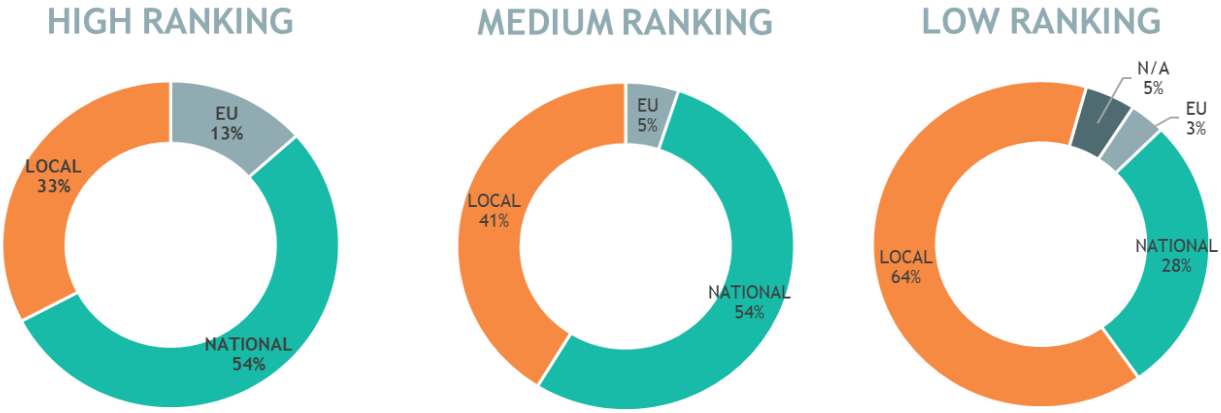


Graphic 5: Occurrences (number of the times the bottlenecks are verified) and weighting categorized according to the 5 macro levels

A further analysis of the survey related to ranking of bottlenecks in relation to the five macro categories, highlights that infrastructure-related issues together with **governance structure** and **organizational and management structure** issues to be the prevalent problem across high and medium ranking levels.

Intervention levels

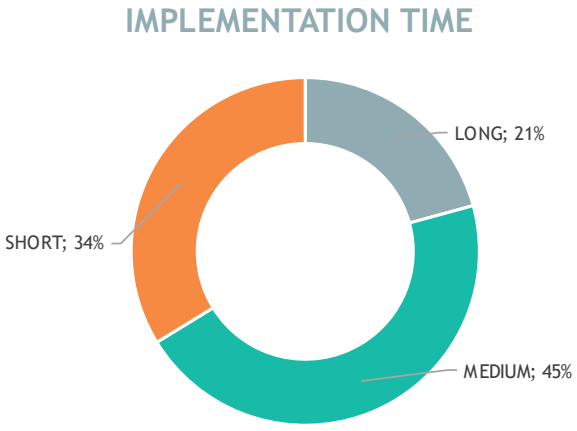
The stakeholders surveyed were able to determine the intervention level needed to overcome bottlenecks at EU, national and local level. **National** interventions are deemed necessary primarily for issues of high and medium ranking levels, while **local** interventions are considered adequate for problems of lower importance. **EU** intervention, on the other hand, is predominantly required for issues of high-ranking level.



Graphic 6: Influence of the administrative level and ranking level in relation to the occurrences.

Implementation time

Graphic 7 shows the results of the survey regarding the time frame for implementation. Considering the implementation time needed to solve the bottleneck (long, medium, or short)**, nearly 80%** of bottlenecks require **medium or short time** interventions. It is worth considering that most of the **longer** interventions are assigned to **infrastructure** and **governance** structure.



Graphic 7: Comparison implementation time to solve bottlenecks

b. Detailed assessment

The detailed assessment underscores the significance of specific bottlenecks within each macro category and prioritizes bottlenecks, according to the stakeholders, based on their level of importance, particularly focusing on those deemed as high and medium priority. This prioritization aids in determining strategies to address these bottlenecks effectively. The following tables represent a collection of bottlenecks and their weighting, which were collected during group discussions with the stakeholders. Results with the categorisation low are neglected here.

