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CROSSFREIGHT

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D. 1.2.1: Crossfreight Railway Business Process TO BE

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1. Executive summary

This deliverable presents a comprehensive and detailed overview of the future scenario (TO BE) designed for the CROSSFREIGHT project, which aims to enhance the efficiency, integration, and sustainability of cross-border rail and port logistics. Building upon a structured top-down approach, complemented by strong bottom-up contributions, this report provides clear guidance for optimizing shunting operations and business processes within a variety of railway nodes and intermodal terminals.

The methodology combines a high-level strategic framework with concrete, localised input collected through a dedicated survey distributed to all project partners. Each partner contributed in-depth information on their current operational challenges, expected improvements, and planned digital tools and solutions. This shared knowledge has been systematically compiled and analysed to define node-specific interventions that are fully aligned with the overall project objectives.

The report is organised to first illustrate the methodological steps taken and the rationale behind the chosen approach, then to present in a clear and structured manner the responses provided by each partner to a common set of key questions. This format makes it possible to identify recurring needs and priorities, as well as innovative solutions tailored to the unique context of each participating node.

The main outcomes include recommendations for the digitalisation of shunting workflows, the introduction of real-time monitoring and data exchange systems, improved safety and security measures, and stronger coordination among multiple stakeholders. These improvements are expected to deliver tangible benefits, such as reduced operational costs and delays, increased capacity utilisation, lower environmental impact, and better service reliability.

Finally, this deliverable serves as a practical reference for the design and implementation of pilot actions, ensuring that each node can test, validate, and scale up the proposed innovations effectively. It also lays the foundation for transferring the most successful practices to other logistics hubs within and beyond the project area, thereby contributing to the wider goal of creating a greener and smarter European transport network.

2. Methodology

To define the TO BE scenario for the CROSSFREIGHT project, a top-down methodological approach was adopted. This approach begins with a comprehensive analysis of the current AS IS processes in the identified railway nodes and progressively narrows the focus to the critical aspects that require optimization. Building on this initial framing, a structured survey was carefully designed and distributed to all project partners to gather detailed and context-specific input on existing operations, prevailing challenges, and the expected improvements to be realized through pilot actions.

While the general structure follows a top-down logic - providing a coherent framework and common objectives - its actual implementation evolves into a bottom-up process. This is because the final version of the TO BE scenario is the result of aggregating, harmonizing, and synthesizing the diverse contributions, practical insights, and operational knowledge provided directly by each partner. In this way, the methodology ensures that strategic goals are firmly grounded in the real operating conditions of each node, allowing for solutions that are both realistic and transferable.

This dual approach fosters strong stakeholder engagement and supports the identification of locally relevant priorities, while guaranteeing alignment with the overarching project vision. By combining qualitative and quantitative insights and integrating feedback loops between the central project team and the individual partners, the methodology creates a solid and flexible basis for designing efficient, interoperable, and digitally supported solutions that respond effectively to the diverse needs of the participating railway and port nodes.

The survey is presented below.

a. Survey Introduction

This document aims to analyze and define the "To Be" scenario for Crossfreight, focusing on key processes to be implemented through pilot projects at various operational nodes. It follows a top-down methodology, starting from the current "As Is" state and identifying critical aspects that require

optimization. A structured survey will guide the selection of processes for implementation, supported by flowcharts, diagrams, and visual representations. The analysis will highlight both strengths and weaknesses using an infographic format with green and red flags. Key questions will address operational and business objectives, expected outcomes, and integration of ICT tools. The pilot project framework will define specific interventions and process improvements. Additionally, the study will explore cost reduction, efficiency gains, and streamlined operations. A short report will document the pilot's architecture and operational scenarios. Finally, potential resistance to technological changes and strategies to overcome them will be discussed.

b. Survey Methods

For the analysis of the To Be Scenario it was decided to implement a top-down methodology, which started from the as-is analysis of the different nodes and tended to narrow the focus of the analysis on the critical processes to be implemented in the pilots.

Subsequently, by means of the framework presented below, consisting of a survey oriented to the individuation of the processes to be implemented through the pilots in the different nodes, we expect to elaborate the To Be scenario by means of flow chart representations, diagrams and images to understand what the expected outputs will be.

c. Infographic on critical issues

Produce an infographic to list the main aspects to be addressed in the pilot following the scheme below, highlighting positive and negative aspects through green flags and red flags as an example for the Port of Ravenna:

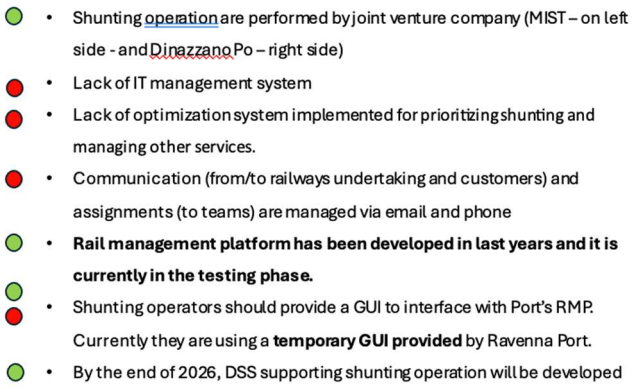

Figure 1: In order to take into account positive and negative issues, please use green flag for the strength point and the red flag for the point of weaknesses.

d. Questions

Based on the main critical aspects highlighted by the red flags above, please answer the following survey:

1. What are the operational and business objectives to be achieved through the implementation of the business processes?
2. What are the central points you aim to implement through the introduction of new business processes in the nodes?
3. What are the main expected outputs (cost reduction, shunting times, etc.)?
4. Create operational scenarios with the integration of ICT tools in reference nodes.
5. Define intermediate processes and the different steps for the introduction of the main solutions.
6. What are the main resistances to change and how can they be addressed in the introduction of technological implementations in the different nodes?
7. Which are the other operators involved in the new business processes in the node?
8. Does this new business process influence safety and/or security?
9. Is this new business process based on an already existing national/European regulation?

3. Crossfreight Railway Business Process TO BE

The main goal of this activity is to deliver a comprehensive report that illustrates in detail the methodological steps and practical approaches adopted to optimize and streamline the business processes identified within the various railway nodes participating in the CROSSFREIGHT project. Building upon the thorough analysis of the current operational context (AS IS), the report outlines a future, improved scenario (TO BE) that includes targeted recommendations for process reorganization, the integration of advanced digital tools, and the introduction of innovative ICT solutions to address identified inefficiencies and bottlenecks.

This future-oriented scenario provides a robust and shared framework that not only aims to increase the overall efficiency and fluidity of shunting operations but also seeks to strengthen coordination mechanisms among the multiple actors involved in freight flow management. By harmonizing workflows and fostering seamless information exchange, the TO BE scenario supports the creation of a more resilient, integrated, and sustainable rail freight transport system.

