D.3.2.1 METHODOLOGY FOR REVIEWING OF TECHNOLOGICAL SOLUTIONS FOR THE IMPROVEMENT OF SUSTAINABLE AND MULTIMODAL / CROSS-BORDER PASSENGER SERVICES

Document Control Sheet

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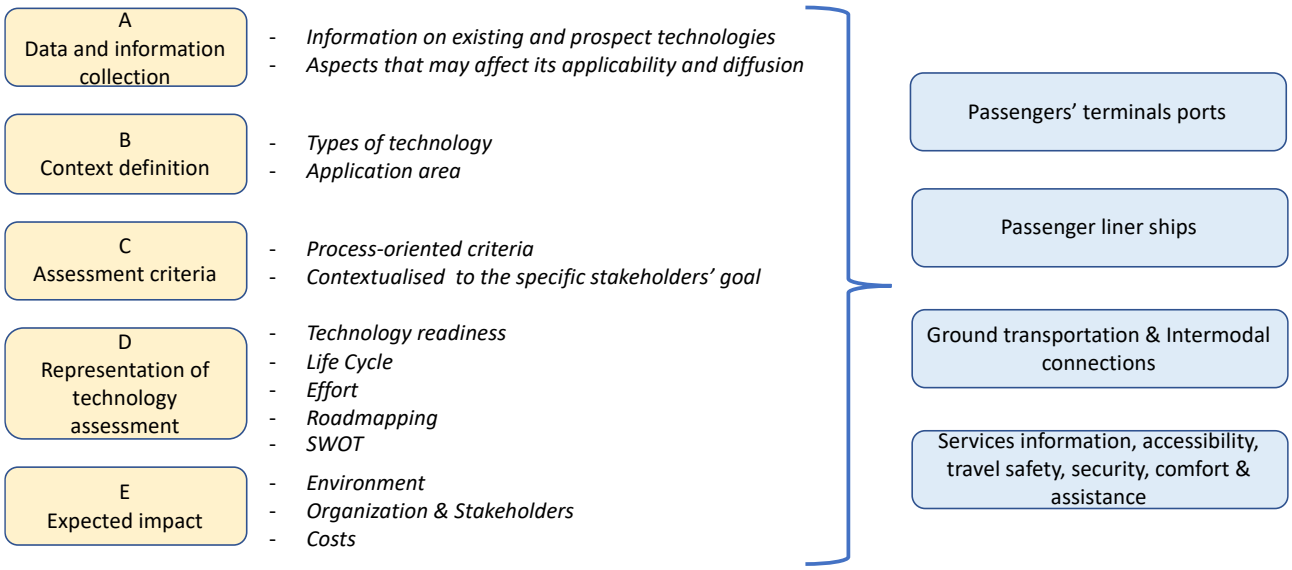
Summary

The MIMOSA Project has the goal of improving the quality and sustainability of cross-border and coastal passengers' mobility between Italy and Croatia. The specific role of WP3 in the project is to identify and spread sustainable solutions on the basis of an up-to-date knowledge about travels' demand and offer, as well as to propose an action plan for a sustainable transport planning model. In the framework of the WP3, Activity 2, this document represents the Deliverable 3.2.1, which include the methodological steps that are necessary for the review and assessment of technological alternatives. In a nutshell, the overall process includes five main steps, to be applied to four different areas / technological domains. Such process is summarised in the figure 1.

Figure 1. Overall process with five main steps



The two following sections are devoted to the description of the overall goal of the project framework (section 1. Introduction) and, specifically, the role of WP3 in the project (section 2. The Scope of WP3). Section 3 (Aim and scope of this document) draw the boundaries of this methodology, specifying that it is a document intended not only to provide guidelines for the actions of the MIMOSA project but also to constitute a more general reference for the stakeholders of the program area. Section 4 provides the theoretical background of this methodology, while sections from 5 to 9 explicit the steps to implement for the technological review, in general, and in the four identified areas.

1. Introduction

The main goal of the MIMOSA project is to improve the offer of multimodal sustainable passengers' transport solutions and services, with the promotion of a new cross - border approach for passenger mobility in the Programme area. The project partnership, composed by the main actors at the regional and national level in both countries, is determined to jointly tackle the common challenge of increasing multimodality, reducing the impact of transport on the environment.

As pointed out in the Key Facts analysis of the Italy-Croatia Cooperation Programme, connections between Croatia and Italy show bottlenecks and lack of quality and people self-organise for travelling from one country to the other and back. The Cooperation Programme itself highlights that the cross-border area is characterised by the dominance of road transport on land-bound routes and by limited connections to the hinterland. At the same, there is a strong need to reduce the environmental impact of transport activities by increasing multimodality and shift to most appropriate environmentally friendly modes of transport, as well as the need to reinforce ICT application for making open and easier the access to transport info and intermodal opportunities for passengers mobility. In general terms, that is also calling for the overall vision well beyond the port, which will then undoubtedly play a key role in the intermodal node.

Having a result-oriented approach, in developing visible outputs, ranging from multimodal solutions to innovative and smart tools and technologies, MIMOSA is focused to change the current situation affecting the cross - border and regional connections, making more accessible, low - carbon and sustainable the mobility of passengers in the whole Programme area.

A cross - border cooperation approach is necessary for solving the common problems of road traffic and of a low level of connectivity between the two countries, for providing citizens and tourists with a wider offer of mobility sustainable options, based on a shared knowledge on transport demand and passengers habits and needs, which makes the project original in comparison to previous initiatives. Thus contributing to achieving the medium - turn result of passengers behavioural changes. The project is based on a common cross - border approach at an institutional level and has a result-oriented approach in planning and testing new and concrete solutions for reducing the environmental impact of transport. It seeks to reduce the environmental impact of transport by increasing multimodality and by fostering the shift to environmentally friendly transport modes in passenger mobility.

2. The Scope of WP3

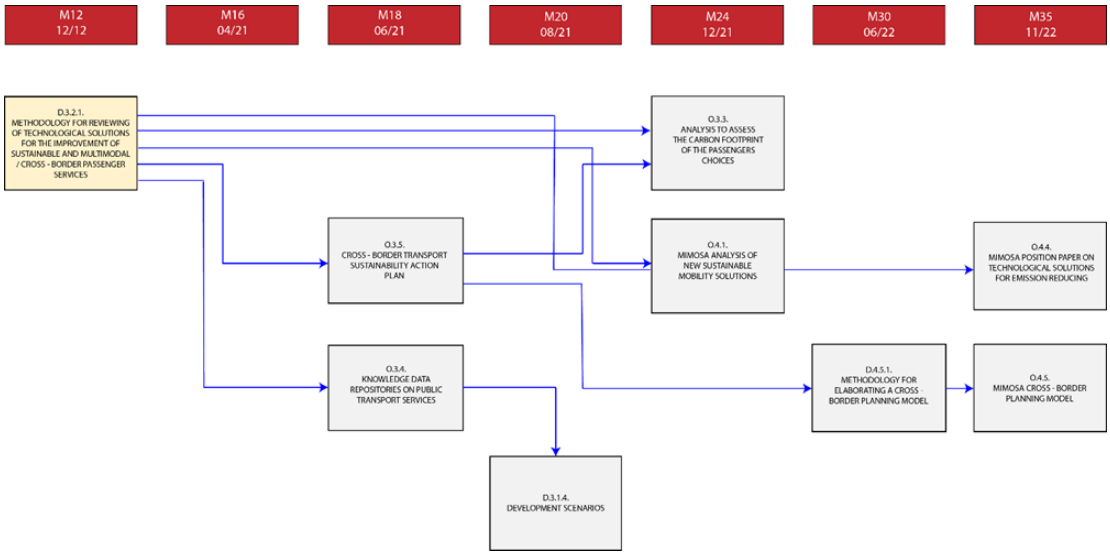
The main task of WP3 is to provide up - to - date knowledge of the supply and demand for transport services between Italian and Croatian liner passenger service with an overview of existing and possible passenger segmentation. The general aim of WP3 is the shifting of passengers from cars to sustainable transport solutions at the following territorial levels:

1. Local Level
2. Regional Level
3. Cross - border level

Each of the proposed outputs has a strategic and strong cross-border dimension: to improve the knowledge of transport demand (O.3.1), passengers habits (O.3.2), the carbon footprint of the passengers' choices (O.3.3), and the offer of public transport services (O.3.4), for defining a transport sustainability action plan (O.3.5) and in elaborating a CB planning model (O.4.5) it is necessary the contribution of decision-makers of both countries, whereas pilots and feasibility studies (O.4.1, O.4.2, O.4.3, O.4.4, O.5.1, O.5.2) will need coordination, to ensure harmonization and standardization of the tested solutions and the involvement of Italian and Croatian stakeholders.

