

OUTPUT FACT SHEET

Pilot actions (including investment, if applicable)

Version 2

Project index number and acronym	Interreg CE Transport and Logistics Stakeholders Network (TalkNET), CE 1044
Lead partner	North Adriatic Sea Port Authority - Port of Venice - Italy
Output number and title	D.3.2.4. PA for multimodal nodes/terminals efficiency and optimization: ICT/ITS tools for rail traffic
Investment number and title (if applicable)	Not applicable
Responsible partner (PP name and number)	Port of Rijeka Authority (PP6), Riva 1, 51000 Rijeka, Croatia
Project website	https://www.interreg-central.eu/Content.Node/TalkNET.html
Delivery date	December 2019.

Summary description of the pilot action (including investment, if applicable) explaining its experimental nature and demonstration character

When loading cargo on wagons, it is extremely important to optimize loading in relation to the wagon capacity. The current mode is that operators, according to previous experience and using simple Excel table, or even just by using mental effort and skipping formal optimization, create wagon utilization calculation and loading plan.

The task Android application needs to achieve is to load and distribute containers that need to constitute one shipment to available train wagon composition to be transported from point A to B and show them visually/graphically.

The chosen solution is to create tailor-made software that will independently calculate the loading plan based on cargo and wagon data. This will speed up the loading process and increase the productivity of rail transport. Ultimately it also contributes to increasing the competitiveness of the transport route.

Container train is composed of a number of wagon cars:



Each wagon type possesses specific technical data, among which most important are:

- Number of axles
- Weight
- Maximum total weight
- Length

Wagons are loaded with containers, and each wagon depending on type, can carry one or more containers. Containers are divided by their length and standardized:

- 20 ft.
- 30 ft.
- 35 ft.
- 40 ft.



Furthermore, containers can be Dry Van (DV/DB), High Cube (HQ/HC), Flat Rack (FR), Refrigerated-reefer (RF), and Open Top (OT), and these models in various configurations.

The task Android application needs to achieve is to load and distribute containers that need to constitute one shipment to available train wagon composition to be transported from point A to B and show them visually/graphically.

Pilot activity refers to the identification of bottlenecks and the development of solutions. The solution was found in consultations with key stakeholders who defined how cargo loading optimization software should look like. Pilot activity includes software development, testing, education, and everyday use.

The task the application achieves is to load and distribute containers that need to constitute one shipment to available train wagon composition to be transported from point A to B and show them visually/graphically.

Application configuration:

1. Ability to enter container models and data
2. Ability to enter and save train composition (up to 20 wagons each)
3. Ability to exchange saved train composition data with other registered users
4. Administrative rights for selected users

Application functionalities:

1. Input number and type of containers to be transported
2. Load cargo list in predefined Excel form (sample provided)
3. Load and save train composition to be used

4. Automatically distribute containers to wagons according to business rules - optimization goal is full wagon utilization by weight
5. Possibility of „manual“ mode: redistribution of containers on wagons after computer-assisted optimization
6. Save loaded cargo train composition
7. Every user can access only own data related to train composition and end result, but can use predefined container types common for all users
8. Dangerous cargo is automatically placed at the end of train composition
9. Application respects maximum length of the train according to State of the railway network, maximum weight, maximum axle load and technical characteristics of the used wagons

Predefined and loaded dynamic loading schemas for the following wagons used with locomotives in the port of Rijeka:

- Sggrs(s) 80'
- Sggmrss 90'
- Laags 90'
- Rgs-Z 60'
- KGS-Z 40'
- LGS-Z 40'

The application is given to use to all stakeholders organizing railway cargo transport who ask for user name and password. Main achieved quantitative (numerical) outcomes of the pilot project are:

1. 1 Key pilot action use-case partner
2. 1 Functional specification developed
3. 1 dedicated Web domain leased (<http://www.prailway.host>)
4. 1 hosting VPS server leased (dual core, Strasbourg data center <http://www.ovh.com>)
5. 1 Web/Android application developed, accessible at domain <http://www.prailway.host>
6. 1 UAT (User Acceptance Test) performed
7. 1 Technical documentation of application's components utilization
8. 6 test users created
9. 1 set of source code delivered
10. 3 video presentations created:
 - Introduction
 - Business processes
 - Application features and use

Main achieved pilot action goals:

1. Introduction of operative research methodology in container loading thus increasing last mile connectivity efficiency (considering location of the terminal in the city center),
2. Improvement of financial efficiency as a component of overall sustainability (by maximum loading used wagons),
3. Introduction of additional efficient multimodal shuttle trains
4. Improvement of the terminal-rail connection and terminal management by increase of throughput
5. Enhancement of the terminal-rail connection
6. Introduction of innovative methods in container loading process, establishment of the model for new services by including new wagon models

Stakeholders workshop; consultations with stakeholders were held on 23rd July 2019. And 8th August 2019. There was a continuous communication with the identified key pilot action partner, where they provided information required to complete the business case and process modelling prior to coding and development.

The application was alpha tested internally using live data provided by the stakeholder. Beta testing and user acceptance testing was done by the key partner, and application functionality is confirmed in writing.

The partner provided several points for improvement and declared a few minor bugs. All identified bugs were fixed, part of the requirements were acknowledged, if they were within the scope of the TalkNET project. Others are noted to be used as request for enhancements in the following versions of the software.

Technical methods description:

1. Application frontend uses Bootstrap and Bootstrap, jQuery modules, rangeslider.js, NProgress, FileSaver and SheetJS.
2. Static webpage serving is achieved using Nginx, for other, bidirectional communication, Socket.IO is used.
3. Server uses Linux operating system, Debian Stretch distribution.
4. Backend stability on the server is achieved using module Supervisor for Node.js (v10.16.3) run in the screen instance.
5. Used database is MariaDB (v10.1.38).

The project relied as much as possible on open source technologies, in order to enhance portability, make the system more easily upgradeable and avoid the possibility of vendor lock-in.

NUTS region(s) concerned by the pilot action (relevant NUTS level)

Croatia (HR) is included in the **Nomenclature of Territorial Units for Statistics (NUTS)** of the European Union. The NUTS of Croatia were defined during the Accession of Croatia to the European Union, codified by the Croatian Bureau of Statistics in early 2007. The regions were last revised in 2012.

The three NUTS levels are:

- NUTS-1: Croatia
- NUTS-2: 2 Regions (non-administrative)
- NUTS-3: 21 Counties (administrative)

The pilot action within applicable scope primarily impacts the city and region where Port of Rijeka Authority resides, and so do railway transport operators that can benefit from the optimization process, so this means NUTS1 "Croatia" (code HR0), NUTS 2 "Adriatic Croatia" (code HR03), more specifically, County of Primorje-Gorski Kotar (code HR031). However, considering universal nature of the successfully executed pilot, it can be potentially transferred also to other Croatian, and other NUTS regions.

Investment costs (EUR), if applicable

Expected impact and benefits of the pilot action for the concerned territory and target groups and leverage of additional funds (if applicable)

Consultations with stakeholders were held on 23rd July 2019. And 8th August 2019. There was a continuous communication with the identified key pilot action partner, where they provided information required to complete the business case and process modeling prior to coding and development, and achieve alignment with the preset pilot design requirements.

The application was alpha tested internally using live Internet provided by the identified stakeholder.

Beta testing and user acceptance testing was done by the key partner, and application functionality is confirmed in writing.

The partner provided several points for improvement and declared a few minor bugs. All identified bugs were fixed, part of the requirements were acknowledged, if they were within the scope of the TalkNET project. Others are noted to be used as request for enhancements in the following versions of the software.

