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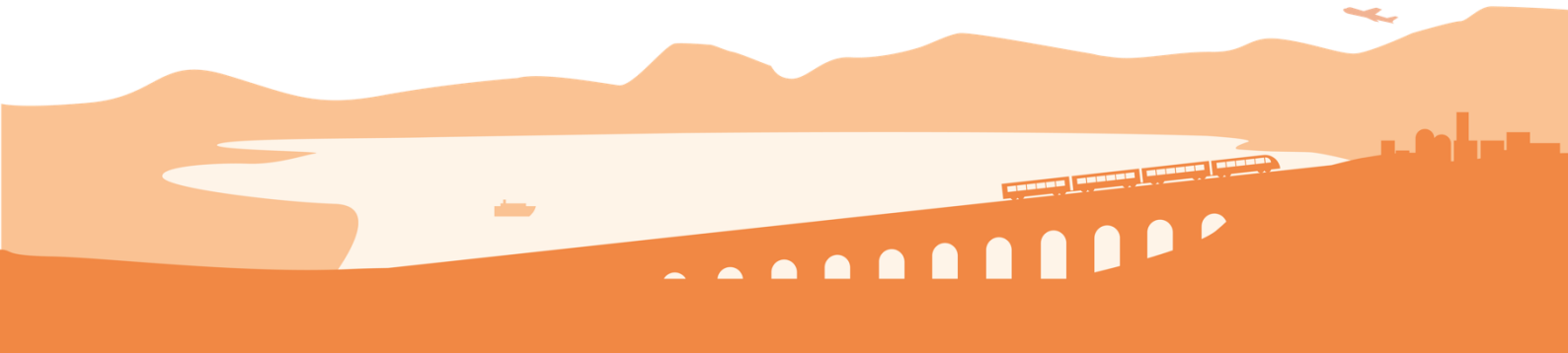

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1. Overview

This deliverable (D.3.1.1) provides the long-term sustainability guidelines for Solution No. 1 – Transport Flow Management and Vehicle Booking Systems (VBS), jointly developed within the ACCESSMILE project by the Port Network Authority of the Eastern Adriatic Sea (Trieste), the Port of Rijeka Authority, and MAHART Container Center (Budapest). The solution integrates the results and experiences of three complementary pilot actions aimed at improving last-mile accessibility between the port/terminal and the delivery points in rural and peripheral areas

The pilots addressed key bottlenecks affecting port and terminal gates: fluctuating truck arrivals, congestion, and manual entry/exit procedures. The implemented systems – the Pre-Exit Notification in Trieste, smart gate access with virtual ID cards in Rijeka, and Vehicle Booking and Call-in systems in Budapest – collectively form a transnational framework for efficient transport flow management.

Each pilot action focused on a key digital and operational aspect aimed at improving last-mile accessibility to TEN-T networks from rural and peripheral areas. The current report refers specifically to topic 1: transport flow management and vehicle booking systems. The participating parties tested and implemented in their different sites complementary approaches on improving the last mile accessibility of rural/peripheral areas to TEN-T network through ICT development, in the area of transport flow management and vehicle booking systems.

Participating partners experienced fluctuations in truck traffic flows and long queues at port and terminal gates, which considerably slowed down the entry and exit processes at the sites. The scope of the designed pilot actions was to leverage ICT development to better manage truck flows as to reduce the waiting time at port/terminal gates, so that rural and peripheral areas can be better and faster connected to the main TEN-T nodes.

Each Pilot action revealed a positive effect of the transport process at each site; the common results and learnings were evaluated and consolidated. After reporting the separate results of the Pilot Actions, the aim of this document is to appraise whether and how the outcomes of the interventions can create a solid foundation for further replication and scaling up across other companies in the industry of the Central Europe area and beyond.

2. SWOT analysis of ACCESSMILE pilot solution and adopted technical measures

Implementing a pilot solution introducing a new transport flow management and vehicle booking system in all the three sites faced many challenges, but on the other hand revealed many possibilities for improving this service and involvement of rural and peripheral areas. The forthcoming SWOT analysis provides a synthetic overview of the pilot action no. 1 implementation in terms of Strengths (S), Weaknesses (W), Opportunities (O) and Threats (T).