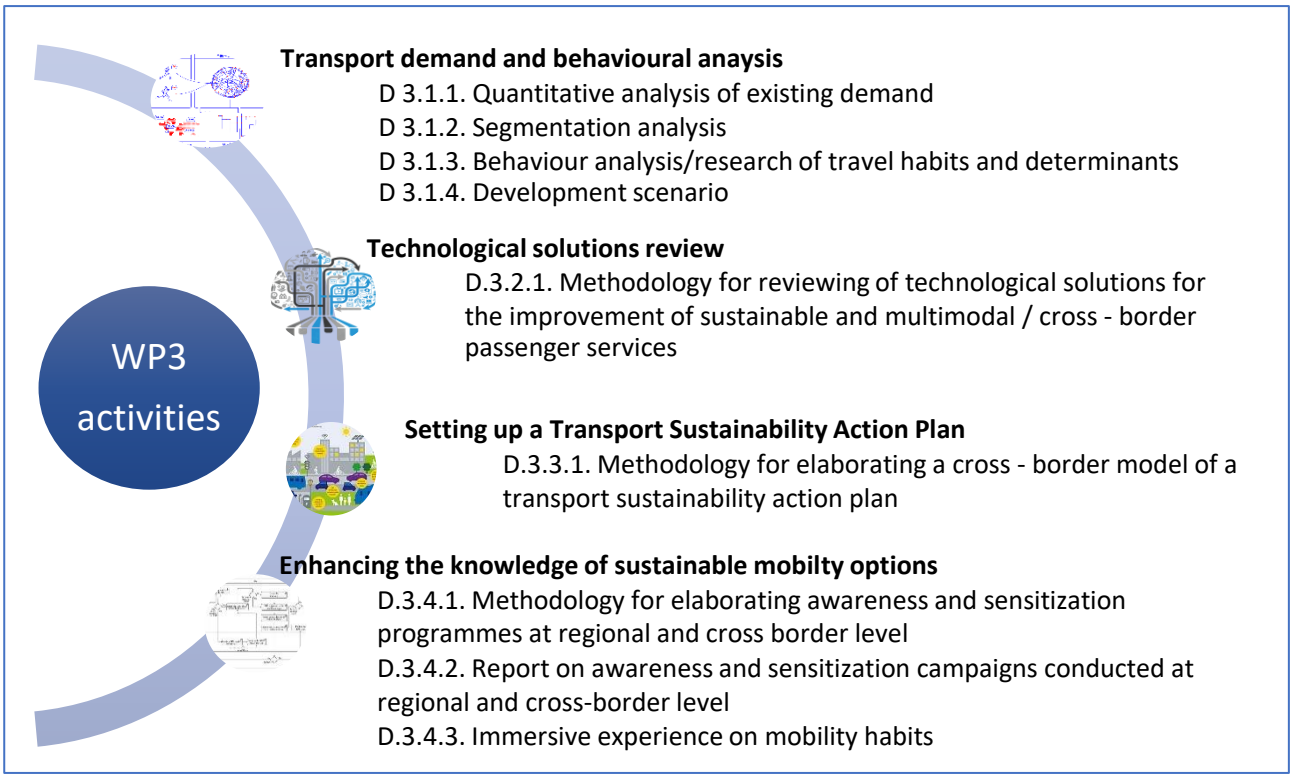
The importance of WP3 lies in the fact that its expected outputs will be facilitated as a set of criteria about which decisions can be made (as a framework of reference) for pilot actions of WP4 and WP5. The relevance and relatedness of D. 3.2.1. with future outputs and deliverables is depicted in fig.1.

Figure 2. The relevance and relatedness of D. 3.2.1. with future Outputs and Deliverables



WP3 is jointly coordinated by Ca 'Foscari University of Venice (PP2) and the University of Rijeka - Faculty of Maritime Studies (PP10), but all project partners contribute to specific and cross - border roles. The package is comprised of 4 consecutive activities which are further subcategorized into deliverables.

Figure 3. WP 3 activities and deliverables



Activity 1 - Transport demand and behaviour analysis (coordinated by PP2 with the support of PP10, with the contribution of all partners). Passenger transport demand analysis is conducted for the entire program area (Italy and Croatia).

Demand analysis will be both quantitative and qualitative. The traditional analysis of passengers' flows, disaggregated by origin and destinations, will be accompanied by an analysis aimed at identifying the determinants of travellers' behaviour and choices, as well as an analysis of current and potential demand segments. From the analytical determination of the main flows and related determinants, in the micro-level (demand segments, behaviours) will be possible to drive useful

indications for the formulation of scenarios, i.e.: the description of one or more possible future transport development trends, starting from the existing situation, concerning relevant aspects of transport supply and demand. Such scenarios will be developed for the specific purpose of providing authorities and competent institutions with a reference framework for the improvement of cross-border transport planning.

As a whole, Activity 1 is comprised of four deliverables:

- D.3.1.1. Quantitative analysis of existing demand, that aims at providing an updated picture of the movement of passengers between Italy and Croatia, with prevalent attention to maritime transport and coastal areas in connection with intermodal passengers terminal.
- D.3.1.2. Segmentation analysis, whose goal is to identify the main features of groups of travelers having similar behaviours and choice criteria, in order to better understand how to improve accessibility and transport-related services in general.
- D.3.1.3. Behaviour analysis/research of travel habits and determinants, which aims to investigste the key determinants of travel behaviors and choices of the identified segments of travelers, thus offering knowledge useful to define public awareness actions towards more sustainable behaviors;
- D.3.1.4. (Sustainable) Development scenario, an analysis that, given the current situation and trends, aims at identifying and evaluating the effects of alternative policies, procedures and plans on cross-border passenger transport future trends.

Activity 2 - Reviewing technological solutions (coordinated by PP10 with the support of PP2, with the contribution of all partners). In the logic of providing technical means and services as viable and desirable alternatives to car use, the second necessary analysis is an overview of technological solutions that better suit the improvement of sustainable and multimodal / cross - border passenger services in the identified scenario under activity 3.1. from demand and infrastructure determinants (e.g. demand segments, seasonality, port capacity, average speed, distance, etc.). This activity is comprised of deliverable D.3.2.1. Methodology for reviewing of technological solutions for the improvement of sustainable and multimodal / cross - border passenger services.

Activity 3 - Setting up a Transport Sustainability Action Plan (coordinated by PP10 with the support of PP2, with the contribution of all partners). The activity focuses on the establishment of data repositories on public transport services and the definition of a methodology for the development of a cross - border action plan for the sustainability of transport and its application at the main transport hubs (ports) in the program area. It will consider the geographical and socio-economic specificities of the regions involved, such as the type of travel demand and expressed by regional decision-makers as well as resulting from the analyses of available/collected data. It will provide a

basis for all pilot actions of WP4 and WP5. This activity is comprised of deliverable D.3.3.1. Methodology for elaborating a cross - border model of a transport sustainability action plan

Activity 4 - Enhancing the knowledge of sustainable mobility options (Coordinated by PP2 with the support of PP10, with the contribution of all partners). This activity is comprised of three deliverables:

- D.3.4.1. Methodology for elaborating awareness and sensitization programmes at regional and cross border level
- D.3.4.2. Report on awareness and sensitization campaigns conducted at regional and cross-border level
- D.3.4.3. Immersive experience on mobility habits

3. Aim and scope of this document

The main outcome of the MIMOSA project is to increase multimodality and infomobility together with reducing transport carbon footprint (emissions). For the successful MIMOSA project outcome, it is necessary to develop a methodology for reviewing of technological solutions for the improvement of sustainable and multimodal / cross - border passengers services (Deliverable 3.2.1). This methodology presents the foundation of further actions for MIMOSA project outputs and deliverables.

Specifically, the aim of this document is to provide the methodology guidelines for the analysis of existing and new technologies in shipping and port services. Within the framework of the MIMOSA project, the focus is on technological solutions capable of improving the quality, safety and environmental sustainability of marine and coastal transport services and nodes.