Furthermore, this deliverable plays a crucial role in ensuring that all partners have a clear and consistent reference for implementing pilot actions and testing new digital solutions in real operational contexts. The insights and guidelines contained herein will also facilitate knowledge transfer and the replication of successful strategies across other nodes, contributing to the long-term objective of modernizing and enhancing the competitiveness of cross-border rail logistics within the project area and beyond.

In the following section, each question is presented individually, followed by the respective answers provided by each project partner. This structure allows for a direct comparison of perspectives, needs, and priorities across the different nodes, while also highlighting common trends and complementary approaches. The answers serve as the foundation for shaping node-specific pilot actions and for defining a coordinated strategy for process optimization and digitalization throughout the project area.

I. What are the operational and business objectives to be achieved through the implementation of the business processes?

PP1 Fondazione ITL – Port of Ravenna: Operational and business objectives of the Ravenna pilot action is to streamline and optimize operational railways process in the intermodal node at so-called "Canale Candiano" yard among the different value chain stakeholders including Railway Undertaking, Shunting operator, connected logistics and terminal companies as well as Ravenna Port Authority. The overall objective is to shift from the actual manual operation of single railway shunting process managed via e-mail and phone to the expected assisted automation (TO-BE scenario) through a customized and interoperable IT management system, enabling to prioritize shunting operations, to optimize resources allocation as well as to digitalize data sharing in the intermodal node of the Port of Ravenna with potential transferability to the intermodal nodes of Emilia-Romagna Intermodal Cluster and other nodes.

PP2 Adriafer – Port of Trieste: The business goal is to smooth the train circulation within the Trieste port areas in order to increase the throughput and better manage the train traffic. In order to achieve this goal, operational processed digitalization is one of the main key success factors. The train circulation procedures digitalization started in 2019 and covered already several relevant steps such as PCS Sinfomar train circulation management module realization and Trainshunt software implementation in Adriafer shunting company. The vision is to have a unique data source (the PCS Sinfomar) for train shunting request, train security authorizations etc. To achieve this goal the PCS Sinfomar and Trainshunt have been already integrated but not all the current operational processes have been digitalized.

PP3 AIN: The operational objectives at AIN focus on enhancing safety management procedures through the implementation of a digital platform dedicated to the reporting and analysis of railway accidents and incidents. This solution aims to streamline the investigation process, reduce manual data handling, and provide rapid access to critical information across departments and relevant authorities.

From a business standpoint, the introduction of this digital tool is intended to support continuous improvement in service quality and operational performance. The platform will enable more accurate performance monitoring, generate data-driven insights, and ensure timely compliance with national and European safety obligations. By reinforcing a safety-first culture through automation, AIN also aims to improve internal efficiency, reduce legal risks, and strengthen its role as a reliable logistics partner.

PP4 ERF – Port of Marghera: The main operational objective for ERF at the Port of Marghera is to significantly enhance the safety of shunting operations by introducing a structured system for monitoring and managing the maintenance of railway infrastructure elements, particularly those in last-mile contexts. This is especially important given the complexity of shunting activities and the coexistence of multiple actors operating on shared tracks.

On the business side, this process aims to reduce costs associated with unexpected infrastructure failures and inefficient maintenance planning. By leveraging digital tools to systematically collect and analyse infrastructure data, ERF seeks to adopt a more predictive and cost-effective maintenance strategy. This, in turn, will minimize operational disruptions, improve reliability, and contribute to safer, more sustainable logistics processes across the Port of Marghera rail node.

PP6 Sangritana – Terminal Saletti: The operational objectives of Sangritana at Terminal Saletti are primarily focused on the digital transformation of rail circulation monitoring activities across its 12-km rail node. The aim is to implement a fully integrated IT solution that enables the precise tracking of train movements in real time, ensuring better coordination and flow management. This is particularly critical due to the single-track configuration of the infrastructure, where delays or miscommunication can lead to significant operational inefficiencies.

From a business perspective, the objective is to reduce dependence on manual processes, thereby limiting the impact of human error and lowering the number of staff required for routine circulation control. In parallel, the company aims to increase service reliability and safety standards, both for its own rail services and for those operated on behalf of third parties. By adopting digital monitoring and data logging tools,

Sangritana also seeks to enhance operational transparency and improve the predictability of train arrivals and departures — factors that are increasingly crucial for maintaining competitiveness in intermodal logistics. Ultimately, the initiative contributes to higher productivity, reduced operational costs, and greater confidence from clients and stakeholders.

PP7 Port Authority of Sibenik – Port of Sibenik:

Operational Objectives:

- Increase Efficiency: Reduce shunting times per wagon and total cycle times by automating manual processes and enabling real-time coordination.
- Enhance Safety: Minimize human errors and communication failures through digital tools, improving the reliability of shunting and train movements.
- Improve Flow Management: Enable seamless logistics flows by tracking trains and wagons in real time and optimizing terminal operations.
- Boost Capacity: Increase the number of wagons handled per hour and trains operated daily, supporting planned growth (e.g., cement and container cargo).

Business Objectives:

- Cost Optimization: Lower operational costs by reducing manual labor and delays, enhancing cost recovery for shunting services.
- Competitiveness: Position the Port of Šibenik as a viable feeder port by modernizing processes, attracting new business (e.g., container traffic).
- Sustainability: Reduce reliance on truck transport, lowering CO2 emissions and aligning with environmental goals.
- Scalability: Build a flexible, IT-driven framework to accommodate future expansion (e.g., new quays, increased freight tonnage).

PP 8 Transagent – Port of Rjieka: Pilot activity of the Transagent Rail Ltd. includes upgrading of the IT system to harmonize technical and financial indicators and to generate financial indicators from the

technical indicators. It means that the user, Transagent Rail Ltd., can see anytime if the technical performance generates profit or loss, all incurred costs, but also show other performances, such as train driver's working hours, energy used, all potential additional costs etc. Improved digital solutions will contribute to increase efficiency and improving market competitiveness in carrying out the procedures of cargo transportation, which is the company's core activity.

Through the implementation of pilot activities, it will be possible to provide better and more quality services, reduce costs, shorten the duration of the process, better accuracy and reliability, better visibility and effective exchange of timely information and documentation with partners in procedure of transporting goods. Improved performance will result in a bigger competitiveness of Transagent Rail Ltd. in the domestic and cross-border market.

Operational - The ability to monitor resources in real time, simplified and faster communication within different departments of the company, as well as simplified and faster communication between the service provider and the customer.

Business – better organization of operational resource utilization, which results in reduced company costs and better communication and faster service between the service provider and the customer.

II. What are the central points you aim to implement through the introduction of new business processes in the nodes?

PP1 Fondazione ITL – Port of Ravenna: The rationale behind the pilot of the intermodal node of the Port of Ravenna is to define and implement a new business process leveraging optimization strategies though IT shunting management system which will be developed and field operation tested. The central points are represented by the need to optimize the planning and execution phase of the shunting operations in the Candiano yards (left-side yard "Candiano" and right-side yard "Base e Pesa"), enabling to achieve effective resources allocation and reduce times and movement of the rolling stock. The IT system aimed

at optimizing planning (scheduling) procedures efficiency through an optimization of trains placement in railway yards and their movements.