Strengths	Weaknesses
• Proven digitalisation of gate operations across three major logistics nodes. • Reduced waiting times, queues, and truck idling at terminals. • Full interoperability between customs, security and booking systems (Trieste, Rijeka, Budapest). • Positive environmental impact through emission reduction. • Strong collaboration among authorities, ICT providers and logistics operators.	• Heterogeneous IT maturity levels across pilot sites. • Partial integration between national customs and port systems in some contexts. • Limited awareness among SMEs in rural/peripheral areas of digital access solutions. • Need for regulatory alignment for wider rollout.
Opportunities	**Threats**
Technical advancements: • Alignment with EU smart mobility and digitalisation agendas (DTLF, Green Deal). • Replication potential in other TEN-T ports and inland terminals. • Opportunity to integrate with Port Community Systems and regional logistics platforms. • Supports EU decarbonisation targets through reduced congestion and improved logistics efficiency.	**Technical advancements:** • Variability in institutional cooperation across different countries. • Dependence on external IT vendors for system maintenance. • Risk of fragmentation without common governance and shared data protocols. • Financial constraints for long-term maintenance in smaller terminals.

Table 1 - SWOT analysis of pilot action No 1 Transport Flow Management and Vehicle Booking Systems (VBS)

Weaknesses and threats identified by the SWOT analysis need to be overcome in order to further develop the pilot solution. For this purpose, potential measures were identified in the table below.

Key issues from the SWOT analysis		Potential measures to overcome weaknesses and threats	Expected effects
1.1.	Heterogeneous IT maturity levels across pilot sites. Partial integration between national customs and port systems in some contexts. Limited awareness among SMEs in rural/peripheral areas of digital access solutions. Need for regulatory alignment for wider rollout.	Promote interoperability through shared technical standards (API, XML, eFTI). Establish a joint governance board among partner ports to coordinate upgrades. Provide targeted training and awareness campaigns for SMEs. Seek EU and national funding for maintenance, replication, and upscaling activities.	• Better flow of trucks during entry and exit process • less CO2 emission, greener operation • smooth goods and data flow • better involvement of rural and peripheral areas
1.2.	Variability in institutional cooperation across different countries. Dependence on external IT vendors for system maintenance. Risk of fragmentation without common governance and shared data protocols. Financial constraints for long-term maintenance in smaller terminals.	Push for standardization in EU the processes and systems used by the authorities and institutes, especially customs authorities. Standardize interfaces and connection for easier maintenance Establish common governance and shared data protocols. Seek EU and national funding for maintenance, replication, and upscaling activities	• standardized policies and solutions within EU • Improved ICT systems • Attract more terminals using the processes of the pilot actions

Table 2 - Possible measures to overcome identified key weaknesses and threats

3. Long-term sustainability goals and strategies of the pilot solution

Three long-term sustainability goals have been identified for the continuation of the new processes in improving transport flow management:

Goal G1: Maintain and expand the digital systems implemented during the pilots.

Goal G2: Promote widespread uptake among logistics operators and authorities.

Goal G3: Strengthen cross-border institutional cooperation and policy alignment.

The table below provides possible strategies to apply for achieving the stated goals and the expected impacts if the implemented strategies.

No.	Long-term sustainability goals	Proposed strategies for implementation of goals	Expected long-term impact
G1	**Maintain and expand the digital systems implemented during the pilots**	Ensure continued operation and upgrading of the Trieste Pre-Exit Notification, Rijeka's Portunus Smart Gate, and MAHART's VBS and Call-in system under each authority's digitalisation plan.	Increased efficiency, standardisation, and interoperability across multiple TEN-T nodes.
G2	**Promote widespread uptake among logistics operators and authorities.**	Share guidelines, open documentation, and replication tools to other ports and terminals; organise workshops under the Central Europe network.	Broader adoption of digital gate management, improved regional accessibility
G3	**Strengthen cross-border institutional cooperation and policy alignment**	Establish a formal cooperation mechanism among customs, port and transport authorities to coordinate interoperability and data exchange.	Long-term institutional commitment, enhanced regulatory consistency and resilience of the solution.