Within this framework, this document has a twofold nature. It is preliminary support to the subsequent analysis and implementation activities of the pilots envisaged by the MIMOSA project. The primary target group of this methodology are, in the first place, the partners of the MIMOSA project. In addition to, this document might serve as guideline for the stakeholders of the project involved in transport & services-related decision-making processes. In this sense, methodological steps and procedures are indicated here that it will not be necessary to apply within the MIMOSA project, but which represent points of reference in contexts of analysis of technological alternatives for maritime and coastal transport, even outside the project. For this reason, some of the indications provided in this document are redundant with respect to the actual needs of the MIMOSA project

The role of this methodology within the project, and how it is related to further output and deliverables are summarized in figure 1. Specifically, this deliverable represents a direct and fundamental input for Output 3.5. (Cross-border transport sustainability action plan), Output 3.3 (Analysis to assess the carbon footprint of the passenger choices), Output 4.1. (MIMOSA analysis of new sustainable mobility solutions), and Output 4.5. (MIMOSA Position Paper on technological solutions for emissions reduction), to the extent, it provides the methodological steps to be fulfilled for the mentioned outputs. Moreover, the present document is indirectly related to Deliverable 4.5.1 (methodology for elaborating a cross-border planning model), given it will affect the already mentioned output 3.5.

The scope of D3.2.1 methodology includes:

- the methodological and classification options applicable to the analysis of existing and prospective technologies within a reasonable time-span;

- an assessment of the feasibility of the different technological alternatives;
- a sequence of steps for the implementation of the analysis and the formulation of a strategy for the adoption of sustainable improvement measures.

Although focused on the needs and the boundaries of the MIMOSA project, this document is conceived in such a way as to ensure the maximum transferability in all actions related to the improvement of multimodal maritime transport, even beyond the context of the mentioned project. In this regard, it will be specified the steps of analysis that can be realistically implemented given the information and data that are realistically available concerning the program area, within the more general framework of what would be the ideal procedure in a hypothetical context in which there are no limits to the obtainable information.

Besides Deliverable 3.2.1, the Methodology for elaborating a cross - border model of a transport sustainability action plan (Deliverable 3.3.1) is also important to assess the quality of passenger port terminal as a hub (interface) in order to get a clear insight of the passenger transport demand or the supply (infrastructures, facilities and services) providing transport solutions offered to the demand.

Furthermore, the methodology will be used to set up data repositories on public transport services for developing O.3.4. and to define the methodology for the elaboration of the cross - border Transport Sustainability Action Plan (D. 3.3.1.) which will be applied on main transport nodes (ports) in Italy - Croatia Programme Area.

Two cornerstone deliverables D. 3.2.1. and D. 3.3.1. are the foundations for the proper functioning and achievement of future outputs and other deliverables. Despite that, D.3.2.1. has a higher impact than D.3.3.1 due to more numerous Outputs affects (O.3.5., O.3.3. and O.4.1.). Meanwhile, D.3.3.1. directly affects Output (O.3.5) which is substantially important together with O.3.6. which considered as a durable tool and guidelines ensuring an increased knowledge in function of Cross – Border Planning Model integration. Furthermore, the analysis, survey and collected data from the interconnected outputs from WP3 depict the current situation of passenger demand and port technological assessment which will be used as a new foundation for the Deliverables (D.4.5.1.) and Outputs (O.4.5.) belonging in WP4. The importance of D.3.2.1. and D.3.3.1. lies in the transferability of achieved Outputs in WP3 which will affect the entire Programme Area with the aim of improving passenger transport services at local, regional and cross border level (D.4.5.1. and O.4.5.). Thus, the involvement of stakeholders will be a key factor for the transferability of outputs. The main tools

for transferability are the permanent project cross - border network (O.6.2.), whose members will use and hand over the single outputs for complementary scopes to fellow professionals and beneficiaries, including the updated data and analysis represented in O.3.1., O.3.2., O.3.3. O.3.4.), and the EUSAIR stakeholder platform. Through O.3.5. and O.3.6., it is by improving knowledge and expertise that transfer will occur, from partners to decision-makers working on these topics.

The methodology guidelines can be organized based on the modal approach of the port as a land-sea interface:

1. **Ship to port interface:** Identification and assessment of port infrastructure about productivity, intensity of throughput, passenger liner services, port connectivity (number of existing and future transportation lines), technical and technological ship characteristics, energy efficiency and system equipment which contribute to the navigation safety and environmental protection.
2. **Port operations in terminals:** Identification and assessment of terminal efficiency regarding passenger demands (Passenger shelter, benches for passenger rest, luggage storage space, Information facilities such as Wi-Fi, passenger information boards, etc.). Furthermore, the availability of ICT tools for improving the management of the port operations with integrated data exchange integration among different actors involved in the traffic management and planning of the multimodal network could be emphasized.
3. **Port to hinterland interface:** Intensity of infrastructure used for multimodal transport (road, railway), the existence of other transport hubs (airports) in the port vicinity. Also, the relevant key factor is hinterland to port interface which ensuring a smooth multimodal accessibility with adequate infrastructure and services on the supply side.

Furthermore, these model approach based on literature research analysis allowed for identifying the problems related to review of technological solutions for the improvement of sustainable and multimodal/cross-border passenger services and formulating the following research questions:

1. Which key factors and aspects describe the existing state of cross-border passenger terminal ports and passenger liner ships in the function of passenger demands?
2. What is the current technological state of cross-border passenger terminal ports?
3. What is the current technological state referred to collateral activities besides maritime technology?
4. What is the current technical and technological characteristics for existing cross-border passenger liner ships?

4. Background and theoretical framework

Given the nature of “methodological guidelines” of this document, it is necessary to clarify its premises, the main concepts involved and the theoretical framework of reference[1], to be sure not to give rise to interpretative ambiguities.

The background of the MIMOSA project stands in priorities identified by TSG2 EUSAIR as regards macro-regional strategies. Those specifically pursued by the MIMOSA project are:

- pillar 1 (blue growth), s.o. 3 (to improve sea basin governance, by enhancing administrative and institutional capacities in the area of maritime governance and services);
- pillar 2 (connecting the region), s.o. 1 and 2 (to strengthen maritime safety and security and develop a competitive regional intermodal port system; to develop reliable transport networks and intermodal connections with the hinterland, both for freight and passengers.

Following above-mentioned objectives, the methodology drafted in this document put the premises to take into consideration (in the subsequent analysis) also the assessment of enabling technologies for intermodal connection services, therefore not only the technologies aimed at maritime passenger traffic.

Moreover, this document has a key role in setting the base for further activities oriented towards the programme output indicators tackled by the project, specifically 4.101 (Improved multimodal transport services) and 4.103 (Harmonized services for passengers put in place). The methodological proposal contained in this deliverable starts from a series of premises and concepts which are here briefly described.

Technological solutions

In this document, the "technological solutions" is referred to indicate the application of hardware and/or software equipment and machinery to improve the performance levels of an activity, process, or organization. Therefore, these are solutions whose implementation is based mainly on engineering and IT knowledge and whose implementation in the field may or may not involve the adoption of different organizational procedures or new management processes.

[1] it is not the purpose of this document to provide a review of scientific contributions on the topics covered. Partners will indicate only some basic bibliographical references regarding the topics covered.

Technological solutions are typically opposed to organizational solutions. In some cases, the boundary between the two domains is clear: for example, according to this criterion, traffic restrictions as organizational solutions, the introduction of intelligent barriers as a technological solution is defined.
It should be emphasized that any introduction of new technology almost always involves the necessary adoption of changes to the existing organization (see below).

Technological solutions review

A review of technological solutions must necessarily include an assessment regarding: a) the greater or lesser capacity of the solutions to provide improvements (economic, social, environmental) to the activities for which they are applied, b) the relationship between costs and benefits of the investment, c) the organizational impacts deriving from their adoption.
With particular reference to point c), the adoption of technological solutions almost always involves a change in the organization (roles, tasks, procedures, relationship with customers and suppliers, etc.) while the opposite is not necessarily true. Therefore, the comparison of technological solutions based only on technical & economic parameters doesn't provide a complete picture of the potential outcomes.

The theoretical framework for passenger service

Passenger ships are defined as a ship carrying more than 12 passengers (SOLAS (I/2)[2]. Furthermore, passenger transportation is based on national or international voyages. Passenger ships in international voyage must comply with all relevant International Maritime Organization (IMO) standards, including safety regulations in Safety of Life at Sea (SOLAS) Convention and requirements for the prevention of pollution from ships together with Load Lines Convention regulations[3]. Nevertheless, national passenger ships also play a crucial role for passenger movement while the regulations for passenger ship safety in IMO's SOLAS Convention do not generally apply to passenger ships on domestic voyages, but many countries base their regulations on the IMO standards.