PP2 Adriafer – Port of Trieste: The aim is to give to final users a unique IT tool, the PCS Sinfomar, for shunting requests in the Trieste port area. In order to achieve this goal, all the main operational processes have to be covered. The project will target the realization of new digitalized operational processes between Sinfomar and Trainshunt regarding:

- Shunting requests cancellation
- Shunting requests suppression
- Share the same wagon cars database between the 2 IT systems
- Simplify the train security authorization process for shunting operations

PP3 AIN: The core focus of the new business processes at AIN is the full digitalization of accident and incident reporting workflows. Currently managed through Excel sheets and manual communication channels, the goal is to migrate to an integrated software platform with secure login access and user-friendly interfaces.

This platform will allow for faster input, real-time monitoring, and consistent documentation of events, including accident notifications, on-site investigations, and the issuing of safety recommendations. By introducing an online form directly accessible through the company's website, AIN also seeks to facilitate more immediate and standardized communication with stakeholders such as infrastructure managers and railway undertakings. The overall objective is to improve internal efficiency, ensure regulatory compliance, and create a centralized knowledge base for continuous safety improvement.

PP4 ERF – Port of Marghera: The central objective of ERF's new business processes is to enhance situational awareness and control over the condition of the railway infrastructure used for shunting operations. This involves the systematic collection of infrastructure data, focusing particularly on critical

components such as track switches, connection points, and yard-specific elements that are often neglected in broader national railway maintenance frameworks.

The implementation of a digital monitoring system will allow ERF to establish a predictive maintenance strategy, optimizing intervention timing and reducing downtime. This shift from reactive to proactive management will not only improve safety but also extend the lifecycle of infrastructure assets and enable better planning of daily operations. Ultimately, it supports the transition to a more resilient and data-driven operational environment.

PP6 Sangritana – Terminal Saletti: The key priority would be to monitor the rail traffic flow on Sangritana's rail tracks, as well as to guarantee the security of the trains once parked in terminal.

The monitoring of rail traffic on a 12km rail node is crucial as it is performed on a single-track path, therefore there is the need to reduce waiting times.

The security of the trains parked in terminal is essential as the terminal is currently not controlled by security guards and it is essential to guarantee the security of the goods stored in terminal during the parking phase of the wagon sets.

PP7 Port Authority of Sibenik – Port of Sibenik:

- Digitalization of Communication: Replace telephone-based coordination with a reliable digital platform (e.g., mobile app or radio network) for instant, logged interactions.
- Automation of Infrastructure: Upgrade manual switches and crossings with automated, remotely controlled systems to streamline shunting.
- Real-Time Monitoring: Implement IoT and GPS-based tracking to provide visibility of train and wagon locations across the node.
- Terminal Optimization: Introduce a Terminal Management System (TMS) to automate wagon allocation and loading/unloading schedules.
- Data-Driven Decision Making: Enhance the IST system with analytics to monitor KPIs and predict operational bottlenecks.

PP 8 Transagent – Port of Rjieka: The central focus of Transagent's new business processes is to enhance operational communication and coordination between internal departments, infrastructure managers, and end-users of railway services. The company aims to implement a digital platform that streamlines the exchange of technical, scheduling, and service-related information — reducing delays caused by fragmented or informal communication methods.

In addition to real-time data sharing, the system will also support structured feedback loops, enabling continuous performance assessment and adjustment. By digitizing these communication flows, Transagent seeks to ensure that critical data (e.g., train status, cargo information, crew allocation) is available to all stakeholders at the right time, ultimately improving reliability, reducing misunderstandings, and supporting high-quality service delivery in cross-border freight operations.

III. What are the main expected outputs (cost reduction, shunting times, etc.)?

PP1 Fondazione ITL – Port of Ravenna: The main expected outcomes achievable by the implementation of the IT management system are represented by improving efficiency of operations, reducing operational costs by minimizing trains' waiting times and optimizing shunting teams allocation, increasing the intermodal node and shunting tracks' capacity utilization, reducing CO2 emissions of diesel locomotive operations, reducing energy consumption, enhancing interoperability and synchronization among different stakeholders (Railway undertakings, Railway Infrastructure Manager, Shunting operators, terminal operators, MTOs, Ravenna Port Authority).

PP2 Adriafer – Port of Trieste: The main expected outputs are:

- Increase the number of digitalized processes concerning train circulation management within the Trieste port areas;
- Offer to final users new functionalities to smooth the IT system adoption in real operations;

- Increase data quality between the IT systems interactions.

PP3 AIN: The main expected outputs of the digitalization process at AIN include a significant improvement in the speed, accessibility, and reliability of safety-related data. By replacing manual Excel sheets with a secure digital platform, the process will enable faster reporting and retrieval of information related to accidents and incidents, thereby supporting quicker decision-making and follow-up actions.
Efficiency gains are expected through reduced administrative workload, fewer errors in data entry, and easier sharing of safety documentation with stakeholders. Additionally, the new system will allow for trend analysis and reporting over time, thus helping to identify recurring issues and formulate targeted preventive measures. Ultimately, this will improve the safety culture across the node and enhance regulatory compliance.

PP4 ERF – Port of Marghera: The expected outputs of ERF's new maintenance-oriented process include substantial improvements in both operational safety and cost efficiency. By implementing a digital monitoring system for the railway shunting infrastructure, ERF will be able to anticipate faults and schedule maintenance activities more effectively, reducing the risk of incidents during shunting operations.
From a financial perspective, the shift to condition-based maintenance will help lower the overall costs by preventing unplanned downtimes and avoiding over-maintenance. Additional benefits include more predictable asset performance, better planning of yard capacity, and increased availability of tracks for operational use. This, in turn, will contribute to smoother rail movements and improved service quality for all users of the Marghera rail node.

PP6 Sangritana – Terminal Saletti: At Terminal Saletti, the expected outputs of the new system are multifold. Operationally, the real-time tracking of all trains entering and exiting the 12-km network will eliminate the current reliance on manual calls and radio coordination, significantly reducing errors and

delays. This will streamline internal workflows and improve scheduling precision, especially on the single-track segment.

In terms of security, the deployment of surveillance equipment will provide 24/7 monitoring of parked wagons, helping to deter theft and reduce incidents of cargo tampering. These improvements are expected to result in reduced insurance costs, enhanced customer satisfaction, and higher credibility of Sangritana as a logistics provider. The system will also generate valuable data for long-term planning and optimization.

PP7 Port Authority of Sibenik – Port of Sibenik:

- Cost Reduction: Decrease labor costs by reducing manual switch operations and verbal coordination (e.g., fewer staff hours per shunting operation); Lower maintenance costs through predictive analytics identifying infrastructure issues early.
- Shunting Times: Reduce shunting time per wagon from 15 minutes to 5-10 minutes with automated switches and real-time tracking; Shorten total cycle time (loading to delivery) for 20 wagons from 7 hours to 4-5 hours via optimized terminal processes.
- Capacity Increase: Raise wagons handled per hour from 3 to 6-8, enabling higher daily train throughput.
- Safety Improvements: Decrease incidents caused by human error or communication failures by at least 50% with automation and digital tools.
- Environmental Benefits: Shift cargo from trucks to rail, potentially reducing CO2 emissions by 20-30% per tonne-kilometer once freight trains resume.

