DigLogs

White Paper

Deliverable 2.2.4

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This document reflects the author's views; the Programme authorities are not liable for any use that may be made of the information contained therein.

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Executive summary

DigLogs is characterized by the implementation of seven pilots in Italy and Croatia with technological solutions, models and plans for advanced digitalised logistic processes for multimodal freight transport and passengers' services. This project will have a significant impact on the quality, safety and environmental sustainability. In fact, the project addresses the Italia Croatia Cross-Border Cooperation Program of Interreg, in particular the objective 4.1 to Improve the quality, safety and environmental sustainability of marine and coastal transport services and nodes by promoting multimodality in the programme area.

This white paper provides a transversal overview of all the pilots, objectives, activities and how these pilots relate to a future full implementation.

The pilots contribute to three major areas of innovation, which all contribute to fostering multimodal services, in different ways:

- Supporting Better Multi-modal delivery planning
- Supporting Passenger Services
- Improving Port Authority Services Supporting Clients

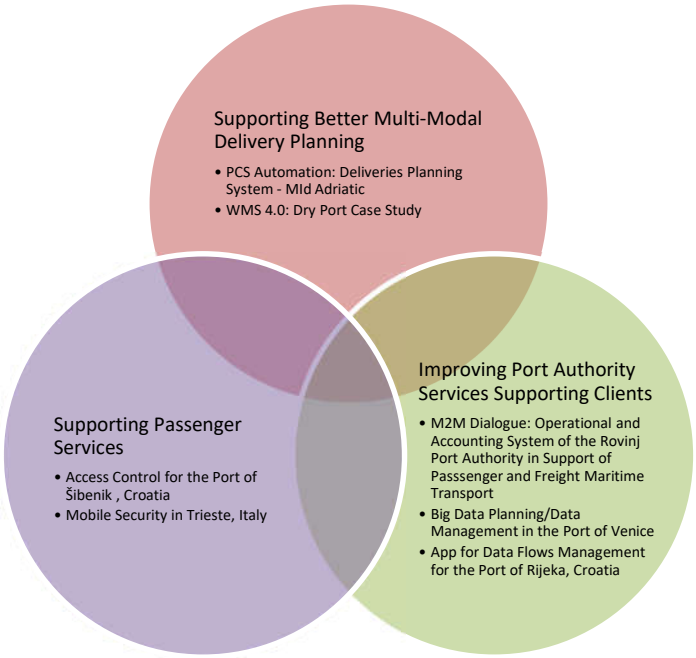

Figure 1: DigLogs Pilot Project Overview

The individual solutions vary and range from operational improvements within ports to key integrations to the Port Community Systems being developed.

Figure 2: WordCloud of DigLogs Pilots

1. Supporting Better Multi-Modal Delivery Planning

Two pilots focus on improving the multi-modal delivery planning:

- PCS Automation: Deliveries Planning
- WMS 4.0: Dry Port Case Study (Italy)

1.1 PCS Automation: Deliveries Planning System – Mid Adriatic

1.1.1 Overview of Pilot

At present, Carriers have high operational costs due to the complexity of the intermodal shipments planning management. At the same time, the decision-making process when setting a specific route for a service could be affected by personal bias, resulting in an inefficient service routing, with consequently higher costs. Another major problem is caused by the complexity in re-routing services in case of unexpected events, including delays, traffic, weather, and other variables. Due to the complexity of rerouting services, the unreliability of Estimated Time of Arrivals (ETAs) can mislead users and make the intermodal services less competitive than the standard ones.

The creation of an automated Deliveries Planning system aims at preventing these issues, by guiding the operator throughout the decision-making process, showing the various alternatives for an intermodal service, allowing to book in advance the service needed, simplifying the procedures for Custom Declarations and the processing of Dangerous Goods. At the same time, the system would allow a track and trace system to guide the whole service, reprocessing ETD considering traffic and weather conditions.

The PCS Automation - Deliveries Planning pilot aims at creating and testing a Deliveries Planning module, which could in the future extend the Port Community Systems. The **Deliveries Planning** Technology aims at providing an improved knowledge for operators in the decision-making process for the shipment routing through comparison of multimodal services in terms of prices, transit times and schedules, matching ITUs requirements/compatibility with the vessel, shipment requirements and Dangerous Goods limitations, while providing re-routing options based on traffic & weather conditions. The full scope of the Deliveries Planning innovation system aims at guiding the operator with an automatic booking process (including Custom Declarations and Dangerous Goods processing), then follows the shipment through a Track&Trace system, giving a real-time updated ETA, and finally provides emission certificates at the end of the journey.

The pilot application focuses its scope on the route selection algorithm, exploring all the parameters that might affect the selection and establishing the criteria for prioritizing optimal route selection. It examines the circumstances and parameters that might cause rerouting at each node along the chosen route. Finally, it will examine KPIs for calculating route performance and provide comparison reports among different available options, as well as comparison between planned (nominated) and completed (travelled) route performance.

1.1.1.1 Scope of Pilot

Due to the various nature, dimension and sometimes the absence of PCS in port communities, Polo Inoltra has decided to create an independent module, that would be included in existing PCS systems, automatizing processes, or, for smaller ports which do not have a PCS in place, a stand-alone system that could still function without a PCS.

Pilot application limits its scope to the nominal booking, Track&Trace simulation and calculated approximated ETA and CO2 emission, as well as defining the interface data structures towards potential future system integrations.

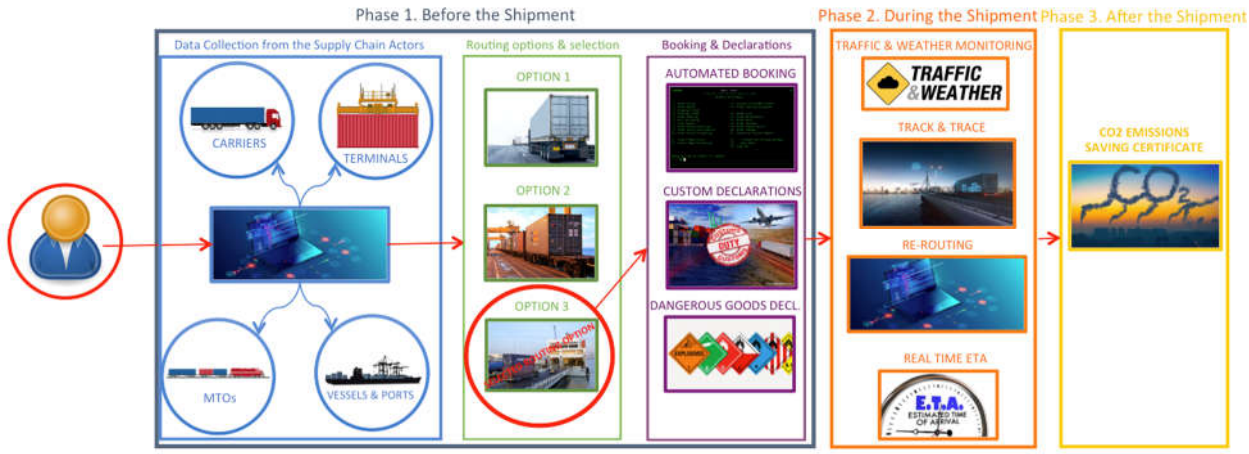

Figure 3: Deliveries Planning Functions

During the Pilot Phase, due to the current absence of Roll On- Roll Off (RoRo) services in the central Adriatic, will be lab-simulated the presence of multiple RoRo routes, starting from several ports of the Adriatic, in particular, the simulation will consider at least three different RoRo Services. These three services will have different time schedules, different booking procedures and availabilities. On the other hand, the system will consider actual intermodal rail-road connections to local Terminals.

It is expected that actual Transport Operators and Shipping Companies will participate in the Pilot Test as operators needing to plan intermodal services, either rail-road-sea or sea-road-sea ones, from Italy to Croatia and vice-versa. They will access the Deliveries Planning platform, compare the different options available, choose the most favourable route and proceed with the operational organization of the service. Ports and Sea Liners will receive the information, integrating them into their system.

The pilot system will work with the following data types:

- Booking & Transport Orders:
  - Types of goods (relative packaging groups & material state);
  - ITUs' compatibility with a set of goods;
  - Dangerous goods (Class, Packing Group, UN codes, Kemler codes);
  - ETAs, Volumes and Frequencies set of variables;
  - Mandatory Conditions (Costs, timescales and emissions).
- ITUs:
  - Category: containers, swap bodies, cr. semitrailers;
  - Type: bulk, tank, HC, curtain side, etc.;
  - EN13044: gabarit, trailers codes, etc.;
  - ILU codes register;
  - Road info registration.
- Travel Sections and Nodes:
  - Modality: road, rail, sea;
  - Travel sections and nodes: mapping the existing services concerning rail and sea connections and the relative nodes. For the pilot phase, this task will be conducted on the selected geographical test area only.
- Vessels:
  - Routes and relative Schedules of services;
  - Vessel typology;
  - Vessel capacity;
  - ITU requirements;
  - Dangerous goods restrictions.
- Ports and terminals:
  - ITU requirements;
  - Booking procedures;
  - Dangerous goods restrictions;
  - Storage and THC costs;
  - Working hours.
- Trains, Stations & Rail Terminals;
  - Train routes and schedules;
  - ITUs requirements;
  - Wagons' composition;
  - Dangerous goods restrictions;
  - Storage and THC costs;
  - Working hours.