Related policy improvements and the integration of policy actors are clearly visible after project completion in the form of:

- increase of sustainability of railway transport
- decrease of utilization of unneeded resources (wagons) that otherwise could not be identified
- decrease in energy consumption

Almost all identified target groups contain stakeholders that would derive, even indirectly, benefit from executed pilot project. Stakeholders withing target groups are shown in the following table:

Stakeholder's name	Stakeholder uses the application in work	Stakeholder uses the application indirectly	Not used
Adriatic Servis		X	
Alianca		X	
Anglo Adriatic		X	
Atlantagent		X	
Bandic Maritime		X	
B.w.a.		X	
Cma Cgm croatia		X	
C. Steinweg – TPG		X	
Dragon Maritime Adria		X	
Euromar plus		X	
Global agent		X	
Jadroagent		X	
Jadrolinija		X	
Liburnia Maritime agency		X	
Rea Dubrovnik		X	
Transagent		X	
Adriaticagent		X	
Damco		X	
Gate Express		X	
Log Adria		X	
Maersk Croatia		X	
Panalpina Croatia		X	
Primacošped		X	
Truck carries (group category)		X	
Railway operators (group category)	X		
Visitors to port area			X

Usage by and impact on freight agents and railway operators

Direct beneficiaries/users of the cargo optimization application are all railway cargo transport operators in the Republic of Croatia: (as of April 2020.)

1. CER Cargo d.o.o.
2. HŽ CARGO D.O.O.
3. EURORAIL LOGISTICS d.o.o.
4. ENNA TRANSPORT d.o.o.
5. Pružne građevine d.o.o.
6. RAIL CARGO CARRIER-CROATIA D.O.O.
7. RAIL & SEA d.o.o.
8. SŽ TOVORNI PROMET d.o.o.
9. TRAIN HUNGARY MAGÁNVASÚT IPARI, KERESKEDELMI ÉS SZOLGÁLTATÓ KORLÁTOLT FELELŐSSÉGŰ TÁRSASÁG
10. TRANSAGENT RAIL d.o.o.l 2020)

As a part of the European Union, all applicable laws and regulations in Croatia related to railway and cargo traffic are adjusted towards common legislature. There are no barriers to applicability of created solution also within territories of other partners, with implementation of mandatory adjustments whose source is primarily of technical and not regulatory nature (state of railway network, specific characteristics of cargo wagons, railway limitations etc.).

As a consequence, parallel development and natural extension of the TalkNET pilot action, additional funds have been allocated for development of "Rail" module in 2021, as a part of Adriatic Gate j.s.c. PCS module development. Annexed attracted investment at the beginning of January 2021 was in total amount of around 150.000 EUR + VAT, CEF funded (Annex 2 of the Grant Agreement INEA/CEF/TRAN/M2016/1365949). The module should be developed during Q3/2021, tested, and integrated within PCS.

Sustainability of the pilot action results and transferability to other territories and stakeholders.

Main partner for the business process modeling and creation of functional specification was Transagent Rail d.o.o. Findings of the application, and creater algorithym can be further transferred within the territory, and can be adopted for use with various railway operators' ERP systems, but require adjustments according to business rules, types of used railway wagons and their technical loading schemas and other rules. Furthermore, it is possible to create a fully dynamic loading schemas for the cargo wagons, that would make it possible for railway cargo operators themselves to set up a particular wagon (owned or leased).

At the moment, sustainability of the project results is achieved in the following ways:

1. Full transfer of all IP rights to Port of Rijeka Authority, including intellectual rights and surrender of source code
2. Retained technical documentation and administrative access to Internet domain and virtual server required for application operation
3. Creation of publicly visible fronted for the system, connectable with Port of Rijeka Authority
4. Selection of a visible and easily recognizable domain („PRAilway“ in the domain name refers to Port of Rijeka Authority)
5. The application became a part of IT portfolio of Port of Rijeka Authority and IT system administrator is tasked with oversight of the server and proper functioning of the application
6. Financial means required for ongoing operation for at least five years after end of TalkNET project are secured (domain registration extension, server lease)
7. Ongoing communication and contact with the developer subcontracted for application development, in case of need for upgrades or changes is secured by selection of a suitable company for subcontracting of services.