Passenger service is based on passenger liner service as maritime-transport function by using passenger liner ships, and passenger round-trip service as tourism function by using cruise ships. In general, passenger liner service is the transport of passengers, cargo and vehicles which need to be

[2] International Maritime Organization (IMO). (1974/2011). *International Convention for the Safety of Life at Sea* (SOLAS I/2), with amendments. London: IMO.
[3] Frančić, V., Njegovan, M. & Maglić, L. (2009) Safety analysis of passenger ships in domestic voyages. *Scientist Journal of Maritime Research*. 23(2). Pp. 539-555.

performed on pre-established lines according to published conditions of sailing schedule and price list, meanwhile, cruise line service is round-trip service for passenger pleasure, usually taking passengers on an extended cruise with the occasional port of calls in various places of interest[4].

Generally, passenger liner ship consists of four main types: a) Coastal liner passenger ship, b) Ro-ro passenger ship (Ferry), c) High-speed passenger craft (HSC), and d) Passenger-cargo ship[5].

A coastal liner passenger ship is a passenger ship in coastal liner service (from point A to point B) which are mostly built-in 20th century for purpose of connecting the islands with the mainland, build from materials mostly other than steel (aluminium, wood and composites), constructed with one main ship hull and central superstructure also as per SOLAS convention on technical provision and construction that is on restrictions on the materials to be used for the hull.

RO-RO passenger ship (Ferry) is a passenger vessel with facilities to enable road or rail vehicles to roll on and roll off the vessel, and carrying more than 12 passengers (SOLAS). Generally, the ro-ro passenger ferry does not include: a) vessels that do not operate on a regular schedule, b) vessels that normally carry only unaccompanied freight vehicles, e.g. ro-ro freight vessels, c) vessels that operate on routes greater than 4 hours in duration, e.g. cruise ships, and d) vessels whose main purpose is not the transport of passengers/vehicles from point A to point B, e.g. cruise ships[6].

High-speed passenger craft is defined as a High-Speed Craft (HSC) carrying more than 12 passengers[7]. Furthermore, High-Speed Craft (HSC) is a craft capable of maximum speed equal to or exceeding:

$$3{,}7\ \nabla^{0{,}1667}\ \text{(m/s)}$$

where: ∇ is displacement corresponding to the design waterline (m^3)[8].

[4] Rathman, D., Tijan, E., Jugovic, A. (2016) Improving the coastal line passenger traffic management system by applying information technologies. *Scientist Journal of Maritime Research*. 30(1). pp. 12-18.
[5] Jugović, A., Mezak, V., Lončar, S. (2006) Organization of Maritime Passenger Ports. *Journal of Maritime and Transportation Sciences.* 44(1). pp. 93-104.
[6] Stupalo, V., Jugovic, A. & Mrvica, A. (2016) Quantitative Analysis of Maritime Passenger Transport in Europe. *International Journal of Maritime Science & Technology "Our Sea".* 63(4). pp. 256-263.
[7] International Maritime Organization (IMO). (1974/2011). *International Convention for the Safety of Life at Sea* (SOLAS X/I), with amendments. London: IMO.
[8] International Maritime Organization (IMO). (1994/2000). *International Code of Safety for High-Speed Craft (HSC Code)*, with amendments. London: IMO.

Passenger-cargo liner ship is a passenger vessel with facilities to enable cargo loading and unloading with LO-LO technology (lift on and lift off) and carrying more than 12 passengers (SOLAS).

Reviewing technological solutions for MIMOSA project will include passenger ships in an international voyage in passenger liner service between Italy and Croatia with particular reference to the specific type of passenger liner ships.

5. Methodological Step for the review of technological solutions

The following steps summarise the ideal process to provide a review of the different technological solutions available for the improvement of passengers' services, according to an unconstrained general perspective. The actual conditions and needs can make one or more steps difficult or impossible to implement, just as some steps may be useless or redundant. Nevertheless, since this document has the nature of methodological guidelines, it is useful to indicate the following steps.

a) *Collection of information on existing and prospect technologies and on the aspects that may affect its applicability and diffusion in the specific context considered by the project.*

Often, a detailed desk analysis is sufficient to obtain a quasi-exhaustive list of technologies applicable to the field of maritime transport in coastal areas. However, such list would be useless without an assessment procedure concerning: a) the current state of the infrastructure equipment of ports, ships and maritime operators in general, b) the effective availability and applicability of the technologies examined. For this reason, the methodology to be followed requires a double level of investigation: i) a literature-based desk search, to identify both the consolidate, state-of-the-art and prospect / most promising technological development; ii) surveys, interviews and field research, to acquire the opinion of operators, and include their knowledge on the subject in future outputs and deliverables.

The most relevant part of this phase will consist of the questionnaire that will be submitted to all ports (Port Authority - PA) in the program area in passenger liner service between Italy and Croatia (26 passenger terminal ports in total).

The questionnaire will have the purpose of mapping the infrastructural and service equipment of the ports, to be able to identify bottlenecks, potential and future development trajectories.
In parallel, interviews with operators (5 shipowners in total) will be conducted to know the orientations of the main stakeholders on future developments. Furthermore, another important part of this phase will be the consultation of Partners, stakeholders and expert through forms and interviews, asking to provide information about a series of topics related to technological development in maritime transport.

b) *Definition of the overall context of investigation and delimitation of relevant fields of technologies.*

In parallel with the collection of information on technologies, it will be necessary to classify the technologies according to the most relevant decision-making and application areas.

In the first place, the general types of technologies that will be taken into consideration are mainly related to the following sectors:

- Passenger terminal ports infrastructures
- Passenger liner & Roll-On / Roll-Off ships
- Ground Transportation & Intermodal connections (as for last-mile & coastal area mobility)
- Passengers services information, accessibility, travel safety & security, comfort & assistance.

The list above shall be considered as a general delimitation of the overall field of investigation. A different and more detailed classification could be applied during the implementation stages of the project and according to the results of the surveys and interviews among stakeholders.
For instance, further classification criteria might include:

- Transport-related vs Service related,
- The main area of impact (economic, social, environmental),
- Nature of the benefit provided (e.g. interoperability, emissions, noise, cost efficiency, service improvement, safety, increase in capacity, etc.),
- Type of process owner & decision-maker involved in the adoption of the technological solutions (private or public; port, shipowner, agency, etc.),
- Type of implementation into the organization (turnkey vs EPC – Engineering, Procurement and Construction), etc.

c) *Definition of criteria for the assessment of technological solutions feasibility, efficiency and effectiveness.*

The review of technological solutions to be developed in coming outputs and deliverables will have to include an assessment of both overall and specific feasibility of proposed solutions.
For the purpose of the project:

- the assessment should follow the method/s deemed easier and coherent with the specific aims of the analysis and with the objectives of the partners and stakeholders involved, among the methods identified as suitable by the scientific literature. It is believed that the more consolidated and long-established methods should be given

priority over others, more innovative but less tested. Among the former, the following seem particularly suitable[9]:scenario analysis[10], risk assessment[11], environmental impact assessment (EIA), Delphi, bimodal system dynamic[12].

These methods have the benefit of combining the evolutionary / "deterministic" components of technological development with process-oriented priorities, that are necessary for consensus formation.

- The assessment should be based on criteria related to aspects specifically relevant for the subject in charge of their implementation, rather than on general and decontextualized criteria. For this reason, it is crucial to take into consideration the context of the application and the organizational impacts deriving from the adoption of technological solutions (discussed in point e).

However, further elements relevant to the classification and assessment may emerge from the examination of the technical solutions and the interviews with the stakeholders.

d) Representation of technological solutions assessment

The representation of the alternatives subject to evaluation is fundamental, since the way in which the alternatives present themselves can influence the outcome of the evaluation. There are numerous tools for this purpose:

- Technology readiness level[13] measured with reference to the scale used for the horizon program by the EU (See APPENDIX B). For the evaluation of the possible application/diffusion of a technological solution, reference will be made to levels 6-9 of the EU TRL scale. Levels 4 and 5 will also be considered for the medium-long term scenario analysis.
- Market life cycle of the technology, measured with reference to the degree of adoption of a technological solution in relation to the period for which the innovation was available (early development, introduction, growth, maturity, decline).

