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Selection and customisation of benchmarking techniques

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DELIVERABLE 9.3

Selection and customisation of benchmarking techniques

Contents

1 POSITIONING OF THIS REPORT IN WP9

The aim of WP9 is to develop benchmarking and weighing techniques that allow individual sea and inland ports to compare their activities and operations with the EU average and relevant peer groups, and with ports in other important regions like Asia and the Americas (for seaports). The specific objectives of the work package include:

- Review of existing benchmarking techniques and practices
- Designing methodology to aggregate results of individual ports
- Selection and customisation of benchmarking techniques
- International benchmarking against non-European port systems

Deliverable 9.3 involves the selection of appropriate benchmarking techniques taking into account the specificities of the indicators considered and the needs of the respective port authorities and other users. This implies the benchmarking technique is customised thereby avoiding a "one size fits all" approach in benchmarking practices for all indicators.

The report is structured along five sections, each discussing the selection and customisation of benchmarking techniques for indicators of one of the five performance indicators groups considered in Portopia.

2 CATEGORY 'Market trends and structure'

2.1 Overview of indicators

The indicators in this category include measures such as:

- Maritime traffic is the sum of different types of seaborne cargo handled at the sea interface area of the port over a stated period of time.
- Market share is the market share of a port within a certain port aggregate.
- Call size: The indicator is determined by the average of all call sizes entering the port.
- GDP growth vs. tons per type of cargo: this indicator gives the relative link between GDP and cargo growth. The tonnage section is divisible into sub-indicators of cargo groups such as containers, roro, dry bulk, liquid bulk and general cargo.
- Intra-European traffic incidence in EU ports: the percentage of cargo (mostly container cargo) which is destined for European ports.
- Modal split is the split between road, rail and barge (and pipeline) for all inland traffic.
- Traffic forecast is the outlook for traffic within a 1, 1-5 or +5y period.
- Traffic Growth is the growth of traffic in a certain time period.
- Transhipment incidence is the share of transhipment cargo in total maritime traffic.

We refer to the deliverables of WP1 for a more detailed discussion on the above indicators. In the next sections, we discuss how and why a selection of these indicators are included and used for benchmarking purposes in the PORTOPIA system.

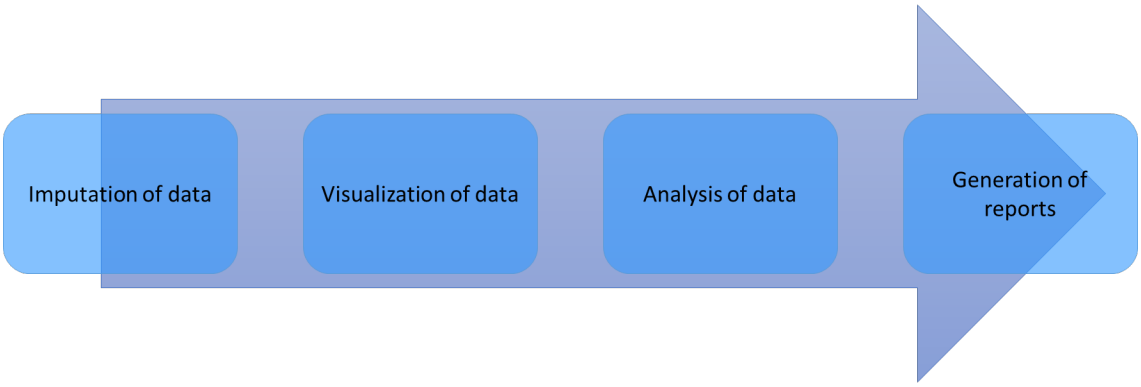
2.2 Benchmarking in the Rapid Exchange System

2.2.1 Overview of RES

The RES or Rapid Exchange System is the tool of Portopia developed to handle the integration of all market related data outlined in WP1 of the project. The goal is to provide the user with a fully functional system maximizing added value and functionality.

The IT RES system is composed of multiple layers which each needs to be integrated seamlessly in order to function. The final output is a system which allows for the gathering or imputation of data, the visualization of data, the analysis of data and the generation of industry reports.

Figure 1. overview of RES structure



The imputation of data section is comprised of multiple input sources, amongst which the manual imputation of data by users, the automatic imputation of excel files from other sources and the link between different databases (for e.g. Eurostat). The visualisation of data is done through dashboard(s). The analysis of data is a tool developed by Glintt and already implemented into the system. The generation of reports is partially automatic but can be supplemented by expert information generated by consortium partners.

The majority of the output indicators of the RES is throughput based. The initial ESPO Rapid Exchange System was coordinated by DGITM a department of the French Transport Ministry. Data collection was performed quarterly in electronic format through a standard table in Excel format. The new RES as part of PORTOPIA establishes a link, as far as possible, between the port traffic figures provided by the ESPO Members to the Unique Classification of Transported Goods (NST 2007) [EU Regulation n°1304/2007] which is the classification method used by EUROSTAT. It is also meant to give more complete information on port traffic in order to fully exploit the potential of the PORTOPIA web-service.