All intellectual property is contractually transferred to the Port of Rijeka Authority. Architecture of the system and database, the system itself, and technical description are handed over to the Port of Rijeka Authority along with source code.

Users can get login by requesting access opening to the Port of Rijeka Authority Administrator, as shown in the Figure on the following page.

PRailway

Port of Rijeka Authority Railway Wagon Loading Optimization

Remember me

In terms of transferability opportunities to other territories, ICT systems are by definition transferable and applicable to other nodes, by customizing the service based on the single needs and business models of the client hub.

Lessons learned and added value of transnational cooperation of the pilot action implementation (including investment, if applicable)

For each partner the meetings that took part and related themes discussed are resumed and referred to the five clusters identified by the project: clusters 1-3 of multimodality (1- Last mile connections of multimodal nodes, 2- Improvement of multimodal terminals efficiency and optimization, 3- New multimodal services) and clusters 4-5 of eco-innovation (4- Alternative fuels deployment, 5- Deployment of energy efficiency in transport operations). Cooperation within clusters gave project partners an opportunity to see other viewpoint of challenging issues and also gave Port of Authority Rijeka unique ability to compare its level of development and progress of digitalization and optimization endeavours with those of other project partners.

The scope of these actions is to make a comparison between the partners' issues on the TalkNET themes with their stakeholders to understand if there are good practices that can be used to develop project action plans and pilot actions. After the analysis in the nodes' regions, the partners became more conscious about the logistics thematic affecting their area. Thanks to these studies, they can now focus on specific solutions to solve their problems avoiding waste of resources to find the right solution.

Therefore, these meetings will be beneficial and all project partners have the task to promote them in order to raise the awareness of the main problems and to find the common solutions to the challenges of these fields.

Lessons learned of the Port of Rijeka Authority are the following:

- Every similar project should be viewed in its entirety from the very beginning
- Timely planning is crucial for project success
- It is important to envisage requirements for the external consultants, as maritime traffic projects are highly specialist projects that often require inclusion of external experts
- It is quite difficult to find application development services due to lack of skilled developers already lacking throughout EU, so a significant contingency in timing is required
- Identified stakeholders from target groups may vary in engagement and interest in the project, so adequate approach ensuring buy-in end cooperation needs to start very early in the project
- Sharing of ideas with other PPs is very important venue to keep up to date with latest development in the area, and especially trends like de-carbonization, research and development, introduction of disruptive innovations and optimizations
- Regular (at least annual) brief video conferencing should continue, as a means of ongoing cooperation between PPs
- Any optimization project requires also specialists that are outside of the maritime transport sector - usually quantitative methods experts, present at the universities, and even artificial intelligence experts and data scientists

Conclusions about added value of transnational cooperation are gathered during meeting of the working group for the pilot project assessment held on 27th May 2020. In terms of added value of transnational cooperation, the results of the pilot action carried out by the Port of Rijeka have been assessed and the following results can be highlighted in relation to mutual learning among project partners, in particular those partners that deals with same logistics process.

Identified strengths of the pilot action are:

1. Relevant savings in train composition
2. Reduction of useless handling operations: therefore saving of time, equipment and money
3. Opportunities to analyze the data received in order to create trends and statistics

4. Accessibility from various devices with either iOS or Android, from either a mobile phone or a tablet (user-friendly solution)
5. Improvement in the wagons' loading efficiency gives the possibility to implement effective intermodal connections

Potential deployment of tested innovation:

- ICT systems are by definition transferable and applicable to other nodes, by customizing the service based on the single needs and business models of the client hub.

Among the critical points, it was mainly underlined that the software is very specific and thus regular updates of the software are necessary and that there is the need to strengthen the IT department with high-skilled employees. Finally, requirements for the carriage of dangerous goods (RID) are not always compatible with load optimization.