Table 3 - Proposed strategies to provide long term continuation of improved transport flow management

3.1. Hints for continuation & extension of the solution

The solution can be further extended to other terminals by promoting common data models and open-source tools. Trieste's Pre-Exit module can be integrated into other PCS platforms; Rijeka's virtual card system can be expanded to additional port gates; MAHART's VBS can connect to nearby logistics parks.

A broader vision foresees a Central European Network of Smart Gates and Booking Systems, interlinking maritime and inland terminals. Future upgrades may include AI-based flow prediction and IoT integration for real-time monitoring of vehicles and emissions.

Although the ownership of the pilot outputs remains with the Port of Trieste, Port of Rijeka and Mahart Container Centre, they can be easily transferred and replicated in rural and peripheral areas across Central Europe and beyond. The challenges addressed - limited digitalisation, poor last-mile connectivity, and lack of access to intermodal solutions - are common throughout Europe. To support transfer, the outputs will be promoted at the ACCESSMILE Transfer Conference, involving EU policy makers, transport associations, and Macro Regional Strategies. Infographics and digital brochures will be developed and made available on the project website and shared via social media and sector events.

Lessons learned from the ACCESSMILE pilot phase confirmed that the effectiveness and transferability of Vehicle Booking Systems and transport flow management solutions depend not only on the deployment of digital tools, but also on their integration into operational procedures and governance frameworks. The pilot experience demonstrated that interoperability between Port Community Systems, customs platforms and booking tools is a prerequisite for ensuring scalability and long-term adoption across different TEN-T nodes and logistics environments.

In addition, the pilots highlighted the importance of involving logistics operators, terminal staff and public authorities from the early implementation stages. User engagement, staff training and gradual deployment approaches proved essential to ensure operational acceptance and effective uptake of the solutions.

4. Financial indications related to the long-term sustainability

The financial viability of the solution is supported by its integration into existing port and terminal IT infrastructures. Routine maintenance is covered under the digitalisation budgets of each implementing partner. Future upscaling may rely on a mix of funding sources:

- EU programmes (Interreg, CEF, Horizon Europe) for interoperability and decarbonisation;

- National and regional funds for port innovation;

- Private contributions through service fees for premium functionalities – where applicable.

A shared financial model could include cost-sharing agreements between port authorities and terminal operators, ensuring continuous operation and future scalability.

5. Recommended pilot solution governance schemes

To ensure continuation of the improved transport flow management processes and vehicle booking systems, it is crucial to establish a suitable organizational structure that will enable cooperation of all key stakeholders from the neighbouring countries.

A joint governance scheme is recommended under the coordination of the Port Network Authority of the Eastern Adriatic Sea. The scheme would include representatives from customs, ICT providers, terminal operators, and national authorities. This “Smart Gate Alliance” could coordinate system evolution, interoperability standards, and data protection measures.

Each partner retains ownership of its respective system but commits to sharing documentation, updates and technical interfaces to maintain compatibility. This governance model promotes trust, transparency, and long-term collaboration across borders.

The ACCESSMILE pilot phase also demonstrated that governance and stakeholder coordination are as important as the technological components themselves. Successful implementation requires continuous alignment between operational workflows, institutional responsibilities, and digital systems. For this reason, governance mechanisms should include regular coordination among terminal operators, customs authorities, ICT providers and transport stakeholders, ensuring that procedural adaptations evolve consistently with technological developments.

6. Recommendations and suggestions for the replication of the pilot solution beyond the pilot area

Pilot testing of the new transport flow management processes and vehicle booking systems represent a model for implementation for other ports and terminals who suffer from the congestion in from of the gates and from the slow exit/entry processes.

Replication is feasible in any port or terminal facing congestion and flow inefficiencies. Key steps include:

1. Mapping gate bottlenecks and process inefficiencies.

2. Adopting digital notification and booking tools adapted to local conditions.

3. Ensuring integration with customs and security systems.

4. Using open data standards to enable interoperability with existing PCS and TOS.

Replication should follow an adaptive rather than purely replicative approach. The pilot phase demonstrated that successful deployment depends on the ability to align the implemented solutions with local operational conditions, governance arrangements, traffic volumes and levels of digital maturity. While the core principles of interoperability, automation and coordinated flow management remain transferable, technical configurations and operational procedures may require contextual adaptation.