2.2.2 Benchmarking of maritime traffic and vessel data in the RES environment

The benchmarking possibilities within RES are determined by a number of factors such as the possibilities for data disaggregation and aggregation at the level of individual ports, geographical regions, cargo types and periods of observations. The data collection partly shapes these opportunities.

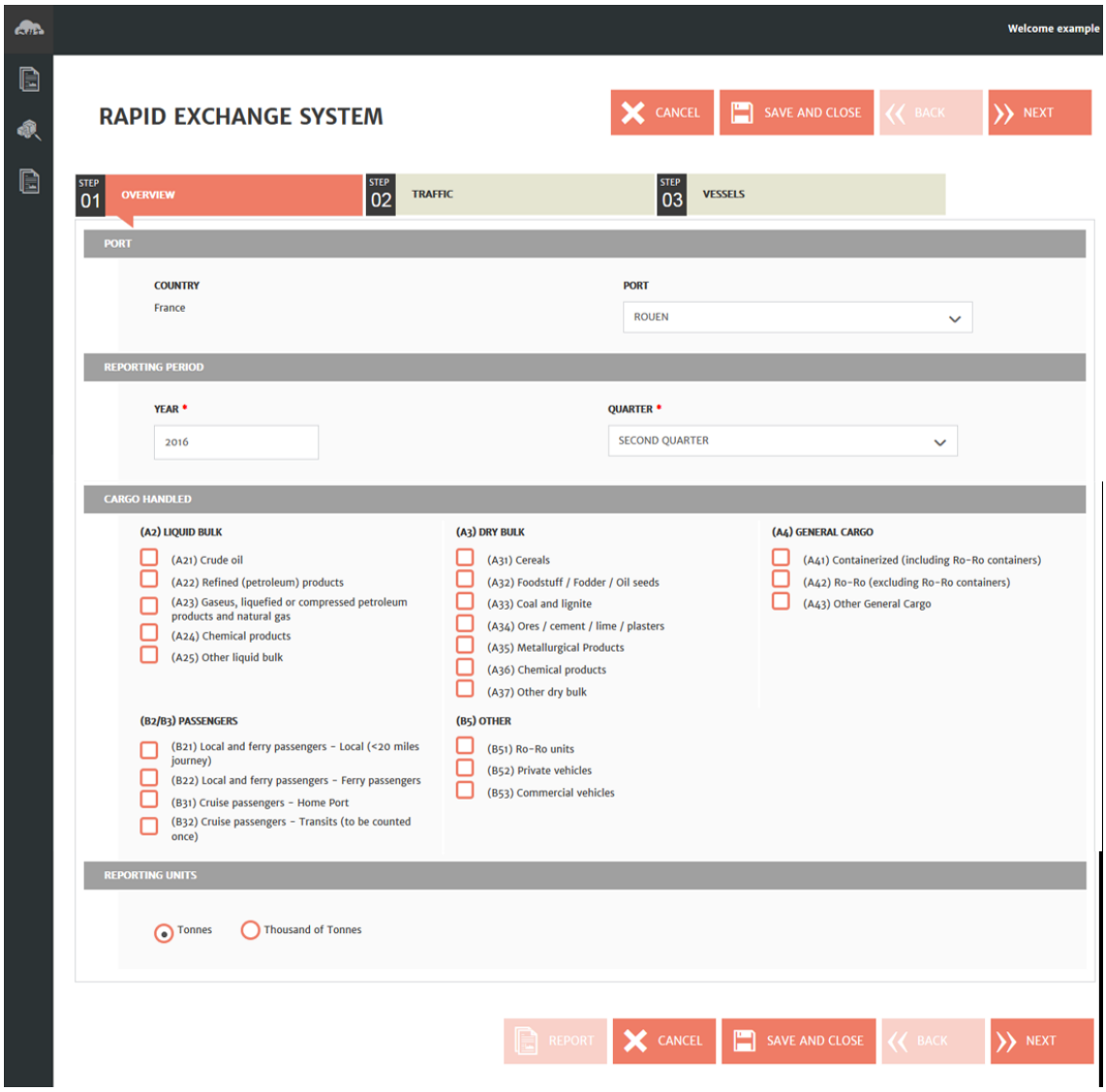
The RES data input form is presented in table 1. Maritime traffic data is gathered by indicating the country, port, year, quarter, cargo handled (in/out) and the reporting units (tons, thousands of tons, TEU, etc..). Table 2 shows the information that was kept in developing the end product of the RES Tool by Glintt.