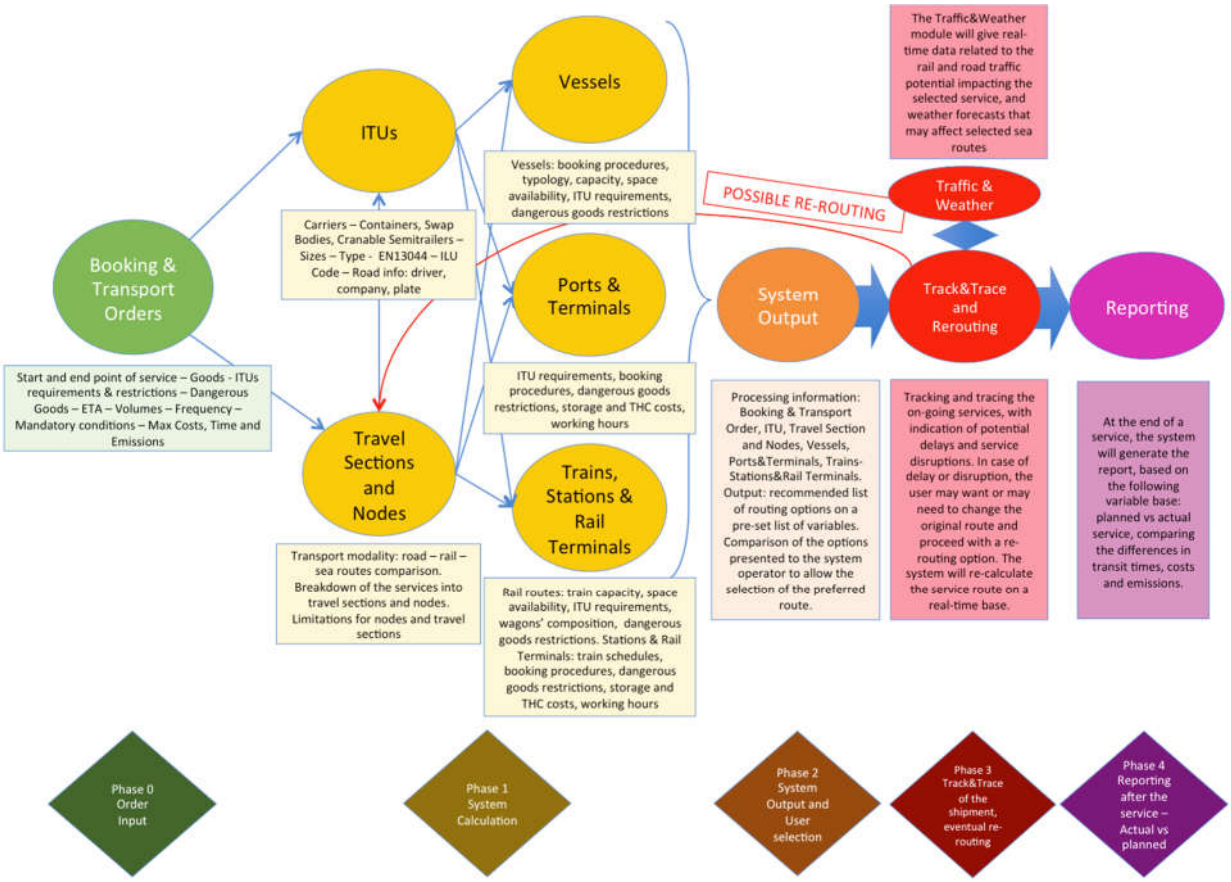

Figure 4: Deliveries Planning - Pilot Solution Design

1.1.1.2 Main Pilot Activities

The **first objective** of the Pilot is to evaluate, in terms of cost, transit times and CO2 emissions, the various options available in connecting the industrial site of Sisak to La Spezia.

On this particular point, the Pilot results will need to compare a standard 100% road service made by truck to a multi-modal service. Several options on this subject will be compared: train services from Sisak to the ports of Šibenik and Split, and sea connections (some of which will be lab built) between the ports of

Šibenik and Split to Italian ports, in particular Ancona, Ortona and Vasto. Finally, there will be a comparison of the rail services actually available on the Italian side of the Adriatic, such as two existing MTO services connecting Interporto d'Abruzzo (at a short range of distance from Ortona and Vasto Ports) to Interporto Novara T1 in the Piedmont Region (with the final part of the service made by road from Interporto Novara T1 to La Spezia), or the connection between Interporto Marche (linked by a shunting rail connection with the Port of Ancona) to Port of La Spezia. The different rail connections will have peculiar implications and differences also in the ITU requirements.

The **second objective** of the Pilot is to handle an unexpected event that would disrupt the originally selected service, forcing the user to re-route the service and to choose another option. Within the pilot scope, we will have demo datasets for parameters like weather alerts, traffic congestion, route closure and other disruptive events, with the possibility to simulate these disruptions. If feasible, we will try to connect to real external sources of data.

The **final objective** of the Pilot testing would be to generate a report, where the final chosen option after the re-routing will be compared to the originally scheduled one, comparing the differences between planned vs actual costs, transit times and emissions.

The pilot engages existing operators as stakeholders, to cooperate where deemed necessary within the expected Pilot plan. This would be mostly beneficial in data collection and testing phases. In particular, we are planning to engage one Shipper (a large manufacturing plant, originating the service), one Multimodal Carrier (operating the multimodal service with his own ITU), two Road Carriers (operating the road services for the first and last mile to move the selected ITU), three MTOs (operating different rail services: Sisak → Port of Šibenik , Interporto d'Abruzzo →Interporto Novara T1 and Interporto Marche → Port of La Spezia) and one sea shipping company (operating the Ro-Ro or the container ship service from Port of Šibenik to Vasto and Ortona ports, and from Port of Split to Port of Ancona).

The **final testing** is to be conducted the Multimodal Carrier which will also be considered as the system user. One operative user will be responsible to operate the Pilot testing system, will make the final decisions in terms of service routing and re-routing and will receive the final shipment report. The other actors will not participate directly in the decision-making process within the system, but will provide the data that will be required for the system to work.

To be clear, for the pilot testing, the pilot will use stakeholders' datasets, but will not integrate real-time connection to their data, as this would be beyond the pilot scope. Rather, we will use off-line data or "snapshots in time" in order to simulate decision making process.

1.1.2 Full Implementation Envisioned

The Pilot Phase the system is an external module with data sets, while in the mid to long term it could be integrated with the existing systems of the Transport Operators and Shipping Companies to provide Realtime services. By doing that, with the help of disseminating the potential of the platform, it will be possible for operators to join the system at a later stage, fully benefiting from the savings provided and starting a process of organizational change, once the automatization of processes will have been given for granted and job roles would have been positively impacted by the system.

If the pilot would be successful, the full implementation of the system would allow a radical impact on multimodal deliveries planning, by offering a reliable solution to determine the best route available, at the lowest cost, transit time or emission scale, with the addition of the re-routing part, a key element in the service definition. The full-scale implementation would mean a wider geographical application of the pilot, with the extension of the coverage from the Adriatic Sea to a wider European environment. The addition of multiple rail routes as well as sea ones, will make possible for shipping companies to use the system for non-accompanied shipments, ITUs based, increasing multimodal ITU shipments across Europe. Extending the number of operators across the multimodal supply chain, terminals, rail operators, MTOs, shipping companies, etc. will grant the increase of the system capabilities and reliability in the routing and re-routing functions, as well as the reporting part.

1.1.3 Decision Points for Full Implementation

For the Pilot testing results assessment, the main success factors are:

- reliability of data
- ease of use for the end-user, the operative staff of the Multimodal Carrier.

In order for the pilot system to be positively assessed, the end-user interface, as well as the pilot service report, will need to be simple, effective and reliable.

The positive external stakeholder feedback will be necessary to understand the future deployment.

If proven feasible, the fully scoped system in the future will aim at automated booking, real time Track&Trace system with real time ETA and CO2 emission calculations, and integrations with external systems, which is all beyond the pilot scope.

1.2 WMS 4.0: Dry Port Case Study

1.2.1 Overview of Pilot

This pilot in the intermodal rail-road terminal of Gorizia (SDAG), Friuli Venezia Giulia Region, Italy demonstrates how multimodal transport arrangements (among a heterogeneous set of logistics operators including carriers, logistic providers, transport operators and authorities) can be thoroughly and conveniently optimised by exchanging real-time information concerning planned delivery schedules.