Also, replication should prioritise TEN-T ports and intermodal hubs in Central Europe, where digital gate management can significantly enhance efficiency and environmental performance. Dissemination of the ACCESSMILE model through EU networks will accelerate adoption.

7. Conclusion. ACCESSMILE jointly developed solution to be taken up / upscaled.

The following table refers to ACCESSMILE Topic 1. jointly developed solutions from joint pilot actions implemented by supported projects. In order to be counted under the indicator, the developed solution should include indications of the actions needed for it to be taken up or to be up-scaled. This indicator implies the involvement of organisations from at least two participating countries in the drafting and design process of the solution. Solutions considered for this indicator should not have as their main focus administrative or legal frameworks. Innovative solutions can be procedures, instruments or tools (including physical objects, methods, concepts, or services etc.). To lead to the desired results, solutions have to be tailored to the needs of final users, also considering the respective framework conditions. Solutions should ideally be deployed in the project lifetime and taken up by a large number of institutions

The Transport Flow Management and VBS solution developed under ACCESSMILE provides a proven, transferable digital framework to optimise gate operations and reduce congestion in logistics nodes. The joint implementation across Trieste, Rijeka and Budapest demonstrates the value of cross-border cooperation in achieving interoperability, sustainability and efficiency.

This jointly developed solution is ready for upscaling to other Central European ports and terminals, contributing to a greener, more resilient and better-connected regional logistics system. It aligns with EU goals on digital transport, decarbonisation and multimodality, setting the foundation for future expansion and policy integration.

The pilot phase further demonstrated that transport flow management solutions should not be considered as stand-alone tools, but as enabling components within a broader digital logistics ecosystem. Their effectiveness increases significantly when integrated with automated gate systems, interoperable data platforms and digital cargo coordination services developed under the other ACCESSMILE thematic areas.

The lessons learned confirmed that interoperability, stakeholder coordination and operational integration are key enabling conditions for the successful upscaling of Vehicle Booking Systems and digital flow management solutions across Central Europe.

ACCESSMILE Solution Topic.1: Transport flow management and vehicle booking system	
Final users/target groups	• shipping lines, forwarders • authorities, customs • Trucking companies, railway undertakings • other terminals, ports • cargo owners, shippers, especially from rural and peripheral areas

Final user needs addressed	• better, quicker and smoother processes • faster truck turn time • visibility and reliability • less congestion, less queue, less CO2 emission • better involvement of rural and peripheral areas
Co-design process (involved partners and country involved)	The pilot action was jointly developed by PP1, Port of Trieste, PP5, Port of Rijeka, and PP7, MAHART Container Center, within the common framework set during the ACCESSMILE transnational strategy and action plan. Partners collaborated closely in designing ICT based measures on transport flow management and vehicle booking, exchanging insights on gate congestion, rural accessibility and digital needs. While implementation occurred in different contexts, continuous coordination ensured methodological alignment, complementarity of tools and shared evaluation criteria. Mutual learning, through the exchange of lessons, experiences and expertise, will be consolidated in a dedicated workshop (D.2.4.2) Solutions were co-designed during the regular meetings, including Project Steering Meetings, on site and on line. The topic 1. had specific meetings related to the co-designing of the pilot actions and peer review meetings with cross-border experts
Taken up strategy	Pilot testing of the solutions represents a model for implementation of the better integration of the rural and peripheral areas with better transport flow management. The solutions deliver clear benefits for all actors involved: terminals and operators achieve faster truck turnaround times and improved predictability of operations; customs authorities benefit from validated advance information, enabling streamlined monitoring and improved compliance; transporters and shippers experience tangible cost savings through reduced waiting times and fuel consumption. By reducing reliance on paperwork, limiting human error, and ensuring smoother cargo flows, the solution provides a compelling value proposition. This combination of efficiency, accessibility, and cost-effectiveness makes it particularly attractive for stakeholders who might otherwise be hesitant to embrace digitalisation, thus fostering broad uptake across diverse operational environments The Pilot Action will encourage the stakeholders located in the rural and peripheral areas, to take use of intermodal transport for their transport needs. Until now the intermodal solution had competitive disadvantage, as the delivery of the full container and returning the empty container back to the depot took one extra day due to the waiting time at the terminal in Budapest.