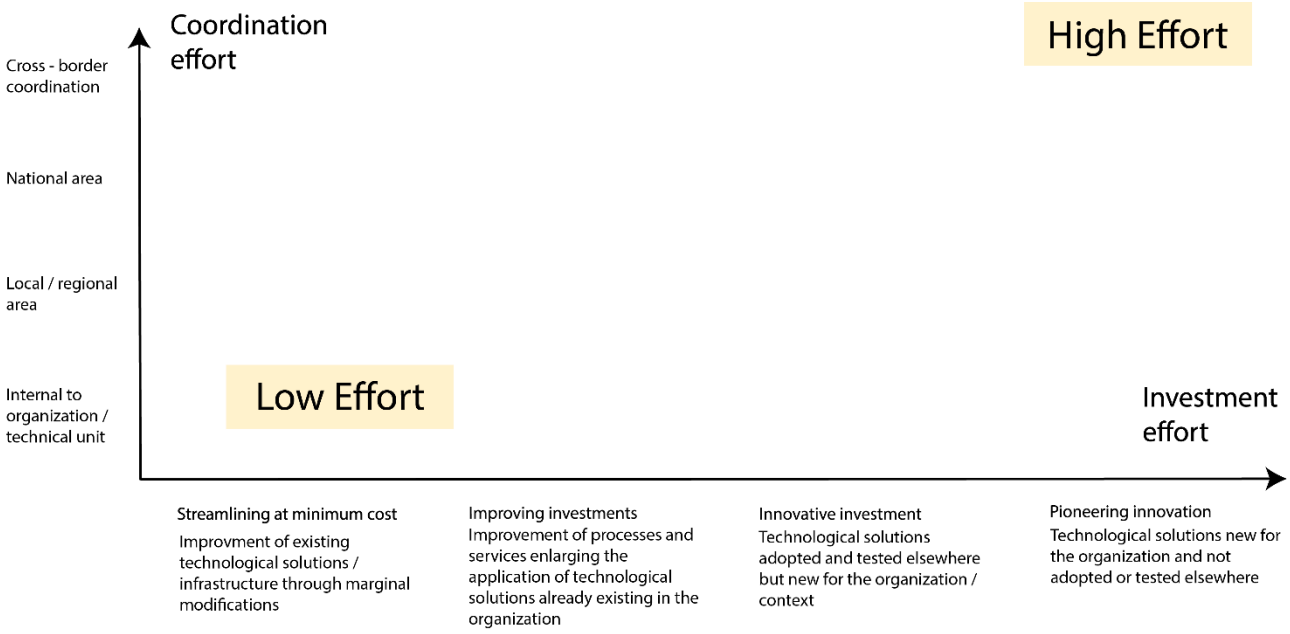
[9] For a thorough review of methods and tools usually applied in technology assessment see Tran & Daim (2008).
[10] Kosow, H., & Gaßner, R. (2008). Methods of future and scenario analysis: overview, assessment, and selection criteria 39, 133. DEU, German Development Institute.
[11] Valerdi, R., & Kohl, R. J. (2004). An approach to technology risk management. *Engineering Systems Division Symposium,* MIT Cambridge (3), 29-31.
[12] Keller, P., & Ledergerber, U. (1998). Bimodal system dynamic a technology assessment and forecasting approach. *Technological Forecasting and Social Change*, 58(1-2), 47-52.
[13] Mankins, J. C. (1995). Technology readiness levels. White Paper, April, 6, 1995.

The two representation tools mentioned above will be adopted mainly in order to identify and describe the most likely trends in new technologies development, but also to assess how realistic is the adoption of a specific technological solution, also based on possible obsolescence or exit from the market.

- Level of "effort" (technological / financial and coordination) required for the implementation for the technological solution in the given context[14]. A peculiar attention will be given to the Impact of technological solutions in terms of investment and organizational/coordination effort required (figure 4). Through the simple classification tool highlighted in fig.2 it will be possible to provide a ranking of the different technological solutions in term of combined (financial, innovation and coordination) effort required, thus providing useful insights on feasibility.

Figure 4. a method for the classification of technological solutions

Figure 5. a method for the classification of technological solutions



Roadmapping: a wide family of techniques providing a structured analysis, usually accompanied by graphic representations, on how, over time, the new technology interacts with the organization

[14] Stocchetti, A. (2012). The sustainable firm: From principles to practice. *International Journal of Business and Management*, 7(21), 34-47.

in which it is inserted and the reference environment[15]. Roadmapping is often considered as an analytic stage referred to the implementation of technology in a single company. However, it has also been adopted within a framework of multi-stakeholder strategic planning initiatives[16].

- SWOT Analysis. This tool is a technique widely used in business management, but it is also effective for the analysis of technological choices in the field of public management[17]. Despite the label "analysis", in fact this term indicates a matrix that synthetically combines the results of various analysis, highlighting the strengths and weaknesses (SW) of an operator according to the opportunities and threats (OT) present in the external environment. Consequently, it is not an analysis tool in the strict sense. It has the advantage of providing a synthetic qualitative representation of the key points that emerged from other analyses, whose integral representation would be difficult to understand or addressed only to experts. For this reason, it is an effective representation tool in the relationship with stakeholders.

e) Identification and description of the expected impacts of the adoption of (new) technological solutions.

A crucial aspect for the decision-maker is linked to the impact deriving from the adoption of a new technological solution on the various aspects involved: on the organization, on the environment, on the cost-effectiveness of processes, on the of service provided, etc.
The most relevant aspect, in particular, concerns whether and to what extent the new technological solutions require, in whole or in part, an adaptation of the organization or its processes. The main organizational changes that are witnessed with the adoption of new technologies typically concern: a) the skills of the operators, b) the procedures for carrying out the tasks, c) the management of safety, d) in general the interoperability with processes upstream and downstream of those involved in the change. For instance, the creation of a bike or scooter sharing service involves the adoption of new control procedures, maintenance, electronic payment systems, but also the stipulation of new insurance agreements and new contractual formulas with

[15] Phaal, R., Farrukh, C. J., & Probert, D. R. (2004). Technology roadmapping—a planning framework for evolution and revolution. *Technological forecasting and social change*, 71(1-2), 5-26.
[16] Phaal, R. (2002). Foresight Vehicle technology roadmap–technology and research directions for future road vehicles. UK Department of Trade and Industry, URN, 2, 933.
[17] Nazarko, J., Ejdys, J., Halicka, K., Magruk, A., Nazarko, Ł., & Skorek, A. (2017). Application of enhanced SWOT analysis in the future-oriented public management of technology. *Procedia Engineering*, 182, 482-490.

the customer. As a whole, the changes brought on the organization by the adoption of this "technological solution" go far beyond the domain of the technology itself.
The "organisational impact" shall be taken into account with other possible indicators of efficiency/effectiveness of the technological solutions.

6. Methodology for reviewing technological solutions for the improvement of sustainable and multimodal/cross-border passenger terminal ports

Passenger ports with their passenger line service have under jurisdiction complex logistical and organizational systems in function of execution of business port activities and their surroundings. Their complexity is derived from organizational requirements oriented towards the promotion of efficiency, ensuring the passenger flawless transport through the port system, together with compliance with local legislation and providing stability and flow continuity.

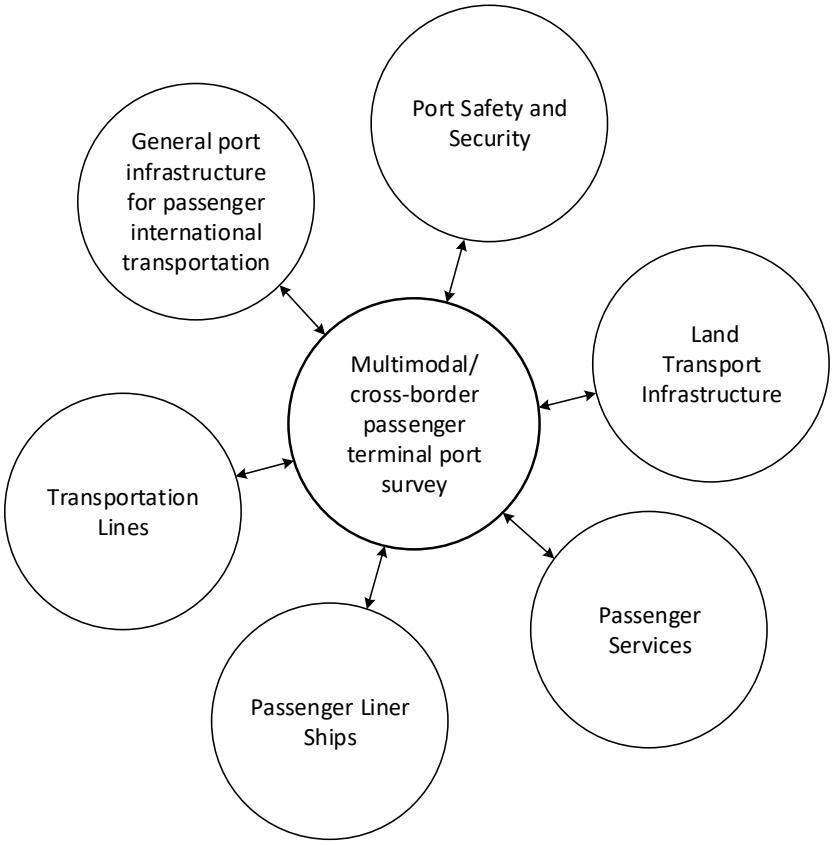
Maritime passenger terminal ports can be considered as substantial preconditions for the development of traffic, tourism and economic activities that serve a range of tourist services while at the same time fulfil the preconditions for passenger needs for transportation.