This pilot focuses on the implementation of a Decision Support System (DSS) linked to SDAG Warehouse Management System (WMS), enabling the interconnection between Multimodal Transport Operators (MTO), terminal operators and carriers in one single digital access platform, allowing them to be timely informed and to synchronise their delivery schedules, thus optimising the final leg of the intermodal transport chain (i.e. from the SDAG terminal to the final destination) from both operational, economic and environmental perspectives.

1.2.1.1 Scope of Pilot

The pilot will implement an open-source platform, providing optimised transport arrangements for last mile transport segments, by making use of specific algorithms and coordinated data from multiple stakeholders. WMS is a software application, designed to support and optimize warehouse functionality and distribution centre management, specifically facilitating the management of daily planning, organizing and staffing, as well as providing support to control the utilization of available resources, to move and store freight into within and out of a warehouse, to assist staff in the performance of material movement and storage in and around a warehouse. The DSS and the WMS at the Gorizia inland terminal (to which the formed will be connected) will synergically provide an "intermodal transport network IT interface" which, by offering a specific intermodal appointment solution, will allow logistics operators to choose among different possible coordinated scheduling solutions and be timely informed about possible delays/disruptions on their way to the terminal in order to ultimately optimise transport operations for specific legs of the multimodal chain.

One of the main objectives of the DSS is to implement a **Truck Appointment System (TAS),** which will enable a communication exchange between the inland terminal and truck operators, and to support the terminal manager in the optimum scheduling of operations. By allocating specific time slots to trucks via a booking system, the terminal operator will be able to optimize:

- the flows of incoming vehicles (specifying the gate, vehicle inspection, potential parking slot where to wait, etc.)

- resources utilisation and operations management to the expected volume
- traffic conditions to the terminal premises and surrounding areas
- communication between the terminal and the drivers informing on delays, etc.

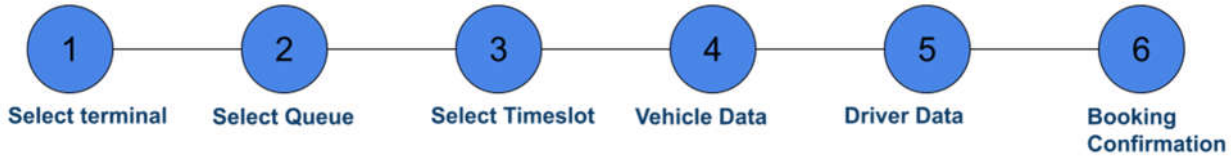

Figure 5. TAS - Booking creation

In addition to the above, the TAS will also be pivotal in advising MTOs on possible free trucks locally available to perform transport for the last mile segment. Upon collecting a heterogeneous set of information from multiple actors regarding the final delivery destination, goods type, vehicle sizes, costs of shipments, the DSS will be able to calculate and offer an array of possible scheduling solutions for different logistics operators. Besides, MTOs can put out requests for offers to truckers for the shipment of goods from the terminal through to the final destination. To this end, WMS 4.0 will create a continuous communication channel between MTOs and drivers/transport companies, aimed at optimisation of cargo delivery to destination by allocating specific time slots and informing multiple actors (e.g., terminal, transport operators, truck companies) on unexpected delays or disruptions.

In summary, the DSS pilot will consist of testing a centralised collaboration platform with MTOs, aimed at collecting from them useful data about their services (e.g., time schedules, origin/destination, delays, ETA/ETD) and providing scheduling support to carriers, other MTOs, dry ports and public authorities. The web application envisaged as part of the pilot will firstly be deployed at Gorizia terminal and will subsequently be open to other dry ports and MTOs in the Programme area, willing to upload their data.

Here are the assumptions and typical conditions for the pilot:

- Inland Terminal knows in advance which trucks, type of materials and operation will arrive
- Inland Terminal can plan their deployment of resources and operation in advance
- Inland Terminal can inform drivers before they arrive, and which warehouse to go to
- MTO can put out request for offers to the truck community for the last mile transport segment
- Truck operators can use TAS to book their pickups/drop-offs into the Inland Terminal

The system will serve as a DSS for key logistics stakeholders (carriers, logistic providers, transport operators and authorities), enabling them to optimise freight transport and interchange processes by finding the best solutions for transport services, combining different parameters like prices, CO_2 emissions, load factor and others. The system could also function as a module integrating WMS and TMS by adding this new source of information in order to improve the planning process, while synchronising the railroad terminal cargo operations with truck arrivals and departures.

In summary, the overarching goal of the pilot system is to improve operational efficiency by integrating heterogeneous sources of data, which will be duly processed through specific algorithms to provide optimal real-time solutions in the complex space of freight transport problems (e.g. best price of combined transport, lower emissions of entire chain, e-procurement tools for maritime transport services, higher bi-directional load factor). As a result, the deployment process of the pilot will include the development of a software, mainly implementing and fine-tuning a pool of specific algorithms solving scheduling problems at key transport nodes.

1.2.1.2 Main Activities

WMS 4.0 uploads and shares data and information from MTOs, Inland Terminal and truck vehicles.

The pilot requires the following realizations:

- Real time monitoring of warehouse stock management volume
- Creating of the Truck Appointment System (TAS)
- MTOs tendering offers
- DSS implementation
- Service Review

Actors involved are Inland Terminal Management Body, Road hauliers, Combined Railroad transport operators, MTOs, Shippers and Customs operators.

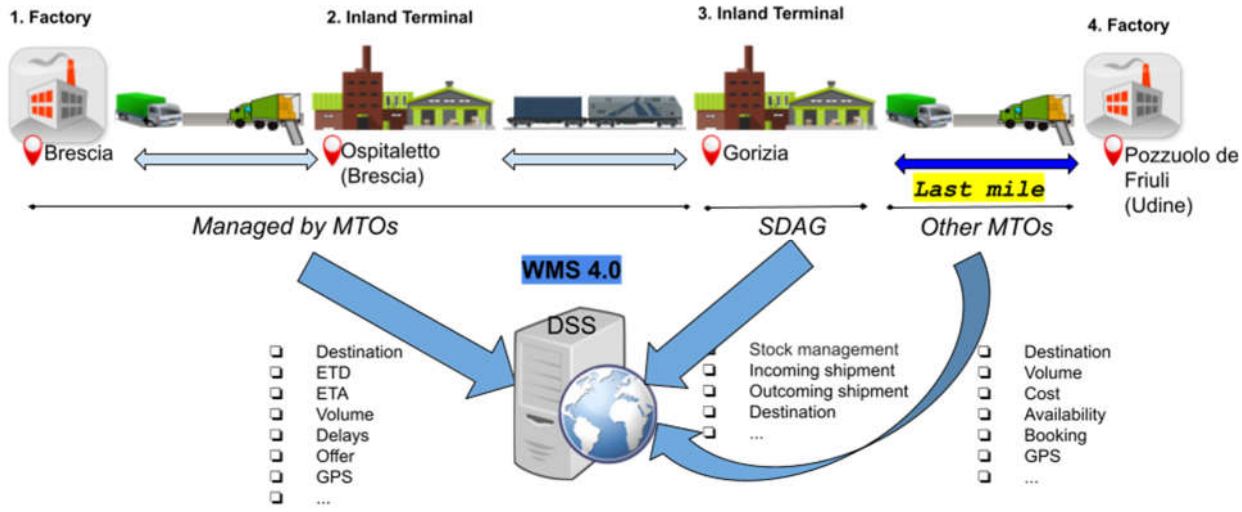

Figure 6. WMS 4.0

An effective action plan to ensure accessibility and maintenance of the pilot application for the 5-year period will be provided.

1.2.2 Full Implementation Envisioned

The deployment of the pilot action will contribute to the following outcomes: smart and efficient management of cargo in the warehouse, savings in terms of time and cost during the moment of loading/unloading in the warehouse, link the Inland terminal to the intermodal network, allow the logistics operators to be extensively informed about the existing intermodal services from the Inland terminal operating in the pilot (and others) and finally, developing and implementing intermodal transport instead of 'all road' transport in the Programme Area.

1.2.3 Decision Points for Full Implementation

The transition from pilot to full deployment will depend upon market appreciation of the pilot services (and performance). The pilot includes a dedicated activity for Functionality, Performance Testing, and Customer Service Review. Any identified issues during the course of the assessment could prove necessary for resolution before the pilot becomes a fully operational system.

2. Improving Port Authority Services Supporting Clients

The urgent need to improve port authority services to ensure better services to their clients is at the focus of 3 DigLogs pilots:

- M2M Dialogue: Operational and Accounting System of the Rovinj Port Authority in Support of Passenger and Freight Maritime Transport,
- Big Data Planning/Data Management in the Port of Venice,
- App for Data Flows Management for the Port of Rijeka.