	After implementation of the Pilot Action and the relevant three IT developments, the trucks' turn time has been improved, making it possible to reach the rural and peripheral areas and bring the empty container back at the same day.
Up-scaling Strategy	The experience and knowledge gained during implementation of transport flow management and vehicle booking system can also be applied for planning and implementation of similar service in another cross-border area (provided the train unit has already obtained relevant homologation and safety certificates for the entire route). Reaching technical standards is of great importance for "up-scale" strategy to extend outputs of cross-border service. The technical scalability is ensured by the modular design of the solutions. The systems are designed to accommodate both high-volume environments and lower-traffic contexts typical of rural and peripheral areas, making it a versatile solution adaptable to diverse operational needs. The successful pilot implementations provide a robust foundation for scaling the ACCESSMILE solutions across the expanding terminal network. The approach to scalability has been designed to address the specific opportunities and challenges. The solutions also show potential for functional upscaling into complementary domains. Extending the digitalisation process would further optimise port and terminal logistics, enabling end-to-end visibility of goods from arrival to departure. This evolution would create an integrated suite of digital notification tools that streamline the full lifecycle of cargo movement, enhancing operational efficiency, compliance, and security. A further determinant of successful upscaling lies in its alignment with TEN-T infrastructure, ensuring that efficiency gains at core hubs extend into last-mile rural and peripheral connections. In this way, the system contributes to a more cohesive and resilient European logistics network, enhancing competitiveness across regions. Finally, the pilot has confirmed that upscaling cannot be approached solely from a technical perspective. The cooperation of customs, border police, and terminal authorities is a prerequisite for deployment in new locations. Structured discussions and formal agreements are essential to harmonise operational workflows, define data-sharing protocols, and clarify governance responsibilities. Such institutional cooperation provides the framework necessary to ensure that the technical system functions consistently and securely, guaranteeing that the benefits observed in Trieste can be replicated and sustained elsewhere.

Table 4 - ACCESSMILE Topic 1. up-scaling strategy

The uptake and upscaling of the solution to other territories would yield significant improvements to the connection rural and peripheral areas to the main TEN-T nodes:

From the Technological Improvement and Digitalization point of view: the technological improvement and digitalization are increasingly becoming essential part of business in terms of controlling the operation in a port/terminal, with special attention to the entrance-exit systems. The use of new technologies can help improve efficiency, increase security, and enhance the overall customer experience. The solution supports innovation, digitalization, automation, smart port technology and IT infrastructure security.

From Safety and Security point of view: safety and security are essential considerations for the overall port authority and terminal business. These facilities are be high-risk areas for accidents and theft, so it is critical to take steps to ensure the safety and security of staff and customers. The application of the solution will mean improved safety, development of emergency response plan and risk management, improved security measures, and training plus education for employees

From Port and Terminal Operations and Management point of view: effective port/terminal operations and management are essential for the successful integration of entry-exit terminals. This solution contributes to better Port/Terminal management, efficiencies, capabilities and operation costs.

From Customer Service and Satisfaction aspects: a high level of customer service can lead to repeat business and positive reviews, while poor service can lead to a negative reputation and loss of business. The application of the solution will contribute to customer satisfaction and feedback, customer experience and service reliability. As the trucks can enter or exit the port/terminal faster, with less idling time, customers will be more satisfied as they can get their products quicker and more reliable.

From Environment and Sustainability aspects: environment and sustainability are crucial considerations for port and terminal operations. They can have a significant impact on the local environment and the communities that depend on them. The application of the solution will foster green solutions, sustainable development, environmental protection and CO_2 reduction. Instead of the trucks queuing in front of the terminal with switched on engine and slowly moving, they can park at a dedicated parking place in switched of position, the CO_2 release significantly reduces. Furthermore, with quicker entry and exit processes the CO_2 emission is further reduced.