Table 1: Detailed listing of infrastructural problems

Infrastructural	Level of importance
lack of/poor rail connection between the main line and logistic centres.	high
insufficient terminal capacity for storage.	high
shortage of intermodal terminals.	high
the train length often does not correspond with the loading track length in the terminals.	high
non electrified tracks at terminals.	high
insufficient rail capacity.	medium
low technical conditions of railway lines	medium
insufficient terminal capacity for parking area.	medium
short tracks and limited number of tracks in loading points.	medium

Table 2: Detailed list of governance structure problems

Governance structure	Level of importance
insufficient laws and investments at national and regional levels to promote intermodal freight transport, resulting in unequal market conditions for road and intermodal transport.	high
insufficient strategies in spatial planning tools.	high
lack of integrated supply chain management between rail systems in different countries considering rolling stock, locomotives, signalling, information systems, track gauges, electric power compatibility or voltages.	high
need of qualified personnel to handle the supply chain.	high
different and inconsistent border crossing procedures.	high
communication gaps with small - medium enterprises, to design adequate transport options.	medium
a higher amount of data exchange is needed in intermodal freight transport compared to road transport.	medium

Table 3: Detailed list of organizational and management structure problems

Organisational and management structure	Level of importance
lack of cooperation between terminal operators and logistic service providers which result in inefficiencies in operational processes as well as in information and communication flows.	high
lack of real-time and reliable information exchange (transfer times, delays, or other operational incidents) among involved actors resulting in inefficient communication.	high
insufficient management of incoming trucks, due to the lack of a clear and direct guidance of an incoming truck to its position on the loading lane.	high
lack of added value services at terminals, such as container repair, hiring and selling of containers, energy for refrigerated units etc.	high
inefficient internal administrative processes of the terminal, including all document handling, customs clearance and checks	medium
insufficient security management systems to protect transport units against theft, sabotage and terrorist activities continuously increases.	medium
low awareness of terminal operators for environmental concerns.	medium
restricted/fixed terminal opening times, which might not comply with the consignor's logistics concept.	medium

Table 4: Detailed list of service and economic structure problems

Service and economic structure	Level of importance
delays in trains arrival, departure, and travel time.	high
terminal handling costs.	medium

Table 5: Detailed list of technological equipment problems

Technological equipment	Level of importance
inflexible shunting equipment.	high
insufficient equipment for handling of dangerous goods.	high
load/ unload capacity limitation.	medium
inefficient transfer techniques.	medium

4. Externalities

The analysis of externalities underestimates the competitiveness of rail freight compared to road freight. It uses both qualitative and quantitative approaches to assess the positive and negative impacts of each mode of transport. Furthermore, the study helps to understand the trade-offs between the two modes and to guide decision-making for sustainable and efficient freight transport solutions.

a. Qualitative assessment

Qualitative assessment underlines the strengths of each system, highlights the challenges of rail freight transport and compares the benefits of one over the other from environmental, social, economic, and political aspects.

Table 6: Comparison of advantages of rail & road transport

Rail Freight Transport Strengths	Road Freight Transport Strengths
1. High carrying capacity for large volumes of goods over long distances. 2. Cost-efficient for handling large volumes of goods. 3. Reliable time performance, unaffected by road congestion or traffic delays. 4. Regular transportation regardless of season, time of day, or weather. 5. Requires fewer drivers per ton of cargo. 6.Enhanced security for goods (less vulnerable to theft).	1. Flexibility due to an extended infrastructure network and point-to-point service delivery. 2. Ideal for speedy delivery over short distances (last-mile deliveries). 3. Ease of entry for transport operators. 4. Frequent service availability. 5. Lower investment costs. 6. Lower fees of road system 7.Lower skill requirements for truck drivers 8. Popular and well-integrated into the market. 9. little handling and few transshipments (safety of goods)