PP 8 Transagent – Port of Rjieka: The new IT system at Transagent is expected to yield several key outputs. First, by linking technical performance indicators with financial metrics, the company will be able to track profitability and efficiency in real time for each operation, allowing for timely and data-driven decisions. Operational improvements include faster processing times, reduced paperwork, and a better match between workforce deployment and actual operational needs. The enhanced visibility of train movements

and cargo status will also improve communication with partners, reduce service errors, and accelerate turnaround times. These factors will collectively contribute to lowering operational costs, enhancing service quality, and boosting Transagent's competitiveness in both national and international rail freight markets.

IV. Create operational scenarios with the integration of ICT tools in reference nodes.

PP1 Fondazione ITL – Port of Ravenna: Operational scenarios based on the integration of the IT management system in the intermodal node of Ravenna are characterized by anticipating information among relevant stakeholders on trains arriving or departing in the railway node, enabling to timely scheduling shunting tracks slots for inbound or outbound operations performed by allocated shunting locomotive attaching the rolling stock and moving to the destination. These operations are expected to be integrated and interoperable with the Rail Management Platform of the Ravenna Port Authority, enabling to share within the Port's ecosystem shunting operations' data and information such as train number, time of train arrival, number of wagons, type of wagons, state of wagons (empty, load), wagons length, number of axes per wagon, maximum load, type of goods, estimated time of arrival (ETA), time of arrival, etc.

PP2 Adriafer – Port of Trieste:

SCENARIO 1:

The terminal operator must require a train shunting between its areas and the train station. The data are inserted in the PCS Sinfomar and transferred, via interoperability channels, to Adriafer Trainshunt IT tool. The Adriafer planners accept the train shunting request, assigning it to an operational team which will perform the activity. All the relevant operations information is shared ex post from Trainshunt to Sinfomar.

In case the terminal operator does not need to operate the shunting request anymore, it will edit in Sinfomar a suppression, The data will be transmitted to Trainshunt.

If the terminal operator has inserted in Sinfomar the train shunting request data but it has not sent them to Trainshunt, in the case of no more need, it will edit in Sinfomar a cancellation.

SCENARIO 2:

Based on Ordinanza 05/2017 AdSP MAO all the trains inbound/outbound to/from the Trieste Port Area Punto Franco Nuovo have to be declared in order to ensure the public entities controls at the customs borders (such as Customs Agency, Finance Guard, etc.). This is the customs process of a train. In parallel there is the operational / circulation process of a train. In such a case in the PCS Sinfomar there is the need to have all the required data to ensure AdSP MAO Train Circulation office staff to authorize the Adriafers shunting operator security request for Port Railway Gates transit. The data of the 2 processes have to be shared among PCS Sinfomar and Trainshunt IT systems in order to let the operators work in their respective software. Moreover, there is the need to combine the data of the two processes in order to have a complete train history within the Sinfomar PCS.

SCENARIO 3:

Based on AdsP MAO Ordinanza 05/2017 the train manifest declarations have to be performed by the train agents, typically operating in offices and not directly present on the field. This implies that the data submission can sometimes be unprecise or different in respect of the real wagons circulation in the train station and port areas. Adriafer operative staff that acts on the field has concrete evidence of the real wagons to be shunted. The information is currently edited in the Trainshunt IT system and, thus, can differ from the one declared by the train agents in the PCS Sinfomar. Thanks to software procedures the is the need to import wagons data from Trainshunt platform to PCS Sinfomar platform in order to combine, if possible, to the ones already present in the system. The new procedure will also restrict manual data errors and, thus, improve wagons data quality.

PP3 AIN: In AIN, the envisioned operational scenario involves the deployment of a secure, web-based platform for managing all aspects of railway accident and incident investigations. This ICT tool will replace existing Excel-based documentation.

The software will support structured workflows covering accident notification, on-site investigation documentation, investigation status (open/closed), and the management of safety recommendations. Advanced filtering and data visualization features will help identify high-risk areas, recurring causes, and performance gaps. Over time, this system is expected to become a reference hub for improving operational safety, ensuring legal compliance, and facilitating internal audits and reporting.

PP4 ERF – Port of Marghera: The envisioned operational scenario for the Port of Marghera foresees the integration of the new ICT monitoring solution with the system already in use for managing the overall shunting process (SIMA). Through this interoperability, data on the condition of railway infrastructure elements (e.g., switches, junctions, and yard-specific tracks) will be automatically shared with shunting planners.

In practice, real-time alerts on infrastructure status and predictive maintenance recommendations will feed directly into the daily scheduling of shunting activities. This will allow planners to anticipate possible disruptions, optimise the allocation of tracks, and reduce unexpected downtimes. Moreover, by coupling infrastructure data with operational planning tools, the system will ensure safer movements, higher reliability, and a more efficient use of available capacity.

Ultimately, the integration of these ICT solutions will enable ERF to shift from reactive to proactive infrastructure management, contributing to smoother shunting workflows, enhanced safety, and better coordination among the multiple actors operating in the Marghera rail node.

PP6 Sangritana – Terminal Saletti: The key operational scenario we have planned is to integrate position tracking devices on the locomotive and, on the same train, at the end of the shunted wagon set.

By using fixed poles during the passages, it will be possible to track the transit of each train, displaying the result on a screen. The results displayed will be mapped according to the current node, serving as a low-cost traffic monitoring system.

With the aid of sensor and movement-catching cameras, our intention will be to add to the position tracking devices also the cameras, 4 per train, 2 per train-side, 2 at the front and 2 at the back of train, pointing out the cameras towards the center of the train. This way the system will monitor any movement made by any person towards the train. If a theft attempt happens, cameras will take, out of night-vision frames, the time, the place and pictures of the event, providing important material for the research.

Altogether, the indicated solution will represent a huge development to the status.

PP7 Port Authority of Sibenik – Port of Sibenik:

Scenario 1: Arriving Freight Train with Cement Cargo

Current ("As Is"): A train arrives at Ražine, undergoes a 30-minute brake test, and the shunting manager calls the dispatcher. Switches are manually set, and wagons are moved to Track 4 and then to the Rogač terminal over 15 minutes per wagon.

Proposed ("To Be"):

IoT sensors confirm brake test results in 15 minutes, automatically notifying the dispatcher via a mobile app.

SCADA system remotely sets switches in seconds, and RTMS tracks the train to Track 4.

TMS assigns wagons to Rogač, with shunting completed in 5-7 minutes per wagon. Total time: ~2 hours for 20 wagons.

Scenario 2: Departing Container Train

Current ("As Is"): Wagons are loaded at Dobrika, manually connected, and the dispatcher authorizes departure via telephone after 7 hours for 20 wagons.