2.1 M2M Dialogue: Operational and Accounting System of The Port of Rovinj Authority in Support of Passenger and Freight Maritime Transport

2.1.1 Overview of Pilot

As part of DigLogs project, Port of Rovinj Authority has decided to upgrade the existing maritime traffic management system to improve information system functionalities related to vessel traffic monitoring, while also including all the related activities that enhance the port's performance. This upgrade refers to the enhancement of the traditional PCS system, when the national PCS system will be fully developed and implemented after beginning of 2020 in Croatia. It will serve as an intermediator between the given software and the National Maritime Single Window – CIMIS. The advantage of having this kind of solution would greatly exceed its nominal value and it would offer best experience to all of its stakeholders.

Rovinj Port Authority will implement the application that integrates the operational and accounting system of the Port Authority's operations and it will serve as a local PCS. The application enables mooring reservation system, graphic mooring occupancy management, billing via mobile application, creating daily, monthly and annual reports, generating mooring contracts, automatic invoicing, CRM-Integrated Email System, accounting, paying invoices and automated importing of bank statements.

Given the fact that the desired PCS will be of such a high value, the pilot application would serve as an intermediator between PCS and National Maritime Single Window system – CIMIS, where they would be able to develop conditions for interchange of the documents relevant to the optimal running of the state's national system. This improvement of work processes, enabling faster and better decision-making by the port's management, also translates into better billing and payment management for suppliers.

This way, additional benefits will be reaped, both by control authorities overseeing traffic and berthing activities via PCS and end user stakeholders – passengers.

Long term goal of the project is to broaden the technological base of the Port of Rovinj, and create a technological mesh of solutions, adding a new layer of visibility and constantly increasing the security of maritime traffic in the port basin.

Decision on the pilot content was made primarily because of the need to technologically advance the existing way of conducting business, while port of Rovinj heads to the top of the industry benefiting from the use of the latest ICT available. This system allows for meeting the minimal required conditions and greatly exceeding them, while also meeting all of their stakeholder's expectations.

2.1.1.1 Scope of Pilot

The pilot focuses on four major improvement points:

1. *New service provided:*
    a. *Upgraded system which enables stakeholders to have a clearer and more transparent overview of the port's processes while reaping the benefits of the latest ICT technologies available*
2. *Direct impact on external stakeholders:*
    a. *Allowing the end users to experience modern and easy to use system which facilitates the existing processes; increased port security by having clear overview of the processes ongoing within the port's boundaries; automatization of the manual work which minimizes the chances of errors*
3. *Changed processes:*
    a. *Integration of the operational and accounting system of the Port Authority's operations as it will serve as a PCS. The pilot enables mooring reservation system, graphic mooring occupancy management, billing via mobile application, creating daily, monthly and annual reports, generating mooring contracts, automatic invoicing, CRM-Integrated Email System, accounting, paying invoices and automated importing of bank statements.*
4. *Involved agencies:*
    a. *Rovinj Port Authority*
        i. *Primary: actors delivering passenger traffic services in the port*
        ii. *Secondary: actors for cargo and other non-passenger traffic*
    b. *Port Community System (PCS)*
    c. *National Single Window (CMS)*

Main pilot function is to provide important inputs from the aforementioned system, which eliminates the possibility of making wrong business calls, all while providing the best user experience and creating the space for further development and advancements.

Scope of the pilot is requisitioning and purchase of the envisaged equipment, its installation and future desire of functional integration with the existing National Maritime Single Window - CIMIS system, already in use in the Port control center of the Port of Rovinj Authority, and the visualization of the port panoramic presentation for the end user group of passengers using already existing visualization using Web page presentation. Some of the interested PCS modules include:

CUSTOMER RELATIONSHIP MANAGEMENT- CRM
Advanced CRM, designed specifically for marinas enables:

› correspondence with customers and complete information about customer & vessel from any device,
› automatic contract renewal according to various criteria,
› printing contracts and invoices in customers' language,
› automatic email and SMS messaging of relevant information (including offers, business letters),
› planned sales activities (automated reminders & alarms),
› electronic document storage

MOVEMENT CONTROL

› graphical overview of marina occupancy today & history & future,
› vessel movements: arrivals, departures, temporary absences,
› vessel data: berth location, planned lifting out / launching services, expected arrivals.

Figure 7: Available options automatized boat identification and movement control

EVENT MANAGEMENT
Advanced event management enables easy planning & managing all events and resources in marina. Customers are automatically informed about event and are able to fill-in the application form to attend event and other activities.

RECEPTION DESK-GUESTS
› quick serving of guests in marina resort with check-in / check-out,
› simplified vessel-data input and registration,
› guest registration for authorities if needed,
› powerful statistical reports

INVOICING - POS
› automatic invoicing and email sending,
› invoices issuing in the selected language,
› supervision of overdue accounts and their auditing,
› all POS functionalities included.

ACCOUNTANCY
The Accountancy module covers the entire process of monitoring financial documents from their origin to posting to the General Ledger:
› customer and supplier balance,
› financial and material accountancy for service administration,
› automatic interest adjustment and revaluation,
› overdue claims preparation.

MANAGEMENT-EIS
› complete monitoring of marina activities,
› physical and financial indicators,
› service, income and expenses analysis,
› future cash flow,
› data mining by various criteria: profit-centre, location, vessel length, services, flag,
› comparison of financial data over years.

SERVICING AND WAREHOUSE ADMINISTRATION
› complete overview of customer requests about vessel,
› planning individual services and workforce administration,
› managing of derricks and equipment,
› supervision of service work on each vessel and overview of work efficiency.

Other functions include: Yacht Club, Apartments, Store, Food & Beverage, Charter.

2.1.1.2 Main Pilot Activities

Rovinj Port Authority currently uses several different unrelated software systems that make it difficult to operate and monitor all business processes. The implementation of a system that integrates all aspects of the Port Authority's operations will enable optimal control over the operations of the Port Authority in all port areas it manages, and at the same time, enable the control of the mooring capacity occupancy. The application enables better integration of the operational part of business and management. Additionally, it solves the problem of duplicate data entry and possible errors that occur during the input, facilitates access to the data since all the data is digitized and in one place, the software is also available through the mobile application, statistical reports on traffic in the port are generated, significantly reduces the paperwork, radically speeding up processes, digitizing business and enabling better financial control.

2.1.1.3 Timing:

Pilot project implementation began in October 2020 and with approved project extension it is expected to be finished by the summer of 2021, providing sufficient time to deploy, modify and tune existing processes. After that, the work will be completed on the transferability plan for the pilot, the action plan involvement and KPI definition and measurement.

Key outputs:

1. Fully functioning system which serves its purpose as a Port Community System
2. Automatization and facilitation of the existing processes
3. Narrowing the margin of the error occurrence

Milestones:

1. Creation of the pilot work plan,
2. Awarded equipment purchase contract,
3. Awarded integration services contract
4. Full system deployment in production

Key role of stakeholder involvement:

User acceptance test will be conducted through several target groups whose interests are greatly influenced by this pilot application, and they are divided into following categories:

1. Local, regional and national public authorities
2. Regional Development Agencies
3. Enterprises, transport and multimodal transport operators (MTO) including operators of multimodal logistics hubs, infrastructure providers
4. Transport Association
5. Education and training organisations

Involvement of local, regional and national public authorities is planned directing in the pilot deployment. Furthermore, port authorities and chambers of commerce whose interests were not greatly engaged in the implementation of pilot activities are considered to be important in the future for the upscaling of activities in the future.

Engagement of the Regional Development Agencies manifests through better involvement of SME-s and to promote the project results at local level. Local events are planned at the regional level to engage SMEs and regional development agencies. Moreover, the regional agencies can assure a bigger project's impact including their networks in the project. Agencies will benefit from the increased knowledge while also monitoring the whole process of development.

Enterprises, transport and multimodal transport operators (MTO) including operators of multimodal logistics hubs, infrastructure providers - strengthen their involvement and to increase the project's impact, and support project's outputs durability and transferability a dedicated Forum will be created to motivate higher commitment towards empowerment of interoperability and supply chain visibility. Representative entities are going to be from the groups of transport operators, MTO-s, shippers, passenger and freight terminals and shipping companies. All of their expertise is expected to be upgraded through the engagement on the pilot implementation, monitoring of the development and as a result they are all expected to benefit from increased knowledge about the ongoing implementation and technology breakthroughs.

The Transport Association are afflicted because the impact of the considered technologies will strongly affect labour market changing the way people work and working environments.

The role of the **education and training organisations** is to boost the impact of the project results in the academic sector. This will allow the Programme area to develop a common strategy towards transport

digitalisation and to better orientate research on applicable solutions. Group exemplar are universities and research institutes who will be on the monitoring side while also benefit from the experience and knowledge gained.