Table 7: Resulting challenges for rail freight transport

Rail Freight Transport Challenges			
A stable and consistent demand for investing in a rail-based logistics system is needed	A sophisticated organizational structure is required	International policies are crucial to address fragmentation in rail systems, ensuring interoperability.	Effective development hinges on implementing well-structured financing mechanism

Table 8: Ecological, social, economic and political aspects of rail and road transport

Aspects	Rail Freight System	Road Freight System
Environmental Impacts	1. Lower greenhouse gas emissions and pollutants. 2. Reduced noise. 3. Requires less energy and land use.	
Social Impacts	1. Safer (considering safety measures) 2. Less congestion. 3. Better air quality and reduced noise disturbance.	
Economic impacts	1. Reduced expenses for environmental remediation (due to decreased air pollution). 2. Reduced maintenance and infrastructure costs for roadways. 3. Creates new job opportunities and fosters industrial and commercial development.	1. Facilitates movement of goods. 2. Connects remote areas to economic centres. 3. Contributes to economic growth and regional development. 4. constant maintenance and repairs of roads due to heavy road traffic.
Political impacts	1. Positive impacts related to environmental and transport policies, regional development, and economic equity. 2. Negative aspects include long-term investments, time-consuming planning, regulatory requirements, bureaucratic challenges, and land use/zoning issues.	1. employment opportunities for a diverse range of workers 2. Public dissatisfaction due to congestion, air pollution, road accidents, fatalities, and climate change. 3. Road toll policies subject to political debate.

Picture 4: © Maryam Chegeni

b. Quantitative assessment

The quantitative assessment focuses on the financial implications, illustrating the potential savings and variations in external costs with a hypothetical shift from road to rail as the primary mode of freight transport, considering a future intermodal scenario where rail plays a central role in the journey, complemented by trucks for handling the first and last mile.

Graphic 8: Illustration of the traffic segment considered in quantitative analysis (primary mode in orange)

This analysis conducted for 24 types of goods, presented by five partners, with potentiality to be transported mainly on rail bases on:

- the 'total ton-kilometres saved on roads' in a week.
- the 'total ton-kilometres required on rail' in a week,
- and the unitary values of each external costs (average costs) associated with each mode of transportation, as reported in the Handbook on the External Costs[1] of Transport by the European Commission, expressed in '€ per tkm'.

Total tons*km transported in a week					
Case Studie	TMIL	University North	Varaždin County	Novara	KORDIS
Tn*km on road	3,778,400	3,361,000	2,923,000	1,332,840	257,260
Tn*km on rail	4,054,400	3,709,000	3,666,000	1,766,150	245,145

Table 9: Comparison of all ton-kilometre savings from all case studies of the Rail4Regions project

Subsequently, these sets of data are employed in the subsequent formulas to compute the total external cost, related to each externality, attributed to road and rail-based freight transportation systems, specifically in the segment where rail replaces the road transport system.

Total external cost for road$_e$ (euro)= *Unitary external cost of road*$_e$ * total tkm saved on road

Total external cost for rail$_e$ (euro) = *Unitary external cost of rail*$_e$ * total tkm needed on rail

Finally, the total cost variations within a potential rail-based freight transport system for the group of case studies provided by each partner are computed using the following formula.

External cost variation (euro) = *Total external costs for rail* – Total external costs for road

Looking at all external factors together, the overall deviations in external costs within each case study group show remarkable savings when switching from road to rail as the main

[1] European Commission, Directorate-General for Mobility and Transport, Essen, H., Fiorello, D., El Beyrouty, K. et al., *Handbook on the external costs of transport – Version 2019 – 1.1*, Publications Office, 2020, https://data.europa.eu/doi/10.2832/51388