Passengers ships' size and terminal size are closely interrelated and strongly impact one another. The increase of passenger ships' size and passenger line services in the programme area has inevitably led to the growth of passengers flows and maritime terminal ports' developments. Increase in passenger flows has resulted in investments in port infrastructure and services where ports not only invested in their infrastructure to cater for a bigger number of passengers but also invested in the number and quality of service provided to passengers. It was all enabled by the change of ports appearance and changes in the port business model. Classic small passenger ports have become modern passenger terminals with the task to meet the need of the growing liner passenger ships as well as the passenger demands.

The methodology for reviewing technological solutions for the improvement of sustainable and multimodal/cross-border passenger terminal port starts with the process of data source recognition and data structure definition. The process of data collection data required to identify the key factors has two phases: a literature analysis and survey development. To indicate the key factors and aspects for the existing state of cross-border passenger terminal ports and passenger liner ships analysis in the function of passenger demands, the authors already used the analysis of scientific publications (national and international) and numerous reports and statistics. The following factors based on literature research analysis and data structure definition are also based on port consultations together with project partner consultations and Pilots support. Based on the defined

group of key factors, the Multimodal/cross-border passenger terminal port survey has been developed (figure 3).

Figure 6. Multimodal/cross-border passenger terminal port survey



The development and existing state of the port infrastructure for passenger international transportation serve as one of the main key indicators. From the point of view of infrastructure assets, an indicator of the port size and its ability to serve its core business is the operational shore length (pier) intended for passenger international transport together with the number of piers and ferry ro-ro ramps with description. Also, significant key role is nautical accessibility, respectively depth of the backdrop, which represent the relevant limitation factor for big draft passenger vessels. Furthermore, the environment variable is a significant key to analyse whether the port infrastructure contributes to decreasing the negative impacts on the environment and complies with environmental legislation.

Port safety and security are vital elements in passenger trade competitiveness. The concept of safety and security plays an important role in the transport policy and significant aspect of the service quality provided to the passenger. Port security refers to the security and law enforcement measures employed to safeguard a passenger terminal and passengers from terrorism and other unlawful activities and activists (e.g. Custom and Border Protection). Furthermore, port safety and security are dictated from the maritime background (IMO) which deals with the safety of the ship, its crew and its passengers, and/or cargo, the safety of navigation, the prevention of pollution and environment protection, fire-fighting and medical aspect.

Land transport infrastructure (road, rail and air transportation) have a significant impact on the quality of the port infrastructure together with logistic efficiency and furthermore to the national economy and port global competitiveness. The Multimodal/cross-border passenger terminal port survey will offer a different segment of road transportation inside/near the port area in the function of passenger demands (public or private bus, car, taxi, and bicycle transportation). The methodology for reviewing technological solutions for the Ground Transportation & Intermodal connections (as for last-mile & coastal area mobility) is analysed in Chapter 8.

From the point of view of passenger services inside the port area, special appropriate suprastructure capacities according to passenger demands need to be analysed. Suprastructure capacities at modern passenger terminal must be so sized and profiled to enable the quick flow of passengers and vehicles and to provide for required passenger comfort, specifically[18]: a) offer (services) in the ports: flow, range, accompanying programs, offers and accessibility activities, b) kindness of personal, hospitality and cordiality of providers of various services, c) ability and level of organization of employees on workplaces (customs, police), d) service and maintenance shops (repair services, mechanic's services, petrol stations), e) catering establishment and restaurants, f) refreshment and service areas, rest centres, motels, hotels, exchange offices, g) well-supplied shops, stores, self-service shops, h) public toilets and sanitary facilities along the roads, i) parking lots (size, sufficient number of places, popular price), j) additional programs for passengers (movie houses, entertainment games).

Transportation lines as passenger liner service from the observed terminal are the transport of passengers, cargo and vehicles which need to be performed on pre-established line according to

[18] Jugović, A., Mezak, V., Lončar, S. (2006) Organization of Maritime Passenger Ports. *Journal of Maritime and Transportation Sciences.* 44(1). pp. 93-104.

published conditions of sailing schedule between two or more terminals (ports) together with price list. The methodology will be based on data collection and data elaboration on passenger traffic flow with the elaboration of existing and potential demand. The analysis will be carried out for international passenger services between Croatia and Italy passenger terminals. Due to the relatively low level of ferry traffic services as well as lack of systematic statistical collection of data on passenger flow, the analysis will be mainly oriented to the survey together with field research. All information, results and conclusion will be elaborated in order to analyse technological solutions for the improvement of sustainable and multimodal/cross-border passenger terminal ports together with the better connection in the logistics chains crossing the Adriatic Sea and its wider hinterland.

7. Methodology for reviewing technological solutions for the improvement of cross-border passenger liner ships

The methodology continues with an overview of passenger liner ships should contain data on a) survey data collection for analysis, b) existing passenger liner ship analysis, c) technical and technological ship characteristics, d) energy efficiency and system equipment which contribute to the navigation safety and environmental protection, e) the comparison of the future ship's characteristics in function of reviewing technological solutions for the improvement.

The methodology will be mainly oriented to the survey together with field research with shipowners and relevant stakeholders in order to analyse existing passenger fleet in transportation chain in the function of technological solutions for the improvement of cross-border passenger liner ships.

According to IMO all passenger ship must comply with all relevant energy efficiency and air pollution requirements according to Annex VI of International Convention for the Prevention of Pollution from Ships (MARPOL). The forthcoming reduction in sulphur in fuel oil to 0.50% from 1st January 2020 (from 3.50% currently) is an important measure which will help protect the health of people in ports and coastal areas - and passengers and crew on ships[19].

One of the main technological analyse aim is the current state of passenger ship's energy and efficiency between Italian and Croatian passenger terminals together with the comparison of best practice in other EU countries according to European Directives for environment protection.

The data structure definition also includes regulations and strategic and planning documents relevant to the development of the Passenger Line Transport Plan which complements D3.3.1 Methodology for elaborating a cross-border model of transport sustainability action plan contain:

- The international framework, with special emphasis on the environmental standard, with special reference emphasis on preventing air pollution and new fuels or systems provided by these standards demand.
- European framework governing issues of importance for passenger liner shipping, with special emphasizing the conditions of public service provision, and the sources which set standards of safety and environmental protection.
- Review of the strategic framework determined by strategic documents at the EU level with special reference to the possible impact on liner passenger traffic, and possible changes in passenger mobility and intramodality of passenger transport.

[19] International Maritime Organization (IMO). (1974/2011). International Convention for the Prevention of Pollution from Ships (MARPOL VI), with amendments. London: IMO.

Being a result-oriented project, the focus of MIMOSA is piloting solutions with the main objective of testing enhanced sustainable transport modes as well as combining various transport modes within the same transport experience and chain. The importance of innovative solutions to improve passenger transport will be assessed with regards to the existing and future conditions of between Italian and Croatian liner passenger service.

8. Methodology for reviewing technological solutions for the Ground Transportation & Intermodal connections

Maritime passenger transport has a significant impact on coastal areas in various respects. In particular, the connection of ports with the hinterland and the management of the first/last mile are important aspects for the objectives of the MIMOSA project. In this regard, the analysis should be declined along with two directions: on the one hand that for reaching the boarding point ("last mile"), on the other that for the use of services and tourism at the destination ("first mile").
As for the first point, the review of technological solutions for ground transportation should consider the interconnections of boarding points with the transport networks at various levels (from the TEN-T networks to the local nodes and transports). Accessibility measures should also be applied to compare the situation of the ports with regard to possible future development plans.