Proposed ("To Be"):

TMS optimizes loading, reducing time to 4 hours. RTMS confirms wagon positions.

Automated switches align tracks instantly, and the app notifies the dispatcher for approval.

Train departs with a total cycle time of 4.5 hours, tracked live to Ražine.

PP 8 Transagent – Port of Rjieka: The operational scenario at Transagent foresees the full integration of a centralized digital platform capable of collecting, processing, and distributing data related to train operations in real time. This includes train arrival and departure times, cargo details, crew assignments, energy consumption, and incident reports.

The system will enable seamless communication between departments — such as traffic planning, operations, finance, and maintenance — as well as with external partners like infrastructure managers and clients. By automating these processes, the ICT platform will reduce redundancies, improve accuracy, and allow for faster turnaround times. Additionally, the system will generate key performance metrics that can be used to evaluate the efficiency of each operation, contributing to continuous improvement and better strategic planning.

V. Define intermediate processes and the different steps for the introduction of the main solutions.

PP1 Fondazione ITL – Port of Ravenna: Intermediate processes and different steps for the introduction of the envisaged IT shunting management system in the intermodal node of Ravenna are represented by:

- functional and technical requirements definition for the IT shunting management solution by the consultation of different stakeholders and ensuring compliance with international technical standard requirements.
- design of the IT management solution, ensuring needed interoperability with other ICT systems and platforms and scalability/replicability to other intermodal nodes which are planning to increase shunting processes' level of automation.

• implementing the testing phase covering the following tasks: functional testing, system testing, integration testing, security testing, compliance testing, defect analysis, re-testing phase based on field operational test's results, fine-tuning.

• deployment of the IT shunting operations management module in production environment once completes field operation tests (FOTs) execution (Activity 2.2) in the node according with CROSSFREIGHT FTOs plans (Activity 2.1).

PP2 Adriafer – Port of Trieste: For all the three scenarios the process steps will be the following ones:

- As is scenario analysis;
- Definition of the software requirements;
- Realization of the new software procedures;
- Technical tests;
- Software procedures bugfix and / or refinements;
- Key users selection;
- Key users test and feedbacks.

PP3 AIN: The implementation of the new digital platform at AIN will follow a multi-step process to ensure a smooth transition from current manual procedures. The first step involves the creation of an online form, hosted on the institutional website, allowing infrastructure managers, railway undertakings, and other stakeholders to notify accidents and incidents directly and in a standardized format.

The second step includes the development and deployment of a secure login-based software platform where all data related to accident investigations — from initial notification to final recommendations — will be entered, stored, and analysed.

Subsequently, user training sessions will be organized for internal staff to ensure effective use of the platform. Finally, the system will be tested in a controlled environment and then rolled out in full, with feedback loops integrated to address technical or procedural issues. This structured approach will ensure high data quality, enhanced traceability, and faster communication during emergencies.

PP4 ERF – Port of Marghera: The introduction of ERF's new ICT tool will be carried out in alignment with existing systems such as SIMA, ensuring seamless integration and interoperability. The first step in the process is the definition of functional and technical specifications, based on consultations with internal staff and system providers.

This will be followed by the development of interface protocols enabling data exchange between the new monitoring solution and SIMA, especially regarding infrastructure condition alerts, maintenance schedules, and track usage data. A pilot testing phase will be launched in a selected segment of the shunting network, allowing for real-world validation of system performance.

After addressing any integration issues, the tool will be deployed across the full network, accompanied by training sessions and support for operational staff. Finally, KPIs related to infrastructure reliability, maintenance costs, and service punctuality will be monitored to assess the system's impact and support continuous improvement.

PP6 Sangritana – Terminal Saletti: The main solution will be implemented following a 3 steps process.

The first step will be to test the hardware solution, in order to obtain meaningful results both from the mobile tracking devices and from the fixed poles during the journey.

At the same time, the second step will be to connect the hardware to an easy-to-use software solution, capable of offering the basis for the real time mapping of the node.

The final step will be the implementation phase, train by train, in order to test the interaction between the system and the user.

In parallel, also the security monitoring devices will be tested and installed at the terminal.

PP7 Port Authority of Sibenik – Port of Sibenik:

Solution 1: Real-Time Monitoring System (RTMS)

Step 1: Install IoT sensors and GPS on tracks and locomotives (3-6 months).

Step 2: Develop a cloud-based dashboard for data visualization (4 months).

Step 3: Train staff on usage and integrate with IST (2 months).

Solution 2: Automated Switches and Crossings

Step 1: Assess and replace dilapidated switches with SCADA actuators (6-9 months).

Step 2: Connect actuators to a central control system (3 months).

Step 3: Test automation and train operators (2 months).

Solution 3: Digital Communication Platform

Step 1: Deploy a TETRA radio network or mobile app (3 months).

Step 2: Phase out telephone lines and train staff (2 months).

Step 3: Monitor reliability and adjust (1 month).

Solution 4: Terminal Management System (TMS)

Step 1: Design TMS software with AI for wagon allocation (6 months).

Step 2: Integrate with RTMS and IST (3 months).

Step 3: Pilot at one terminal (e.g., Rogač) and scale (3 months).

Timeline: Full implementation across all solutions: 12-18 months.

PP 8 Transagent – Port of Rjieka: The rollout of Transagent's upgraded IT system will proceed through several carefully planned steps. Initially, operational needs will be identified and mapped to define the software requirements, focusing on the integration of technical indicators (such as fuel use, driver hours, and wagon performance) with financial metrics.

Next, a tailored software module will be developed and tested internally to ensure the accurate generation of reports and dashboards for both operational and financial departments.

Following successful testing, data entry protocols will be established, ensuring that all relevant actors — including train operators and administrative staff — input consistent and timely data. The system will then

be connected to external platforms, where possible, to facilitate real-time information exchange with customers and infrastructure managers.

The final stage includes training, refinement based on feedback, and monitoring of performance to guarantee the reliability and scalability of the new business process.

VI. What are the main resistances to change and how can they be addressed in the introduction of technological implementations in the different nodes?

PP1 Fondazione ITL – Port of Ravenna: Stakeholders may resist transitioning from familiar paper-based, email and phone-based workflows to digital processes due to concerns about usability, job displacement, or distrust in technology. Overcoming resistance through effective management changes and training is essential for successful implementation. Automation-driven solutions and digitalization procedures implementation need training activities for the end-users of the IT shunting management system (managed by email and phone) for the different stakeholders involved in the processes such as railways undertakings, shunting operators and freight terminals.

PP2 Adriafer – Port of Trieste: Adriafer anticipates several challenges in introducing new digital processes, primarily related to resistance from staff accustomed to existing manual or partially digital workflows. Many employees are familiar with established operational routines, and the introduction of new software solutions requires additional time and effort, particularly for key users who will participate in testing and feedback sessions.

Moreover, the transition demands not only technical readiness but also a cultural shift toward data-driven operations. Another concern is the potential misalignment between data collected in the field by operators and those declared by train agents via the PCS system.