Stakeholders within identified target groups will be informed about the pilot's go-live by means of e-mail, direct and telephone contact and posts on project social media.

With completion of these steps, the pilot will pass from the planning phase through development and execution to the production/exploitation phase of the project.

Validation (sign off) on the project on the whole at this stage will be done at the level of the port authority.

2.1.2 Full Implementation Envisioned

Full implementation will result in facilitating existing processes and eliminating the need for time consuming administrative jobs which have expensive consequences for even minor changes.

It would result in: digitalized processes of mooring reservation, information providing, billing systems facilitation and automatically generated reports. These changes would bring the business operations to a new level, in turn generating more time and power to the Port Authority and all of their stakeholders, as well as ensuring a transparent system.

Successful implementation of the pilot's activities and their results would represent a huge leap forwards towards the complete integration with National Single Window.

2.1.3 Decision Points for Full Implementation

The application's output documents are a prerequisite for future automation of the communication process with National Single Window (CIMIS), which is not technically possible at this time. As soon as it enables electronic data to be automatically entered and accepted from an external application/source, this system will be ready to establish an M2M dialogue with the port of Rovinj.

2.2 Spatial Data Management System for the Venice Port Authority, Italy

2.2.1 Overview of Pilot

The pilot action main goal is to create a new geospatial data interoperable repository for the Port Authority, aimed at eliminating redundancy, speed-up data access and processing and foster interoperability.

The pilot focuses on implementing a centralized and interoperable geographical information system by merging and integrating several existing systems that work independently. Currently, up to 17 different storage systems are in use, fuelling 48 identified different processes, many of which use data that cannot be georeferenced and related to any other.

The processes that will be improved by implementing the new Spatial Data Management System are firstly the ones related to the maintenance of canals and basins and the management of building projects and infrastructures works, as well as the related assessment procedures, the so-called VIA-VAS-VINCA.

From the urban planning standpoint, the Port Master Plan development, as well as the three-year Operational Plan and the annual list of public works drafting quality, will be highly improved by the capability to manage all the data in an integrated way. Also, all monitoring activities such as those about the Mo.S.E system effects, the security/safety controls and risk prevention, the environment, some port operations controls and all related statistical analysis and reporting will be more methodical and cost-effective.

Many external operators and agencies require different kind of granting and permissions during the day, mainly the ones related to the state properties concessions and urban planning or building permits, but also others like the work within the port area permits, the harmful substances usage permissions or special areas access permissions. All of these grants issuing procedures could be more automated and accessible for the users by developing new web-based applications based on the new data system.

Other processes that will be improved and enhanced will be the general management of state concession, the expropriation for public use, the emergency planning, the waste and the green areas management, the water supply and sewage service management and the hygiene and cleaning services.

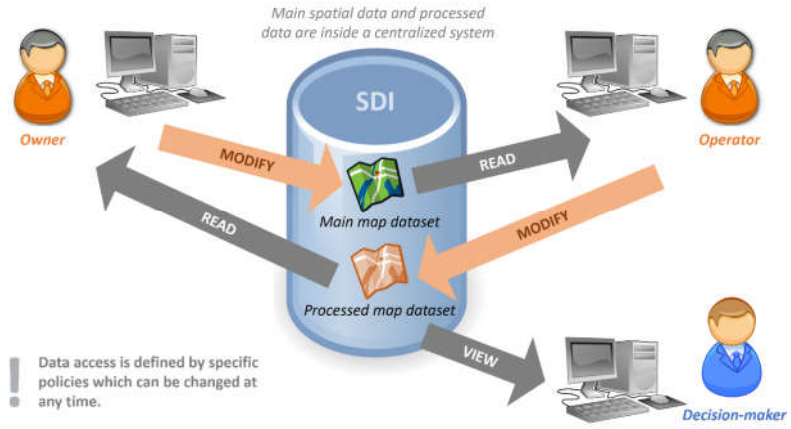

Figure 8: Spatial Data Management System

The hardware/software implementation is supported by a structured education/training programme aimed at making the Port Authority operators able to properly and effectively access the data, perform basic spatial and alphanumerical processing, configuring the connection between the Spatial Data Infrastructure and the tools in use.

The pilot action is the first step of the more complex evolution roadmap, since it consists of the two basic sub-actions related to the infrastructure and the introductive training programme.

2.2.1.1 Scope of Pilot

The pilot action scope is limited to a small subset of the available information assets and number of participants to the training initiatives, while the **long-term goals** include the integration of some existing software platforms, the involvement of employees of all the internal areas and the implementation of new interoperable services for external actors.

The main **pilot function** is to provide the Venice Port Authority with a new IT integrated system for the management and utilization of standard data, real time data and georeferenced (spatial) data both to support decision making processes and improve Port Authority services overall quality.

The **pilot scope** is to make a transition from a current situation in which data is ineffectively managed and used to an improved condition in which more different data can be integrated and dynamically accessed by several users according to different policies and objectives without replication and corruption.

With the pilot action, a Geodatabase will be installed and configured as the main engine of the Spatial Data Infrastructure and operators will be trained to store and process data within the new system. In this stage, as **project input**, it will be required to select an adequate dataset package with which to perform the optimization and migration operations, as well as to select a group of employees to participate in the special training program aimed at enhancing their performance in using the new system for their working activities. **The output** will be a new working instance of the Geodatabase engine with a subset of structured and optimize spatial datasets, available through the platform for all Port Authority operators. The operators will be able to connect their workstations to the SDI, access and process data and produce outputs according to special policy management protocols. The Spatial Data Management System will allow to store the processed data and maps either as new datasets or as algorithms that process data in real time, without forcing operators to change the already known working tools.

The suggested activities will not require software development; therefore, the pilot action will have a "training-empowered" approach in order to achieve both an organizational improvement and a workforce skills improvement, fostering the awareness on how spatial data visualization and dynamic data processing can support decision-making process.

The main **pilot limitation** is mainly related to the complexity of the future system architecture so only a reduced set of data sources can be optimized and integrated into the new system. A possible issue could also be related to the timely availability of some new data sources that should be obtained from a survey in 2021.

2.2.1.2 Main Pilot Activities

The pilot is based on six main macro-activities.

1. The planning stage that has been completed in February 2021.
2. The second stage that relates to the spatial dataset identification which has been completed in March 2021.
3. The third stage focuses on the hardware/software infrastructure implementation, which has been completed in April 2021.
4. The fourth stage addresses the migration of the collected dataset into the new Spatial Data Infrastructure, which is a process including the analysis of the dataset quality level, the optimization of the dataset and its conversion/migration into the destination system. This stage will be completed in August 2021. During this stage, a series of training and educational initiatives for the Port Authority personnel will also be carried out.

5. Between about August and October 2021, the fifth stage will be carried out, consisting in the definition and development of special procedures aimed at integrating and georeferencing the migrated dataset in order to test the expected benefits within the related processes.
6. The sixth and last stage refers to the analysis of the possible optimization of the processes that use spatial data which will support the long-term planning of the Spatial Data Infrastructure integration within the organization. This stage will be completed by November 2021.

2.2.2 Full Implementation Envisioned

The pilot action includes the identification of an initial set of data sources to be analysed, optimized, and migrated based on the Strategic Planning and Development department core information asset. This is because it is the lead department in involvement in DigLogs project preparation and because the first stage of the Spatial Data Infrastructure also includes the hardware/software platform implementation and testing.

Once the test phase (the pilot) is completed, the whole system will be ready to integrate all the Port Authority information assets, which are estimated to include more than 100 different datasets, starting with the departments that manage the most data-driven processes, such as the Technical Department and the Financial and State Property departments.

Furthermore, the SDI will be integrated with a Metadata system application aimed at making more effective the browsing of the several data sources and the data processing procedures and improve the related Port Authority internal processes and services provision. Anyway, the main objective of the system integration stage is to apply special interoperable protocols to the in-use software applications in order to join datasets belonging to different processes and obtain new strategical outputs and relevant statistical data.

2.2.3 Decision Points for Full Implementation

There are some key points of discussion about the long-term implementation scenario of the Spatial Data Infrastructure, especially as regards the applications and processes to which the different data sources are related. Some in-use software application and platforms are still fuelled by the datasets that are going to be migrated to the new system, so there will be the need to decide whether to redesign the data connector or redesign the whole application instead.

Something similar will happen for the processes and services; in some cases, the migration or the changes in data sources will have a little impact on the related services or processes but, in others, the changes will force a service redesign or a process revision. On the basis of the improved ICT infrastructure, the

need to develop new innovative services will arise, so the involved stakeholders, such as users, data owners, or regulatory institutions, will have to come to special agreements about issues related to interoperability, data property or privacy and security.

Furthermore, the technical and/or the regulation scenarios might change and force some actors to modify some procedures, processes, and services in order to achieve the full implementation scenario or even just to keep them properly working.