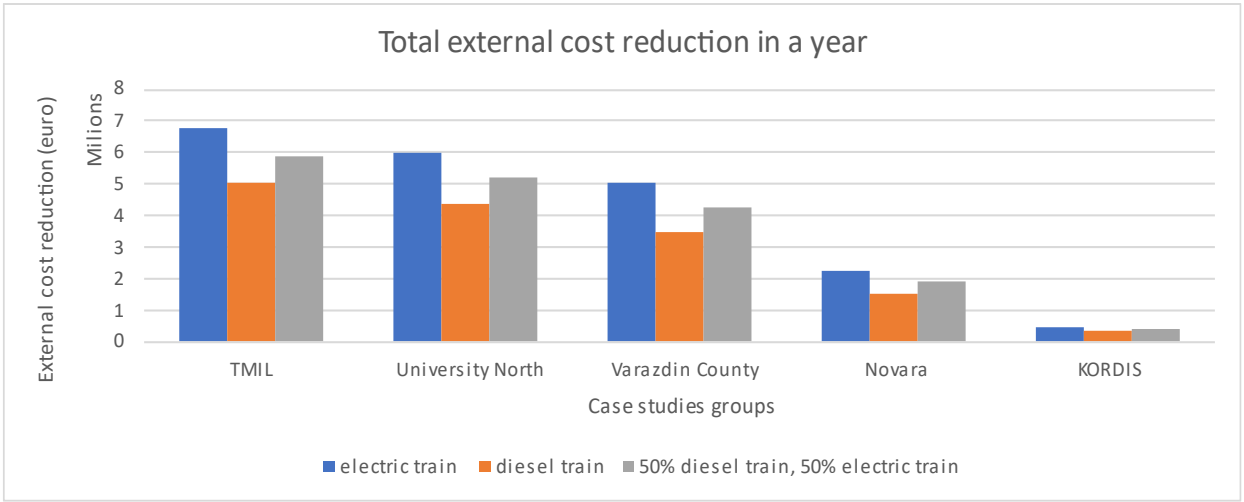
mode of transport. The greater the volume shifted to rail, the more significant the resulting financial savings, which in turn leads to a reduction in external costs. This is illustrated, for example, by the largest and smallest case studies of the project partners TMIL and Kordis, which show annual savings of approximately €6.7 million and €0.5 million, equivalent to 10,800 and 1,414 tons of goods respectively.

Total external costs variation (weekly and annualy) and total tons transported						
Indicators	**scenario**	**TMIL**	**University North**	**Varaždin County**	**Novara**	**KORDIS**
Total tons in a week (tn)	**All**	10,800	10,900	10,000	3,360	1,414
Total cost reduction in a week (euro)	**Electric train**	130,048	115,063	97,408	43,846	9,041
	Diesel train	96,559	84,426	67,127	29,257	7,016
	50% diesel 50% electric train	113,303	99,744	82,267	36,551	8,029
Total cost reduction in a year (euro)	**Electric train**	6,762,495	5,983,252	5,065,219	2,279,972	470,145
	Diesel train	5,021,049	4,390,162	3,490,599	1,521,375	364,851
	50% diesel 50% electric train	5,891,772	5,186,707	4,277,909	1,900,673	417,498

Table 10: Total external costs variation (weekly and annually) and total tons transported

When comparing the three scenarios, the total reduction in external costs is greater when employing electric cargo trains compared to diesel trains (€ 6.7 million and € 5.9 million annually saved, respectively, in the case of employing electric and diesel trains, as evidenced by the TMIL case studies).

However, in the case of utilizing a combination of 50% electric and 50% diesel cargo trains, the total cost savings fall at an intermediate level between the two extreme scenarios (almost € 5 million saved as evidenced by the TMIL case studies).