To address these challenges, Adriafer plans to adopt a phased implementation strategy, supported by targeted training sessions and clear communication of the long-term benefits. Involving users early in the

development and validation stages will help build ownership and confidence in the system. Cross-verification protocols will also be implemented to ensure consistency and reliability of operational data.

PP3 AIN: The main resistance to change at AIN lies in the lack of standardized procedures for the submission of accident and incident notifications. Current practices rely on a combination of phone calls and emails that have been in use since the establishment of AIN, which, while functional, are fragmented and prone to delays or data loss. This online form option will be offered as an additional reporting option. AIN will maintain multiple reporting channels, including the introduction of an intuitive online form alongside the existing phone call and email system.

PP4 ERF – Port of Marghera: One of the key barriers faced by ERF is the regulatory uncertainty surrounding the management of last-mile railway shunting infrastructure. In many cases, national guidelines do not clearly assign responsibility or provide specific operational standards for shunting tracks, which can create hesitation in investing in digital monitoring systems or introducing proactive maintenance policies.

Furthermore, there may be internal skepticism among operational teams who perceive infrastructure as the responsibility of the infrastructure manager rather than the shunting operator. To overcome this, ERF will work closely with regulatory authorities and infrastructure owners to clarify roles and responsibilities. At the same time, a structured awareness campaign will be launched internally to highlight the direct benefits of enhanced infrastructure visibility — particularly in terms of safety, cost savings, and improved coordination with terminal operations.

PP6 Sangritana – Terminal Saletti:

The key resistances to change are always user driven. The current scenario has in the actual average age of the users the potential obstacle in the development.

As the average age of the traffic managers is quite high, the platform will have to be easy to use, or it will not be used.

At the same time, the other key issue will be the easiness of the devices' mounting processes. Having issues in mounting the devices on the train will create obstacles to the personnel, preventing the regular usage of the devices. To solve this issue, hooks and guides will be installed on the devices proving the easiness of installation process.

The final point connected to devices is related to the battery life and the resistance of the devices. As the devices may fall several times, it is essential that these devices are constructed with a protective shell. At the same time, the battery life will have to prove a shift-wise length productivity.

PP7 Port Authority of Sibenik – Port of Sibenik:

- Staff Reluctance: HŽ Cargo employees accustomed to manual processes may resist automation.

Solution: Provide comprehensive training (e.g., 20 hours per employee) and highlight job security (focus shifts to oversight roles).

- Cost Concerns: High initial investment may deter Luka Šibenik and HŽ Infrastruktura.

Solution: Present ROI projections (e.g., cost savings within 3 years) and seek EU funding (e.g., CEF Transport program).

- Legacy Systems: Integration with IST may face technical challenges.

Solution: Use APIs and phased upgrades to ensure compatibility.

Addressing Approach: Engage stakeholders early, pilot solutions on a small scale (e.g., one terminal), and demonstrate tangible benefits (e.g., time savings).

PP 8 Transagent – Port of Rjieka: Transagent identifies two main sources of resistance: technical and human. On the technical side, certain sections of the railway network may lack the necessary infrastructure to support advanced digital systems, including stable connectivity and reliable hardware. On the human side, some employees may be reluctant to adopt new technologies due to limited digital skills or concerns about added complexity.

To address these challenges, Transagent plans to combine infrastructure upgrades — such as better connectivity and robust device support — with a structured training program aimed at familiarizing staff

with the new system. Training will be tailored to different user roles and supported by documentation, live demos, and ongoing helpdesk support. This dual approach will foster confidence in the system and encourage full engagement in the digital transition.

VII. Which are the other operators involved in the new business processes in the node?

PP1 Fondazione ITL – Port of Ravenna: The implementation of the new business processes at the Port of Ravenna involves the active participation of a broad range of stakeholders operating within the intermodal ecosystem. These include **terminal operators**, responsible for handling cargo and train interface operations; **multimodal transport operators (MTOs)** and **logistics service providers**, who rely on coordinated rail movements to ensure efficient end-to-end supply chains; and the **Ravenna Port Authority**, which plays a governance and regulatory role in ensuring that the digital processes align with broader port development strategies.

Additionally, **railway undertakings (RUs)** and **shunting service providers** are directly involved in executing and adjusting operations in real time. The integration of the IT shunting management platform will require continuous collaboration among these actors to enable effective data sharing, synchronised operations, and the achievement of shared performance goals.

PP2 Adriafer – Port of Trieste: The digitalization of train circulation and shunting requests at the Port of Trieste involves a complex network of stakeholders. At the core are the **AdSP MAO Train Circulation Office staff**, who are responsible for overseeing and authorizing train movements within the port area, in compliance with Ordinanza 05/2017.

Equally central are **Adriafer's operational coordinators and production teams**, who manage the physical execution of shunting activities and interact directly with the IT tools (PCS Sinfomar and Trainshunt). Beyond these core actors, the process requires close coordination with **terminal operators**, who initiate

and receive shunting requests, as well as **railway undertakings** that operate trains across the national and international network.

Lastly, **multimodal transport operators (MTOs)** contribute to the interoperability and continuity of logistics flows and are key users of the data generated by the integrated system. Cooperation among these actors ensures that the digital transition supports both operational efficiency and regulatory compliance.

PP3 AIN: In the new digital reporting process at AIN, several key operators are involved to ensure a coordinated and responsive safety management framework. These include the **infrastructure manager**, who is responsible for providing detailed reports on any incidents occurring on the rail network, including technical faults and infrastructure-related causes.

Railway undertakings are directly involved in submitting accident and incident reports and collaborating during investigations. Additionally, **national safety authorities and competent regulatory bodies** participate in ensuring compliance and follow-up on safety recommendations. The new process also requires ongoing communication with **station managers** in the vicinity of reported events, who play a critical role in providing operational details and coordinating field actions.

PP4 ERF – Port of Marghera: The implementation of the new monitoring process at the Port of Marghera involves a range of actors working across the railway infrastructure and terminal operations. Most prominently, the **terminal infrastructure manager** plays a crucial role in granting access to infrastructure data and ensuring compatibility with monitoring tools.

In addition, the **shunting service provider**, maintenance teams, and **logistics operators** that rely on the shunting infrastructure are directly impacted by the new processes. Coordination is also required with the **Port Authority**, which oversees broader transport and safety regulations, ensuring alignment with port-wide digitalization strategies. These actors will be involved in both the deployment and operational use of the monitoring system, particularly when planning maintenance windows or adjusting shunting schedules.

PP6 Sangritana – Terminal Saletti:

The other operators are the following:

- Other rail operators, like Sangritana perform shunting services for both their own trains and other rail operators;
- Terminals: the intermodal terminal of Saletti/TISV and the industrial terminal of SEVEL/Stellantis;
- Carriers: road carriers waiting for train arrivals;
- Shippers/Forwarders: for better planning of ETA/ETD and operations at terminal.