2.3 App for Data Flows Management for the Port of Rijeka Authority, Croatia

2.3.1 Overview of Pilot

The pilot project goal is to establish a monitoring system using a highly modular, ready to go, compact surveillance solution, consisting of video and fixed lens thermal cameras, which is ideal for short to medium range surveillance applications, capable to exactly pinpoint every small vessel or other vehicle present or approaching the passenger terminal. This underlines the passenger pilot category, where Port of Rijeka Authority's project neatly fits.

The pilot system connects seamlessly to the existing Transas VTS system used in the port of Rijeka. It increases resolution of the existing system, enabling early detection and tracking of very small vessels that cannot be reliably detected using existing system. Furthermore, it enables tracking of such vessels during the night and adverse conditions (rain, wind, snow, fog). In addition, the pilot will extend available data, information and visualization to end users – passengers, thus further increasing security in the port basin.

2.3.1.1 Scope of Pilot

The Pilot seeks to provide improved coverage of the area inside Rijeka port breakwater, especially in terms of detection, diversification and identification of smaller targets in close proximity to one another. Since area inside of breakwater is designated for commercial cargo vessels, including service vessels supporting them (i.e. tugs, pilots, etc.), but also fishing vessels, yachts and leisure boats, end users and operators serving them would benefit from covering the area with camera solution which would provide another possibility for insight into traffic and redundancy to the existing radar system, giving the passengers and identified stakeholders inside target groups an improved situational awareness.

Situational view of Rijeka's Cruise Facilities, including City Center, Container pier, Passenger pier and Passenger Terminal (including tendering) is shown below.

Figure 9: Rijeka's Cruise Facilities

Main pilot function is provision of additional visibility layer to VTS system operators, increasing boat resolution and visibility, showing port basin situation to end stakeholders and passengers and enhancing safety in the area, by implementing new sensing hardware.

Oversight and integration with the Rijeka Traffic system in the segment of the visual feed, will be achieved by using a pair of varifocal IP67 IP cameras that will server the data feed using a dedicated switch for further processing and visualisation on the publicly available Web page towards end users (passengers). The idea is to present maritime traffic information in conjunction with other geospatial data and information to the end passengers.

This way, there will be twofold benefit for the end users – passengers – increased safety of maritime traffic on the VTS/VTMIS level, used by the Port Control Center, and the visualization of the area, on the passenger level.

The pilot will have a direct impact on external stakeholders: increased port security for passengers (end users) by provision of a timely, high resolution visualization of the traffic, increased port security by increasing resolution of the existing control mechanism.

Direct added value of the project is further extension of the gathered and processed information towards end users-passengers, thus enabling direct benefits for them. For example, a QR code or similar interconnectivity technology may be used as a form of notification that would be posted at the passenger terminal, or using digital outlets with similar functionality, which would allow passengers to download and install mobile application via smart mobile devices, and access visual representation and numerical

data representing all information related to the vessel traffic in port of Rijeka that is applicable and significant for them.

2.3.1.2 Main Pilot Activities

First steps focus on the installation of the hardware. The sensing devices will be installed in several suitable locations with adequate visibility and connected to power source and data links.

Front-end development for user centric services will run in parallel, and with approved project extension, the completion is planned mid Q3/2021. Output from the camera device will captured and tunnelled to the front-end and visualized using a map on the Internet, freely available to all interested stakeholders from target groups and passengers. Activities related to transferability, action plan and KPI measurement will completed afterwards.

Information related to the pilot, including QR code leading to the map will be placed on information panels installed in easily accessible locations.

Stakeholders within identified target groups will be informed about the pilot's go-live by means of e-mail and social networks dedicated to DigLogs project later in Q3/2021.

With completion of these steps, the pilot will pass from the planning phase through development and execution to the production/exploitation phase of the project. Figures on the following pages show some described aspects of the project.

Validation (sign off) on the project on the whole at this stage will be done at the level of the port authority.

The application would also be useful for passengers arriving at the port of Rijeka as they would have real-time information into the arrival / departure and position of the maritime traffic inside the port of Rijeka, and presents a possibility for further project enhancement.

Key outputs:

Video sensing device, serving output data to a dedicated, custom made Web client application will be connected via a pilot-developed module to existing traffic system and display in real time the inflow of small and large vessels and vehicles moving at the passenger terminal, serving this information towards a) Port Traffic Control center / VTS and b) passengers, using open Web.

Milestones:

1. Creation of the pilot work plan,
2. Awarded equipment purchase contract,

3. Awarded integration services contract, and
4. Full system deployment in production.

2.3.2 Full Implementation Envisioned

Feedback will be gathered and hopefully, it will be largely positive, marking establishment of a satisfactory new service to the end users. Some suggestions that will be received probably will not be acknowledged as a part of this project, but they will be considered as a part of future system upgrades using other sources, which is what is normally expected in similar projects.

End of the pilot action will mark beginning of the operative system exploitation and maintenance. No specific maintenance is envisaged, considering robustness of the installed equipment. In terms of ongoing maintenance, it will be primarily reactive, meaning that appropriate actions will be taken if there is interruption in the functioning. Representation using Internet map will be checked for functioning and managed as a part of the Rijeka Traffic information system. Check procedures and maintenance became an integral part of the IT department's duties inside Port of Rijeka Authority.

Financial means required for maintenance of the product are considered to be marginal, and after depreciation and end of functional amortization, it will be replaced within regular asset renewal policy of the Port of Rijeka Authority.

Usage of the system will be measured using web access counter page and regular Web page metric, already used for access to map served by Rijeka Traffic information system. This metric will show utilization of the map by the end users – passengers and stakeholders within identified target groups.

As a summary, successful pilot project execution and deployment marks beginning of additional functionality provided to end users in a simple and easily accessible manner, adding a layer of visibility in the port area, especially aimed at safety and oversight of the passenger traffic, thus achieving the pre-set project goals.

The intention is to create Web-based system for the end users in order to simplify the usage and avoid creation of two separate applications for mobile devices (Android and iPhone), that would not fit within the project's financial constraints.

2.3.3 Decision Points for Full Implementation

All found and known errors and issues will be classified to a few categories and handled in order of importance until all were fixed:

1. *Critical errors* - all errors that could cause the system to be inoperative were identified and fixed,
2. *Less important problems* - such errors were treated using workarounds, and
3. *Requests for Enhancement (RFE)* - this is input that will be gathered during testing, but after the plan was drafted, and hardware and services procured. Such requests could not be fulfilled as a part of the project, due to time and budgetary constraints. They will be treated as separate small projects, in the period after pilot deployment, using own funding, if their evaluation shows it could be beneficial for the port community, focused
   on the passengers

3. Supporting Passenger Services

Two DigLogs pilots focus on supporting passenger services, in particular:

- Access Control for the Port of Šibenik, Croatia
- Mobile Security in Trieste, Italy.

3.1 Access control for the Port of Šibenik, Croatia

3.1.1 Overview of Pilot

Main pilot function is to envisage, deploy and put into production an innovative solution for passenger flow control in covered Port of Šibenik terminals, and achieve automated solution for enhancement of security and safety in the port area including payment, tracking, oversight and analysis solutions. Its function is to serve as an input solution for further connection with the national PCS system whose implementation is ongoing in parallel with this pilot project. In particular, the pilot will establish a new, innovative and automatic solution for passenger and physical persons ID card issuing, tracking and management within remit of Port of Šibenik Authority with particular focus on passenger traffic. This need is greatly increased with the fact that creation of a national PCS system is ongoing and it does not have a dedicated module for access control.

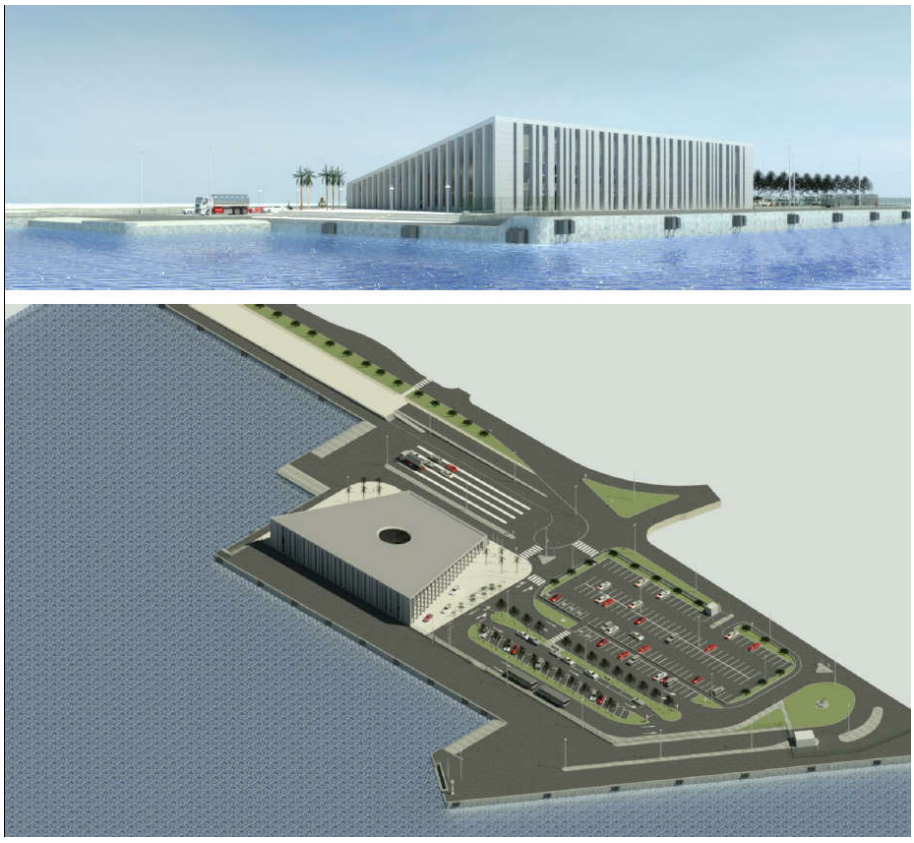

Figure 10: Passenger terminal Port of Šibenik, upgrade of Vrulje quay, building of the passenger terminal with traffic installations from the 3rd phase – architectural 3D visualisation