For the last mile mobility to boarding points, the specification of the overall process described in previous sections of this document should consist of series of steps:

- Identification and classification by size / traffic of the main boarding points.
- Identification of road and rail interconnections of the main nodes.
- Evaluation of the offer of intermodal transport services to/from the boarding points and measurement of accessibility.
- Analysis of existing road, rail and cycle interconnections and of public transport system,s through both questionnaire (see Appendix C) to the local authorities of the areas affected by the ports, and through the analysis of maps.
- Review, through questionnaire (see Appendix C), of the possible existence of projects for the improvement of accessibility in progress by the port authorities or from other subjects involved in various capacities in the first/last mile near the ports[20].

In addition to the interconnections seen above, the "first-mile" mobility mainly concerns local mobility in tourist destinations. That is, the ways in which passengers benefit from local services and the territory in the surroundings of the arrival points. It is, therefore, the case of the islands and

[20] The last three points listed above will benefit from a methodology successfully tested in the INTERREG IItaly-Slovenia "Crossmoby" project. The survey of existing multimodal interconnections wil adopt a hybrid approach (both questionnaire and map analysis)

places of greatest attraction. Also, the further/alternative steps for these cases may concern the analysis of the existing offer of local mobility alternative to the car and infrastructure for the development of local sustainable mobility.

9. Methodology for reviewing technological solutions for the passengers' services information, accessibility, travel safety & security, comfort & assistance

In addition to the interconnections seen above, the “last mile” mobility mainly concerns local mobility in tourist destinations. That is, the ways in which, passengers benefit from local services and the territory in the surroundings of the arrival points, in particular, the islands and places of touristic attraction. Also, the further/alternative steps for these cases may concern the analysis of the existing offer of local mobility alternative to the car and infrastructures for the development of local sustainable mobility.

Both Italy and Croatia have developed national strategies specifically oriented to the improvement of touristic transport and accessibility, with particular attention of the modal shift and the reduction of car traffic[21]. A fundamental requirement for promoting the modal shift (for both travel and mobility at the place of destination) of tourist mobility, concerns the ability to make travel comfortable in all phases, including those upstream and downstream of cross-border transport. All the phases of the travel (from the search for information on the destination and travel, till the on-site use of short-haul mobility in the final destination) can benefit from the adoption of technologies that make the use of a private car superfluous or less desirable at least in the “last mile”.

Such “last mile” analysis referred to mobility in tourist and coastal destinations shall therefore be taken into consideration through a series of steps considering the following areas:

- technologies for improving info-mobility (e.g.: on-line booking & ticketing, multi-language translations, real-time information on travel and services, travel planner, etc.);
- technologies for local transport alternatives (e.g.: electric public and private transport services, bike/scooters/car rental systems, etc.);
- infrastructures for alternative mobility (e.g.: charging stations, bike & luggage transfer services, interconnections to railways, etc.);

[21] See: Republic of Croatia, Ministry of the Sea, Transport and Infrastructure (2017), Transport Development Strategy of the Republic of Croatia (2017-2030), pp. 228-238; Ministry of Infrastructure and Transport (2017), Connecting Italy: needs and infrastructure projects, Annex to the Economy and Finance Document 2017 of the Ministry of Economy and Finance, (Italian version only), pp. 15-23.

- assistive technologies for improving accessibility for people with disability or sensory impairment (e.g.: electric wheelchairs, voice recognition devices, sound signals, etc.).

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11. APPENDIX A – Ports' questionnaire

Dear Sir/Madam,

Thank you for your time to complete this questionnarie.
The questionnaire will give us an insight into the state of passenger ports open to international traffic in 2018 and 2019.

The questionnaire consists of 8 parts that give us an insight into the situation in ports for passenger transport in Italy and Croatia:

A. General information
B. Port area
C. Service
D. Information
E. Safety and Security
F. Connecting land infrastructure and accessibility
G. Environment impact procedures
H. Maritime transportation lines
I. Passengers

Please fill in the questionnaire by entering it directly in an Excel spreadsheet.
You can only select the questions to be answered in the drop-down menu or if you type round.

Where you are asked to rate something, please follow that 1 is the worst grade/condition, and 5 is the best grade/condition.

If you have any doubts or ambiguities, do not hesitate to contact us by phone or email at the information below

General information for port								
A	**General information**		**Filled in by the Port Authority (PA)**					
1	Operational shore intended for international transport - (in meters):							
2	Piers (Berths)	Number of piers (Berths)						
3		Minimum sea depth per pier (in m)						
4		Maximum length of the ship per pier (in m)						
5	Ferry ramp	Number of ramps						
6		Width single (in m)						
7		Ramp type individually (select)						
8		Maximum length of ship per ramp						
9	Infrastructure condition (on a scale of 1 to 5 - select)		1 - 2 - 3 - 4 - 5					
10	**Necessary improvements - (please describe with 5 sentences) - this part will be in Action Plan for future port development**							
11	Port lighting - Describe							
12	Accessibility of the port to persons with reduced mobility							
13	The need to upgrade the accessibility of the port for people with reduced mobility (descr							
14	Municipal waste collection equipment (select)							
15	Possibility to accept waste from ships (select)							
16	Sufficiency of reception devices for ship waste (select)							
17	Capacity of receiving devices for ship waste (in m3)							
18	Sufficiency of receiving devices for waste oils and oily water (select)							
19	Capacity of receiving devices for waste oils and oily waters (in m3)							
20	Possibility for ship bunkering (taking fuel)							
21	Possibility for LNG ship bunkering (taking LNG fuel)							
22	Port plan for LNG bunkering (year of operability)							

Port area		
B	**Port area**	**Filled in by the PA**
23	Land area (in m2)	
24	Sea area in (m2)	
25	Certain boundaries of the port area	
26	Concession of economic activities	
27	If the answer to the previous question is YES, please indicate which:	
28	Problems with ownership in the port area - describe	
29	If the answer to the previous question is YES, please list the problems:	
30	Problem with spatial planning documentation	
31	If the answer to the previous question is YES, please list the problems:	
32	The functioning of the port causes conflicts with urban space	
33	If the answer to the previous question is YES, please indicate which:	

Service			
C	Service		Filled in by the PA
34	Passenger shelter - select		
35	Passenger shelter ugrade plan - please describe		
36	Benches for passenger rest		
37	Proper equipment for boarding passengers (tunnel boarding/disembarking passengers, etc.)		
38	If the previous question is YES, please indicate which:		
39	Luggage storage space		
40	Traveller & luggage management systems		
41	Appropriate conditions for ticket sales (vessel transportation line)		
42	Possibility to buy tickets online (vessel transportation line)		
43	Bus ticket sales (distance in m)		
44	Railway ticket sales (distance in m)		
45	Service to help people with reduced mobility		
46	Unaccompanied children assistance service		
47	Planning the introduction of a service to help people with reduced mobility and children		
48	If the previous question is YES, please indicate which:		
49	Children's play area		
50	Binding service		
51	Land gas station nearby		
52	Sanitary facilities	Select	
53		Select	
54	Service facility	Restaurant - distance in m	
55		Coffee shop - distance in m	
56	Shop (distance in m)		
57	Souvenir sales (distance in m)		
58	Possibility of charging electric vehicles		
59	Number of chargers for electric vehicles in port area		
60	Possibility of charging electric bicycles		
61	Number of chargers for electric bicycles in port area		
62	Wi-Fi service for passengers		
63	App-based services for passengers (information, booking, payment, etc.)		
64	ATM (distance in m)		
65	Exchange office (distance in m)		
66	First aid (distance in m)		
67	Hotel (distance m)		
68	Private accommodation (distance in m)		
69	Possibility of electric power supply of the device (mobile phone, laptop, etc.)		