PP7 Port Authority of Sibenik – Port of Sibenik:

HŽ Cargo d.o.o.: Manages shunting and locomotive operations; will use ICT tools for coordination.

Luka Šibenik d.o.o.: Oversees terminal operations; will adopt TMS for cargo management.

HŽ Infrastruktura d.o.o.: Maintains tracks and switches; will implement and monitor automated infrastructure.

New IT Vendors: Companies providing RTMS, SCADA, and TMS solutions (e.g., Siemens, Alstom).

Regulatory Bodies: Croatian Railway Safety Agency to ensure compliance with safety standards.

PP 8 Transagent – Port of Rjieka: Transagent's updated business process requires close cooperation with several stakeholders within the Port of Rijeka rail ecosystem. The **infrastructure manager (IM)** is involved in facilitating real-time data sharing on track availability, condition, and scheduling. **Railway undertakings (RU)** are key users of the platform, both in terms of providing train and cargo data and receiving updates regarding operations and logistics flows.

The **terminal operator** is another critical actor, enabling smooth interface between train arrivals/departures and cargo handling. Additionally, **customs and port coordination authorities** may be indirectly involved to ensure that procedural and timing data are available for security and administrative checks. This ecosystem-wide involvement is essential to ensure that the digital platform delivers full operational visibility and efficiency.

VIII. Does this new business process influence safety and/or security?

PP1 Fondazione ITL – Port of Ravenna: The new business processes are expected to have impacts on safety through the optimisation and digitalisation of shunting operations scheduling and execution reducing needed resources (shunting teams and shunting locomotive), avoiding potential accidents involving personnel allocated for shunting operations execution. On the other hand, new business processes are expected to ensure a reliable level of security of IT system's data management, privacy and sharing with other ICT systems. The shift towards digital shunting processes exposes operators and organizations to potential cybersecurity threats such as data breaches, malware, and phishing attacks.

PP2 Adriafer – Port of Trieste: The new digital business processes at the Port of Trieste directly influence both **operational security** and **overall safety**. By formalizing and digitizing the process of submitting and authorizing train shunting requests via interoperable platforms (PCS Sinfomar and Trainshunt), the system ensures that only properly verified and traceable requests are processed.
This reduces the risk of unauthorized or improperly coordinated movements within the port rail network. Additionally, the automated validation of key data (e.g., wagon lists, train composition, movement authorizations) contributes to the prevention of errors that could lead to incidents. The integration of systems also enhances traceability and accountability, both of which are essential elements of a modern railway safety management system.

PP3 AIN: The digitalization of the railway accident and incident management process at AIN has a significant impact on **safety**, primarily through the reduction of response times and the improvement of information accuracy. By enabling faster notification, structured data collection, and clearer documentation of root causes, the platform enhances both the **quality and timeliness of investigations**.

Moreover, by identifying trends and common failure points through data analysis, the system will support the development of preventive measures, thus contributing to the long-term safety performance of the node. The increased traceability and transparency also reduce legal and regulatory risks, while building a more proactive safety culture across all involved actors.

PP4 ERF – Port of Marghera: The new ICT-based monitoring process introduced by ERF places **safety** at the core of its objectives. By systematically tracking the condition of the shunting infrastructure — including switches, track sections, and junctions — the system enables early detection of wear, malfunction, or risk-prone configurations that could compromise safe operations.

Through real-time data collection and analysis, maintenance interventions can be planned more effectively, thereby minimizing the likelihood of derailments, delays, or unsafe working conditions. This contributes to the creation of a **predictive safety culture** rather than a reactive one.

Although the tool is not primarily focused on **security** in the traditional sense (e.g., protection from unauthorized access or vandalism), it indirectly contributes to it by improving infrastructure visibility and operational control, which are crucial in complex port environments. The solution also enhances compliance with safety-related obligations, reinforcing ERF's accountability and reliability as a service provider.

PP6 Sangritana – Terminal Saletti:

This new business process will influence both safety and security.

The safety of the processes will be improved as with the digitalization of the activities in the node, human error reduction and a better monitoring of the rail circulation will allow Sangritana to reduce incidents, therefore improving safety of operations.

In terms of security, the security devices in terminal will grant opportunities to monitor parked trains that could be subjected to theft. With such a control, that would be available 24/7, even at night times and when the terminal is closed, the security of the processes will be improved.

PP7 Port Authority of Sibenik – Port of Sibenik:

- Safety: Positive Impact: Automation reduces human errors (e.g., switch misalignments), and RTMS enables early detection of issues (e.g., track faults), cutting incident risks by 50%.
- Security: Digital communication (encrypted app/radio) reduces vulnerabilities compared to open telephone lines.
- Potential Risks: Cybersecurity threats (e.g., hacking of SCADA systems) must be mitigated with robust firewalls and regular updates.

PP 8 Transagent – Port of Rjieka: The implementation of the new business process at Transagent will have a positive impact on both **safety** and **security**. From a safety perspective, the platform will enable more precise tracking of train movements, better coordination among operational units, and early identification of anomalies, such as delays or inconsistencies in declared vs. actual cargo data.

In terms of security, digital traceability of train crews, cargo, and movements reduces the risk of unauthorized access, procedural manipulation, or human error. Furthermore, improved planning and reporting tools will ensure compliance with labor regulations (e.g., shift durations, rest periods), which directly affect worker safety. The system will also reinforce the company's adherence to safety norms and its capacity to respond swiftly in emergency situations.

IX. Is this new business process based on an already existing national/European regulation?

PP1 Fondazione ITL – Port of Ravenna: The new business process planned for the Port of Ravenna will be fully compliant with both **European and Italian national railway regulations**. In particular, it aligns with the **EU Railway Safety Directive (EU) 2016/798** and the **Interoperability Directive (EU) 2016/797**, which promote the digitalisation, safety, and harmonisation of railway operations across Member States.

The ITL pilot also incorporates requirements from the **Common Safety Methods (CSMs)** on monitoring and maintenance (EU 2019/779), ensuring that safety-critical processes — such as shunting movement coordination and infrastructure use — are systematically controlled and traceable.
Additionally, the solution considers national obligations outlined by ANSFISA, the Italian Railway and Road Infrastructure Safety Agency, particularly in relation to safety management systems and data handling. The digital shunting management system being developed is thus designed to both **meet current legal frameworks** and anticipate future regulatory developments promoting interoperability and process automation.

PP2 Adriafer – Port of Trieste: The business process defined by Adriafer is anchored in **local and national regulatory frameworks**, particularly the **Ordinanza AdSP MAO 05/2017**, which governs rail traffic and safety procedures within the Port of Trieste. At a broader level, it adheres to the principles of the **Security Management System (SGS)** as required by **ANSFISA**, the Italian agency overseeing railway safety.
While the local regulations are specific to the operational context of Trieste, the process is also in line with overarching **European directives on safety and interoperability**, such as the **Railway Safety Directive** and **Regulation (EU) 913/2010** on a European rail freight network. These standards reinforce the importance of process transparency, IT integration, and stakeholder coordination — all of which are addressed by Adriafer's approach through the use of PCS Sinfomar and Trainshunt systems.