The pilot addresses:

1. Changed processes:
    a. Application process for passenger access to passenger port area, port security permit issuance process, ISPS assurance process and tracking/reporting
2. Involved agencies:
    a. All passengers
    b. All freight agents operating in port of Šibenik,
    c. All terrestrial cargo traffic operators (categorized for simplicity as one item) and
    d. All other occasional or permanent visitors to port area (police, Customs officers, other state agency officials, vendors, consultants, subcontractors, teams filming in the port area etc.) who need to fill paper documents in order to obtain access to port area.
3. New service provided:
    a. Fully digital virtual (dematerialized) access permit issuing for the passenger access to the port areas, including online and digital payment, reporting and tracking
4. Direct impact on external stakeholders:
    a. Timely permit acquisition, simplified and digital payment using modern tools, digital permit tracking

3.1.1.1 Scope of Pilot

Basic motivation is digitalization of the demand request and access permits for the passenger side of Port of Šibenik. Permits therefore become digital products whose status can be checked from any physical place using tools embedded in the system. Full digitalization should ensure traceability and follow up to every request for permit issuing. Digitalization will enable additional functions for better traffic management and tracing port resources and increase general level of security. End users will gain higher service levels and lowered levels of stress, as they will be able to perform all these actions in advance and remotely.

Scope of the pilot is requisitioning and purchase of the envisaged equipment, its installation and functional integration, development of the web and mobile applications aimed towards administration, passengers and the police, and implementation of analytic capabilities for the system.

Visual **representation** of the ID card in Croatian language is shown in following Figure.

Figure 11: Visual representation of the ID card

3.1.1.2 Main Activities

Crucial project components to be delivered are:

1. Web application,
2. PC and mobile application,
3. Police and security application,
4. End user education and training, and
5. Final production work – delivery.

This project involves introduction of the system that belongs to a group of mission critical components of the Port of Šibenik Authority in the area of the access control. This requires maximum possible system availability by ensuring availability to distributed system parts and application and database collocation (vendor of the system). Energy supply and network links are determined to be critical parts of the required infrastructure. Availability and security of the system needs to be ensured by technical measures and equipment, both on the side of the **end user** (*Port of Šibenik Authority*) and perspective **system vendor**

Timing:

The pilot work began in 2020 and is expected to completed by Q3/2021. Afterwards, work will begin pilot transferring, action plan creation and KPI setting and measurement.

Milestones:

1. Development and delivery of the application program components,
2. Integration testing, and
3. System production.

3.1.2 Full Implementation Envisioned

Long term goal of the project is to facilitate ongoing building of PCS that will have a significant impact on all port of Šibenik stakeholders and their IT systems, and they have been involved in the process from the very beginning, even before than CEF funding was secured. PCS will have several dedicated modules for various concessionaires, and they will have to adjust their systems a part of regular planned internal growth and maintenance activities. Access control is one of such systems, once the PCS will extend also to liners and passenger maritime traffic.

PCS needs to be connected to the surrounding systems (such as CIMIS) with underlying goal being avoidance of multiple data entry and facilitation of data exchange between stakeholders. Along with all the other systems enabling electronic communication in maritime traffic, PCS forms an important constituting and participating element of the NSW platform. The "Project of setting up a single national Port Community System" is currently underway, with the Ministry of the Sea, Transport and Infrastructure being the bearer of the project. Cooperating parties in this project are, among others, Port of Rijeka Authority and Port of Ploče Authority. Once the mentioned project is completed at the end of 2021, all the Croatian port authorities will have a fully functional PCS system at their disposal that will be adaptable to all Croatian cargo ports with minor changes and adaptation dependant on local characteristics of each individual participating port. One of such ports is also port of Šibenik.

3.1.3 Decision Points for Full Implementation

Before decision making for transfer and additional implementations, each leading actor wishing to proceed, needs to analyze benefits and disadvantages serving as a starting point towards the need of potential improvement. Such types of enablers and barriers are typically grouped into financial, physical, technological, environmental, political and legal. In each of the groups, the actor needs to evaluate potential a) benefits b) disadvantages and c) improvements. Full implementation is viable only if improvements and benefits override disadvantages.

- End of the pilot action marks the beginning of the operative system exploitation and maintenance. No specific maintenance is envisaged, considering robustness of the installed equipment. In terms of ongoing maintenance, it will be primarily reactive, meaning that appropriate actions will be taken if there is interruption in the functioning. Representation using Internet map will be checked for functioning and managed as a part of the existing information system. Check procedures and maintenance became an integral part of the IT department's duties inside Port of Šibenik Authority.

- Financial means required for maintenance of the product are considered to be marginal, and after depreciation and end of functional amortization, it will be replaced within regular asset renewal policy of the Port of Šibenik Authority.
- Usage of the system is measured using web access counter page, already used for access to map served by the existing information system. This metric will show utilization of the map by the end users – passengers and stakeholders within identified target groups.
- As a summary, successful pilot project execution marks beginning of additional functionality provided to end users in a simple and easily accessible manner, adding a layer of visibility in the port area, especially aimed at safety and oversight of the passenger traffic, thus achieving the pre-set project goals during earlier project phases.

3.2 Mobile Security in Trieste, Italy

3.2.1 Overview of Pilot

The main **project goal** is to assess the effectiveness of the application of mobile technologies to enhance people safety/security on passenger vessels. The project will be mainly focused on ship evacuation, which is a very complex and critical operation during ship design and even more in the operative environment, when it could be strongly affected by the emergency scenario. In fact, as a consequence of a fire or flooding emergency, ship abandonment could be required.

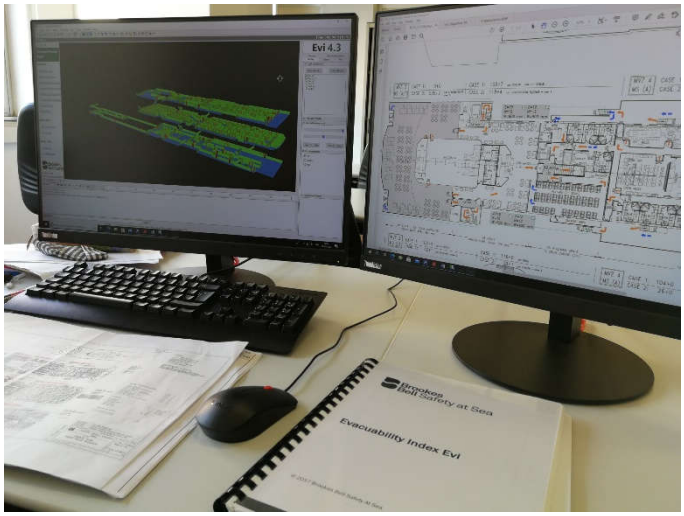

Figure 12. Evacuation analysis during the design phase.

Passengers are currently trained for emergencies, but in a real emergency situation, some escape routes might not be available anymore (especially in case of fire). In such a case passengers could be obliged to come back and search for alternative escape routes, wasting time. Moreover, evacuation can be hindered by the panic occurrence, which might again increase the time required to evacuate the ship. In this context, the usage of mobile technology can enable a reduction of evacuation time, preventing passengers to go in the wrong direction and increasing their situational awareness to limit panic occurrence. The availability of clear guidance information, considering the current status of escape routes, has been already found useful. However, the application of mobile technology to provide guidance onboard has not been tested yet and requires special attention due to the peculiarities of the onboard environment. Besides, the ship is also a challenging environment from a technical point of view. A mobile guidance system requires device localization as a prerequisite. Onboard a ship, localization cannot be carried out with standard methods, such as GPS. The ship is a non-fixed environment and the steelwork does not

allow the application of several wireless technologies, due to shielding effect. Bluetooth technology has been already applied to design onshore localization services [4-5] and on passenger ships for commercial purposes [6]. However, up to now, it has not been applied in building positioning systems applicable during emergencies. Hence, the pilot will investigate also the best technical solution to develop an onboard localization service, which has to make information available to the crew, supporting their decisions and reducing reaction time.