More in-depth, the case of TalkNET has been of great facilitator of solutions that can be shared and tested among project partners, like the new tool developed and tested by the port of Rijeka. In particular, the following lessons learned has been highlighted from other ports, specifically maritime ports, that are facing quite similar challenges and, especially on railway topics:

- Port of Venice: historically the port of Venice has served mainly local markets and throughputs haven't made necessary such tools so far, in order to schedule the cargo handling. Anyway, this pilot action has been considered as a best practice for those terminals that in the future could be involved with an increased container traffic and should adopt IT railway-linked programs.
- Port of Trieste: this activity is implemented by the terminal operators/concessionaires, not by public entity such as the Port Network Authority of the Eastern Adriatic Sea. Yet, better understanding the procedure for streamlining this activity proved to be relevant for the Port of Trieste, which has been investing so significantly on railway transport and modal shift.
- Port of Koper: in the port of Koper, the container terminal uses Tideworks IT system, but the knowledge gained through the tool adopted by the port of Rijeka has been considered as possible improvement of the IT system.
- Port of Budapest: there is a functionally similar system used by the container terminal (MAHART Container Centre) of the Port of Budapest. So Port of Rijeka's example was studied closely and compared with the one operating in the MCC - the functions are rather similar although the MCC's solution is less elaborated. The main reason is that railway operation in general is simpler in the Port of Budapest than in a sea port.

Contribution to/ compliance with:

- relevant regulatory requirements
- sustainable development - environmental effects. In case of risk of negative effects, mitigation measures introduced
- horizontal principles such as equal opportunities and non-discrimination

The application is created in a way to be fully compliant with regulatory requirements. Especially, rules of information and cybersecurity are enforced, so every user has to be properly enabled by the administrator of Port of Rijeka Authority. Furthermore, every user has access only to own configuration, created trains, and other data. However, every user can share his optimization results with other users, if (s)he wishes so. Access to the server is allowed only to the Port of Rijeka Authority's administrator.

Business rules applied throughout the application are fully in line with the applicable railway regulations that are, in turn, in line with EU directives. This refers to open access to all railway operators, but also technical rules stemming from state of the railway, issued by the local traffic oversight agency (HAKOM). For example, length of the cargo train, total weight, weight per axle etc. need to be aligned with local reality of the particular railway track.

The application is neutral in regard to horizontal principles. It enhances reduction of gaseous emissions by optimization of cargo placement on wagons and through related savings, as less wagons may be used in comparison to manual placement. Application is created as a Web application, meaning it is platform and vendor neutral. Technologies are scalable, meaning that they can be used on devices with the same level of user satisfaction, regardless of the fact what is the device factor. Fonts and graphic elements are large, in order for the application to be used also by persons with visual impairments. The application and documentation are gender-neutral.

Other partners usually have already integrated similar tools to their TOS systems that are usually used for cargo wagon loading. Executed pilot end results will be integrated with future (ongoing development) PCS in Rijeka until end of 2021. as a part of additionally secured funding.

**References to relevant deliverables (e.g. pilot action report, studies), investment factsheet and web-links
If applicable, additional documentation, pictures or images to be provided as annex**

Reference to relevant deliverables:

D.T1.2.4 - Analysis on ECO-solutions deployment - Rijeka

D.T1.5.5 - Action plan on ECO solutions - Rijeka

D.T3.2.4 - Pilot Action: ICT/ITS tools for rail operations

The application is available from open Internet to all stakeholders who require container loading optimization services. Access URL is <http://www.prailway.host/> . The domain is registered to the name of Port of Rijeka Authority who withholds extension rights.

The application is placed on a dedicated leased VPS server physically located in Strassbourg. The provider operating the server is OVH, Link: <https://www.ovh.com/> . The server's lease is extended annually. Full administration rights over the server have been handed over to the Port of Rijeka Authority.

Presentations of the business logic behind the application are recorded and publicly available via Youtube using the following channel: <https://www.youtube.com/user/saksentijevic> .