PP3 AIN: The new digital process for accident and incident management at AIN is fully aligned with existing **national and European railway safety regulations**. It specifically supports the implementation of obligations set out in the **EU Railway Safety Directive (EU) 2016/798**, which requires infrastructure managers, railway undertakings, and national safety authorities to systematically collect, analyse, and report on safety-related events.
In Croatia, these requirements are further reflected in national legislation concerning railway system safety and incident notification. While the law does not mandate the exact format of digital reporting, the

proposed system ensures compliance by introducing structured workflows, traceable data entries, and timely communication between all involved parties.

PP4 ERF – Port of Marghera: While there is no **specific regulation** at the national or European level that directly governs the **geometry or maintenance standards** of shunting tracks in port and terminal areas, the new business process introduced by ERF is aligned with broader regulatory frameworks.

These include the **European Common Safety Methods (CSMs)** for monitoring and maintenance as per Regulation (EU) 2019/779, which emphasize risk-based asset management and infrastructure reliability. Additionally, ERF's approach reflects the principles of the **EU Railway Safety Directive** and national safety laws that require railway operators and infrastructure managers to implement systems ensuring the continuous monitoring and safe operation of railway assets.

Thus, while not governed by prescriptive norms for the specific track type, the new process is built to support regulatory compliance in both letter and spirit.

PP6 Sangritana – Terminal Saletti: The business process developed by Sangritana at Terminal Saletti does not directly derive from a specific national or European regulation focused on train tracking or terminal surveillance. However, it operates **within a regulatory framework** that includes important obligations on **data protection**, **system interoperability**, and **safety enhancement**.

In particular, the use of digital cameras and monitoring tools must comply with the **General Data Protection Regulation (GDPR - EU 2016/679)** to ensure proper handling of personal data. Moreover, the shift toward digital circulation monitoring and real-time data logging is consistent with the EU's broader objectives under the **Shift2Rail** initiative and **TEN-T Regulation (EU 1315/2013)**, which promote digitalisation, efficiency, and interoperability in transport infrastructure.

Thus, while the system is not mandated by a specific regulation, it is designed to **anticipate future regulatory expectations** and align with the strategic direction of EU transport policy.

PP7 Port Authority of Sibenik – Port of Sibenik:

National: Aligns with Croatia's Law on Safety and Interoperability of the Railway System, which encourages modernization and safety enhancements.

European: Supports EU regulations like the TEN-T Guidelines (Regulation (EU) No 1315/2013) for efficient, sustainable transport networks and the Railway Safety Directive (Directive (EU) 2016/798) for advanced safety systems.

Not Fully Mandated: While encouraged, specific ICT implementations (e.g., RTMS, TMS) are not yet compulsory but align with EU digitalization goals (e.g., Shift2Rail initiative).

PP 8 Transagent – Port of Rjieka: The business process introduced by Transagent adheres to both **Croatian railway law** and relevant **European Union regulations**. It aligns with the **Railway Safety Directive (EU) 2016/798**, particularly regarding the integration of safety into all operational and financial aspects of rail transport. The initiative also supports objectives set by the **EU Fourth Railway Package**, which promotes innovation, digitalization, and market access.

Moreover, the integration of technical and financial data, and the introduction of monitoring tools for train drivers and energy usage, are in line with **EU policies on sustainable transport and energy efficiency**, including the **European Green Deal**. At the national level, the process ensures compliance with Croatian transport and labor laws related to working conditions, traceability, and risk management. Transagent's platform is therefore designed not only to comply with current rules, but also to support future strategic goals for cross-border freight logistics.

4. Conclusions

This deliverable represents a key milestone in the development of a shared, forward-looking vision for business process optimisation across the railway and intermodal nodes involved in the **CROSSFREIGHT** project. Building on a combined top-down and bottom-up methodology, the work presented here captures not only the technical and procedural innovations envisaged by each partner, but also the cultural, organisational, and strategic dimensions that are essential for real transformation.

The **structured survey** served as a catalyst for self-assessment and collaborative planning, enabling each node to analyse its current "AS IS" situation and articulate a realistic and goal-oriented "TO BE" scenario. The harmonised responses confirm that while each node operates within a unique context — in terms of infrastructure, institutional roles, or operational models — all partners share a common ambition: to transition towards a more **digitally enabled, interoperable, and sustainable freight ecosystem**.

The analysis revealed that several partners, such as Adriafer and ITL, are advancing comprehensive IT platforms to digitise shunting operations and train circulation workflows. Others, like ERF and AIN, are prioritising **infrastructure maintenance** and **safety reporting**, while partners such as Sangritana and Šibenik Port Authority are implementing advanced **monitoring and security systems** that combine hardware and digital tools to enhance surveillance and reduce human error. TRANSAGENT is focusing on digital integration of technical and financial data to improve efficiency, traceability, and decision-making in rail freight operations.

Crucially, the **expected outputs** from these initiatives go beyond mere cost reduction or process acceleration. They include qualitative improvements such as:

- Greater **data reliability and transparency**;
- Strengthened **inter-operator coordination**;
- Enhanced **safety and risk management** capacity;
- Improved **regulatory compliance** and auditability;

- And in many cases, reduced environmental impact through better modal shift management and resource optimisation.

Another key finding concerns the **governance of innovation**: all partners have identified potential resistances to change — whether technological, regulatory, or cultural — and have proposed mitigation strategies, including staff training, stakeholder engagement, phased implementation, and interoperability with existing systems. This proactive attitude confirms the high level of maturity and readiness among the partners to embark on real operational change.

In addition, the report emphasises how **regulatory alignment** plays a dual role: as both a requirement and an enabler. Most of the new processes are designed in compliance with, or in anticipation of, European and national regulations such as the **Railway Safety Directive (EU) 2016/798**, **TEN-T Guidelines**, **GDPR**, and **Shift2Rail** objectives. This not only ensures legal consistency but positions the project nodes as frontrunners in the digital transition of the freight sector.

Beyond the individual cases, the **collective value** of this deliverable lies in creating a **shared methodology and language** across diverse stakeholders. The project fosters a collaborative environment where knowledge, tools, and good practices can circulate freely — enabling each partner to learn from others and scale up solutions that are effective, replicable, and adaptable.

Looking ahead, the conclusions of this deliverable will serve as a **strategic and operational foundation** for the pilot activities in CROSSFREIGHT's next phases. The pilots will allow partners to test their TO BE scenarios in real-world conditions, validate assumptions, fine-tune digital tools, and quantify impacts. The experience gained will be instrumental in supporting policy recommendations and in preparing the ground for wider deployment across other European freight corridors.

In summary, this deliverable contributes to the long-term goal of building a **resilient, connected, and intelligent freight transport network** — one that is capable of responding to market demands, climate objectives, and technological innovation, while maintaining high standards of safety, quality, and service reliability. It also reinforces the role of **public-private partnerships**, regional cooperation, and digital integration as essential levers for shaping the future of European freight mobility.