Graphic 9: Result of the total annual cost reduction of the case studies

5. Objectives and priorities

The analysis of bottlenecks and externalities identifies key objectives for decision-makers, spatial planners, rail transport operators, terminal managers, terminal owners, rail transport operators and engineers. These objectives aim to advance a multimodal freight transport system in which rail assumes a primary role.

a. Recommendations for decision makers

The decision makers at **EU, national and regional** levels have the primary role to promote rail freight transport system. Rail4Regions project highlights the following strategies with **high priority** for decision makers to pursue:

- Allocating well-structured **financing mechanism** in the intermodal freight transport system, with a focus on the cost-reducing advantages of rail transport in mitigating externalities costs.
- Implementing **new laws or policies** that offer incentives to freight intermodal operators and users, such as reducing terminal handling costs or rail taxes. A notable example of best practice is the "Ferrobonus" in Italy, which provides discounts on railway tolls for intermodal operators who choose rail transport over road transport for goods transportation.
- Enhancing and updating the existing **international laws** to overcome infrastructural interconnectivity and **interoperability** problems between countries to obtain an efficient rail freight transport for international trade.
- Enhance the **international laws** to promote a lean and standard **administrative procedure** between countries allowing goods to move swiftly between countries.
- **Courses** organized and incentivized by the government aim to train **qualified personnel** in the rail transport system, catering to both transport operators and interested individuals.
- **New legislation** that compels transport operators and terminal managers to input and gather all data concerning terminal operations within a **standardized data exchange platform** to reduce the time of terminal operations in the terminals.
- Impose higher obstacles for monomodal road transport through higher tolls.

and as a medium priority:

- Identify strategies to involve more stakeholders in rail and multimodal projects, discussions, and workshops.

b. Recommendations for spatial planners

The secondary responsibility for promoting the rail freight transport system lies with **spatial planners,** particularly at the **national and regional** levels. The Rail4Regions project underscores the importance of the following strategies for spatial planners to advance **as a high priority**:

- **Strategic spatial** planning that prioritizes rail lines as the primary freight transport system also considering the needs of small and medium enterprises (SMEs).
- Ensuring **rail connections** between **main lines** and **logistics centres** utilizing electrified tracks.
- Spatial planning preparation for the construction of new terminals
- Assess potential new regional loading infrastructure, from terminals to loading points
- Safeguard existing railway lines and infrastructure by ensuring regular maintenance, modernization, and protection
- Prioritize new industrial development along existing railway lines to maximize connectivity, reduce infrastructure costs, and promote efficient freight transport

and as a medium priority:

- Enhancing rail capacity by revitalizing existing infrastructure and expanding networks through the implementation of new electrified tracks.

- Integration of industrial zones within terminals to boost rail-based economic activities.
- Support the revitalization of former railway lines and infrastructure
- Preserve space around rail infrastructure for future growth and development
- Evaluate and protect areas for potential new rail lines near existing industrial sites

c. Recommendations for stakeholders

Terminal managers

can promote intermodal freight transport system giving **high** priority to:

- Organising a clear and direct guidance of incoming trucks to their position on the loading lane.
- Enhancing safety systems, including the implementation of appropriate signage systems and individual protection devices.

Increasing value-added services at terminals, such as container repair, hiring and selling of containers, energy for refrigerated units etc.

and medium priority to:

- Increasing terminal accessibility time 7days/24 hours.
- Enhancing security systems with surveillance services using security cameras to deter theft and vandalism.
- Considering environmental concerns in internal organisation of terminals.

Terminal owners and managers

should adopt new, flexible safe and efficient loading/unloading equipment's to reduce shunting times (for example: Modalohr, CargoBeamer, NiKRASA, Flexiwaggon, Megaswing, Mobiler)

-> Expanding the capacities of existing terminals and establishing new ones

Rail transport operators

should implement a sophisticated and practical railway service operation schedule that considers all the risk factors that can impact the timeliness and reliability of the rail freight transport system.

Rail transport engineers

should design terminals to accommodate an increased number of marshalling tracks, which can significantly reduce transit times. Additionally, they should plan electrified tracks with appropriate lengths to accommodate trains of varying sizes and allocate sufficient capacity for parking areas within the terminal.

-> Enhancing the technical conditions of railway lines

Forwarders

should prioritize investing in advanced, real-time information exchange systems to facilitate efficient communication throughout the entire logistics chain, particularly regarding transfer times, delays, and operational incidents.

Grafic 10: Recommendations for stakeholders