	Information	
D	Information	Filled in by the PA
70	Passenger info board	
71	Passenger info display	
72	Real-time information systems for passengers	
73	Information on the schedule of maritime transportation lines	
74	Bus timetable information inside port area	
75	Railway timetable information inside port area	
76	Multilingual information	
77	If the question before YES, please indicate in which languages is the inscription available?	
78	List of emergency numbers	
79	List of main contacts (taxi, TZ, car mechanic, towing service, etc.)	
80	Map of destinations with main sights and contacts	
81	Map of the country and region	
82	Basic general information about the country (currency, language, religion, population, voltage, drinking water, travel documents, costoms regulations, information for drivers, etc.)	
83	If the question before YES, please indicate which one?	
84	QR code for tourist information	
85	Significance of destination and region	

Safety and Security		
E	**Safety and Security**	**Filled in by the PA**
86	The port is well protected in all weather conditions	
87	The need to protect the port in certain atmospheric conditions (wind direction, sea height) - describe	
88	Number of hydrants	
89	Sufficient fire-fighting equipment	
90	Professional fire service available in minutes	
91	Sufficient equipment to prevent pollution	
92	Proximity to pollution prevention equipment	
93	Distance of equipment (in m) or port (in nM) where the equipment is located	
94	Indoor / outdoor air quality monitoring	
95	Ladder to get out of the sea	
96	Life vest	
97	Defibrillator	
98	Defibrillator (distance)	
99	Number of employees authorized for security protection	
100	The presence of a port warden	
101	Police services (yes or no)	
102	Police services	
103	Custom services	
104	Check-in & boarding management systems	
105	Border & port security screening	
106	Passenger temperature scanners	
107	Secure internal communication system	
108	People counting technologies	
109	Number of staff trained to provide first aid	
110	Number of employees trained in fire protection	
111	Number of employees trained in marine pollution prevention	
112	Traveller data collection & warehousing systems	
113	Video surveillance of the port area	
114	Secured footpaths (zones)	
115	Automated vehicle access control	
116	Automatic license plate reader	
117	Vehicles traffic monitoring	
118	Any Cyber security attack recorded inside the port system?	
119	If Yes, which system is infected and how?	
120	Cyber security infrastructures	
121	Cyber security plan implemented	

Connecting land infrastructure and accessibility			
F	**Connecting land infrastructure**		**Filled in by the PA**
122	Road infrastructure	Type of road?	
123		Number of lanes	
124		Rate the condition from 1 to 5	
125		Need to upgrade	
126	Road vehicles cause congestion in the port		
127	The port is disrupting the functioning of road traffic		
128	Parking space	Number of cars/places (enter)	
129		Select	
130		Keeping (more then one day)	
131		Billing (yes or no)	
132		Billing	
133		Illumination	
134	Boarding waiting area for passengers		
135	Boarding waiting area for cars		
136	Need to upgrade - describe		
137	Railway infrastructure		
138	Railway station (distance in m)		
139	Existence of bus lines		
140	Bus station/stop (distance)		
141	Public city transport (distance) - if applicable		
142	Airport (distance)		
143	Taxi (distance in m)		
144	Car rental (distance in m)		
145	Rent-a-bike (distance in m)		
146	Number of services inside the port area for reaching the nearest bus stop/railway?		
147	Which service is used for reaching the nearest bus stop/railway?		
148	Sharing services inside the port area?		
149	If YES, specify the number and type of sharing services?		

Following initiatives or procedures for the reduction of environmental impact		
G		**Filled in by the PA**
150	Alternative energy production	
151	Alternative fuels / low sulfur bunkering	
152	Circular economies	
153	Climate initiatives	
154	Cold ironing	
155	Efficient vessel handling	
156	Emissions inventories	
157	Emissions monitoring	
158	Energy management system	
159	Environmental plan	
160	Environmental report	
161	Environmental risk management	
162	Footprint assessment	
163	Key environmental performance indicators	
164	Life cycle assessment	
165	Vessel impact-related incentives	
166	Vessel impact-related port dues / penalties	
167	Other (please specify)	

Maritime tranportation lines			
H	**Maritime tranportation lines**		**Filled in by the PA**
168	Number of existing transportation lines		
169	NEW transportation line in the future		
170	Port names in transportation line No. 1		
	Port names in transportation line No. 2		
	Port names in transportation line No. 3		
	Port names in transportation line No. 4		
171	Port names in NEW transportation line No. 1		
172	Itinerary of transportation line No. 1		
	Itinerary of transportation line No. 2		
	Itinerary of transportation line No. 3		
	Itinerary of transportation line No. 4		
173	Itinerary of NEW transportation line No. 1		
174	ship's name on tranportation line No. 1		
	ship's name on tranportation line No. 2		
	ship's name on tranportation line No. 3		
	ship's name on tranportation line No. 4		
175	Possibility to store bicycle onboard vessel on line No. 1		
	Possibility to store bicycle onboard vessel on line No. 2		
	Possibility to store bicycle onboard vessel on line No. 3		
	Possibility to store bicycle onboard vessel on line No. 4		
176	Possibility to store luggage onboard vessel on line No. 1 (in cbm)		
	Possibility to store luggage onboard vessel on line No. 2 (in cbm)		
	Possibility to store luggage onboard vessel on line No. 3 (in cbm)		
	Possibility to store luggage onboard vessel on line No. 4 (in cbm)		
177	Number of passengers on transportation line No. 1 (2017)		
	Number of passengers on transportation line No. 1 (2018)		
	Number of passengers on transportation line No. 1 (2019)		
	Number of passengers on transportation line No. 2 (2017)		
	Number of passengers on transportation line No. 2 (2018)		
	Number of passengers on transportation line No. 2 (2019)		
	Number of passengers on transportation line No. 3 (2017)		
	Number of passengers on transportation line No. 3 (2018)		
	Number of passengers on transportation line No. 3 (2019)		
	Number of passengers on transportation line No. 4 (2017)		
	Number of passengers on transportation line No. 4 (2018)		
	Number of passengers on transportation line No. 4 (2019)		
178	Number of canceled passenger transportation lines due to bad weather conditions or other extraordinary conditions(in days)	in 2017	
		in 2018	
		in 2019	

Passengers					
I	Tranportation lines		Filled in by the PA		
179	Total number of incoming passengers from Croatia	2017			
		2018			
		2019			
180	Total number of incoming passengers to Croatia	2017			
		2018			
		2019			
181	Do you have a file with the detection of the number of passengers by destination and origin?	YES	NO		
182	If "yes", would you share it with us for our research?	YES	NO		
183	If "yes": person to contact for requesting the dataset	(Contact person name, email, telephone)			

12. APPENDIX B – Technology Readiness Levels scale

TRL 1 basic principles observed
TRL 2 technology concept formulated
TRL 3 experimental proof of concept
--- TRL 1 – 3 not considered in this methodology ---

TRL 4 technology validated in lab
TRL 5 technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)
--- TRL 4 – 5 here considered only for medium-long term scenario analysis ---

TRL 6 technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)
TRL 7 system prototype demonstration in operational environment
TRL 8 system complete and qualified
TRL 9 actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies)

13. APPENDIX C – Questionnaire / Checklist for the investigation on coastal multimodal connections

1. Number of km of roads managed by the municipality
2. Number of km of roads managed by the Region
3. Number of km of state-run roads
4. Number of km of cycle tracks & routes
5. Number of junctions with motorways on the territory of the municipality
   - Distance from the port passenger terminal
   - Park & ride served by shuttle / public transport YES - O NO - O
6. Number of passenger railway stations in the municipality
   - Distance from the port passenger terminal
   - Park & ride served by shuttle / public transport YES - O NO - O
7. Number of bus stations in the municipality
   - Number of lines / routes
   - Distance from the port passenger terminal
   - Park & ride served by shuttle / public transport YES - O NO - O
8. Number of free and/or toll parking
   - Total number of parking spaces
   - Distance from the port passenger terminal
   - Park & ride served by shuttle / public transport YES - O NO - O

9. Other public transport infrastructure (e.g. light metros, people movers, etc.)
- Distance of nodes from the port passenger terminal
- Park & ride served by shuttle / public transport YES - O NO - O

10. Regional/national/international cycle routes: YES - O NO - O

11. Public Transport Local Urban YES - O NO - O
- Number of active lines
- Number of lines connecting the port passenger terminal

12. Inter-urban local public transport? YES - O NO - O
- Number of active lines
- Number of lines connecting the port passenger terminal

13. "Call-A-Ride" services (taxi, Uber, etc.) YES - O NO – O
- Number of operators

14. Long distance / intercity bus services (e.g. Flixbus) YES - O NO - O

15. Transport service, public or private, for disabled people YES - O NO - O

16. Bike sharing services or on municipal concession YES - O NO - O
- Free floating
- Stationary

17. Car sharing service YES - O NO - O
- Free floating
- Stationary

18. Car rental service (e.g. AVIS, EUROPECAR, etc.)? YES - ONO – O
- Number of operators

19. Electric charging points (columns) on the municipal territory? YES - ONO - O
- Number of charging points

20. Adoption /implementation of a SUMP YES - O NO - O

21. Adoption / implementation of a cycling plan / strategy YES - O NO - O

22. Other sustainable mobility measures planned YES - O NO - O

23. How do you evaluate the impact of maritime passenger on the traffic on the roads of the municipality?
- Impact: 0 – 5. (0 = zero, 5 = very high)
- Frequency: (rarely, only on certain days / weekends, only during the tourist season, throughout the year)

24. Is there a plan to improve the accessibility of the port passenger terminal? YES – O NO – O
- About car traffic
- About public transport services
- About new infrastructure
- Other (specify)