3.2.1.1 Scope of Pilot

The **main pilot function** is to develop and test a mobile guidance system capable to reduce the evacuation time on passenger vessels in a real emergency scenario. The system will be composed by an application (APP) to be installed on mobile devices and a backend program capable to collect data from mobile devices for monitoring and analysis purposes. The APP will exploit Bluetooth beacon to locate the user inside ship public spaces and thus guide him to the ship muster stations through the shortest route while taking into account the available escape routes, which could be blocked due to fire, flooding or overcrowded.

As mentioned, the **pilot scope** is to measure the benefits coming from the adoption of mobile technologies to enhance ship safety in terms of reduction of the evacuation time. To this end, tests will be performed in a real environment (passenger vessel).

The main **input** data for the APP will be the signals coming from a Bluetooth beacons net, while the **output** will be a user friendly and clear guidance information that will be provided to the user to speed up the ship's evacuation.

The main **pilot limitations** deal with the small scale of the pilot project. In detail, the experimental campaign involving a sample population will be carried out in a limited area of a passenger vessel. This is sufficient to reach the goal (check technical feasibility and measure the evacuation time) which is the most important prerequisite to enable widespread adoption of the tested technology. Due to the limited area and the limited number of user, the APP and the Backend could require to be scaled and applied in wider environments. During the pilot, the ship WiFi will be adopted to enable the communication between the APP and backend. In a real application, this solution would be viable provided that the WiFi is powered by the emergency grid. Otherwise, it would be necessary to adopt other connection means to assure the functionality during an emergency.

Changed processes: Ship evacuation and abandonment processes.

Although passengers are currently trained for emergencies, in a real emergency situation, some escape routes might not be available anymore. Moreover, evacuation can be hindered by the panic occurrence, which might again increase the time required to evacuate the ship.

New services provided:

The pilot will demonstrate the availability of clear guidance information, considering the current status of escape routes; localisation of passengers, in order to detect and avoid unauthorised access to restricted areas; in case of onboard infections, track of infected passengers and containment of disease spread; commercial purposes.

Agencies and external stakeholders involved:

The pilot involves Shipping companies, Port terminal managers, Shipyards, and Ship Classification Societies.

3.2.1.2 Main Pilot Activities

The pilot includes two applications: the APP and the backend. The APP will be developed and installed on 30 mobile devices (smartphones/smartwatches) and will perform the device positioning based on a Bluetooth beacons net. In detail, the APP will localise the position of the device within the test environment basing on the closest beacon

The backend application is installed on a laptop, shows, records the localisation data and performs some basic analysis including import/export functionalities. The communication between backend and mobile devices equipped with the APP is assured by the Ship WiFi, provided that the solution will be proved to be feasible in the test environment.

The pilot system will be required to work in two modes:

1. Standard: normal condition, the APP locates the user.
2. Emergency: the APP guides the user to the muster stations through the shortest escape route.

Figure 13. Schematic view of the pilot arrangement and communication between components.

In both modes, the APP transmits the device position to the backend, which shows the location of the connected devices on the ship general arrangement. Both the APP and Backend will record data in a log file. The function mode will be selected using the backend application and automatically transmitted to all connected devices.

Multiple escape routes scenarios are assessed. They include design conditions (all escape routes available) and additional scenarios, where one or more paths are blocked. Using the backend, the active scenario is selected to address the actual condition of rooms, corridors or staircases that might be blocked by fire, water or smoke. The selection of the actual scenario is automatically transmitted to the mobile devices where the APP is installed. This basic solution has been considered satisfactory to fulfil the pilot project objectives and can be easily improved adding an automatic generation of the escape routes scenario after pilot completion. Based on the active escape routes scenario, the APP provides guidance information to the user.

The system (APP and Backend) will anyway be maintained for 5 years in UNITS facilities, using proprietary hardware as required by DigLogs application form.

Details for Pilot Testing

The pilot application will be tested on a medium-size passenger ferry which is currently under construction at Visentini shipyard in (Porto Viro). UNITS will sign an agreement with the shipyard, which will collaborate free of charge putting at disposal the ship and its Wi-Fi network. For the experimental campaign, an area within passenger accommodations including two decks has been selected:

- Deck 6 (Passenger deck), where the passengers' cabins are located;
- Deck 5 (Restaurant deck), where the vessel's common areas are fitted, as well as muster stations and lifeboats' embarkation.

The test environment (see following figure) will be limited to the two main corridors on Deck 6, the ship main lounge on Deck 7 and the three staircases connecting the two decks. The area has been selected as a test environment since the presence of multiple staircases makes it easy to define alternative evacuation routes from cabins (start point) to the main lounge (assembly point). Hence, by blocking one or more staircases, it will be possible to test the effectiveness of mobile technology in guiding persons along available escape routes during evacuation.

Figure 14. Test environment for experimental campaign

All rooms within the selected test environment will be properly fitted with Bluetooth beacons to cover all the spaces with the signal of at least three devices. This should enable the localisation of mobile devices in the test area. The location of beacons will be optimised to ensure a good localisation accuracy (errors within 0.5 m). The connection between mobile devices and backend will be assured by the ship Wi-Fi network.

3.2.2 Full Implementation Envisioned

After the experimental tests, collected data will be analysed in order to quantify the benefits of the tested solution. The conclusions, together with the findings from the net configuration phase, will be properly documented according to DigLogs application form. This will be the basis for subsequent dissemination activities and, in case of success of the pilot project, in proving the evacuation time reduction for possible further system development.

The main **long-term goal** is to foster the deployment of mobile technologies for onboard safety and security purposes. The achievement of a reduction of the evacuation time is essential to raise the interest of shipping companies and, thus, to enable further development of the technologies tested during the pilot action. Besides the experience gained during the pilot, from a technical point of view is expected to ease the development of onboard positioning systems and their scalability.

A reliable onboard localization service can enable the development of **more complex solutions** compared to the pilot one. Furthermore, additional tools are already foreseen to increase the ship safety and security, ranging from the access to restricted area control to the persons tracking in case of onboard infections, passing through the enhancement of crew situational awareness and the improvement of communication/data collection during an emergency. Besides, localization can be extremely useful for commercial purposes too. The development of combined systems including also commercial functionalities can, even more, encourage the application of mobile technologies for safety/security, fostering their development and widespread diffusion.

3.2.3 Decision Points for Full Implementation

After the installation and configuration in the test environment, a system trial will be carried out under the supervision of UNITS. During the trial, all the functionalities of the system will be checked in agreement with the test procedures suggested by the developer. After trial success, UNITS will issue an acceptance document and the system will be considered ready for deployment.

The pilot foresees several critical issues which will need to be assessed before a full implementation is possible:

1. Difficulty into reaching acceptance for using the application from passengers;
2. Location-related operational limitations;
3. The compliance to privacy regulations and GDPR might be complex and costly;
4. Being sure of the adequacy of available technologies;
5. Too much reliance on technologies can lead to not doing the necessary in-place checks.

The foreseen decision points that will need to be assessed before a full implementation is possible include:

1. Involvement of Classification Societies to adequate the Regulation framework in terms of safety and security;
2. Replacement of non-digital features with digital ones;
3. Integrating a new product in an existing service;
4. Increasing internal and external communication;
5. Carrying on educational and training activities;
6. Making processes faster and more effective;
7. Embedding new tools or methods inside existing processes;
8. Developing new integrated procedures to eliminate redundant activities;
9. Better connect integrate systems;
10. Getting new information processing functionalities;
11. Getting information network exchange capability;
12. Improving data acquisition capability;
13. Performing systems and applications updates;
14. Specifically allocating financial resources for the needed actions;
15. Scouting for raising new funds and resources;
16. External services and consulting.

Furthermore, the pilot could raise questions in the mid to long term regarding innovation impacts triggered in this industrial sector and new competitive scenarios.

4. Next Steps

As the DigLogs project approaches its final phases, the results from the pilot projects will be analysed and used to develop final conclusions on the success of the pilots and, most importantly, on their potential for:

- full implementation locally with the enhanced features and involving more stakeholders
- transferability plans which provide indications on possibility for replication by stakeholders outside the pilot areas. This will create impact and paths for improvements in multimodal transport services for freight and passenger transport services. It should increase the level of digitalisation of the most of the transport flows, concerning freight and passengers, of the IT-HR area by implementing innovative ICT solutions able to support a wide range of IT services for logistic operators, private passengers, public authorities etc.