Table 1. The RES data input form

YEAR *	2015
QUARTER *	

		IN	OUT	TOTAL
A1	TOTAL THROUGHPUT	0.00	0.00	0.00
	Indicate units used:*			
A2	LIQUID BULK	0.00	0.00	0.00
	Of which:			
A21	Crude oil			0.00
A22	Refined (petroleum) products			0.00
A23	Gaseus, liqufied or compressed petroleum products and natural gas			0.00
A24	Chemical products			0.00
A25	Other liquid bulk			0.00
A3	DRY BULK	0.00	0.00	0.00
	Of which:			
A31	Cereals			0.00
A32	Foodstuff / Fodder / Oil seeds			0.00
A33	Coal and lignite			0.00
A34	Ores / cement / lime / plasters			0.00
A35	Metallurgical Products			0.00
A36	Chemical products			0.00
A37	Other dry bulk			0.00
A4	GENERAL CARGO	0.00	0.00	0.00
	Of which:			
A41	Containerized (including Ro-Ro containers)			0.00
A42	Ro-Ro (excluding Ro-Ro containers)			0.00
A43	Other general cargo			0.00
	ADDITIONAL INFORMATION (in units)			
B1	Number of Calls			
B12	Gross Tonnage			
B2	Number of local and ferry passengers	0	0	0
	Of which:			
B21	Local (< 20 miles journey)			0
B22	Ferry passengers			0
B3	Cruise passengers	0	0	0
	Of which:			
B31	"Home Port"			0
B32	"Transits" (to be counted once - report as INWARDS)			0
B4	Number of Containers (in TEU) (B41 + B42)	0	0	0
B41	"Hinterland"	0	0	0
	Of which:			
B411	Empty			0
B412	Full			0
B42	"Transshipped"	0	0	0
	Of which:			
B421	Empty			0
B422	Full			0
B5				
B51	Ro-Ro units			0
B52	Number of private vehicles			0
B53	Number of commercial vehicles			0

Table 2. The RES data input form as developed in the RES Tool



Next to traffic data capture, the system should also allow to input data on vessel calls and vessel capacity (in GT), which are needed for the calculation of the indicator 'call size'.

Next to the cargo types, the RES system should allow to group ports according to relevant ranges. As specified in Deliverable 9.2, the ranges we consider are:

- Atlantic range: Norway + Iceland +South of Le Havre – Gibraltar
- Baltic range: North of Hamburg - border of Norway
- UK range: UK
- Hamburg-Le Havre range: South of Hamburg – North of Le Havre
- Mediterranean range: East of Gibraltar Mediterranean area
- Black sea: Black sea region

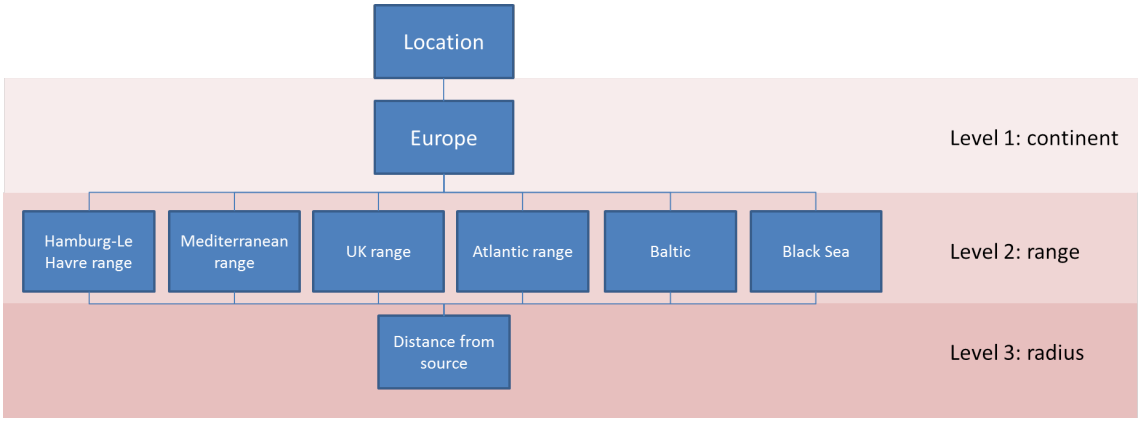
There are several levels of benchmarking that we propose based on the above RES data.

A first benchmarking exercise is at the level of the quarterly or annual growth of maritime traffic (total, in, out for all cargo or a specific cargo segment) or call size. The user would then be presented with a chart that shows the evolution of the growth, per quarter or per year, for the port in context. Thus, in this case the port can benchmark its performance in a specific quarter or year against the performance in other quarters or years. Based on the quarterly data, it is also possible to calculate the share of each quarter in explaining the annual growth of a port. Such data can be helpful to port managers as it gives an indication on the peak and trough quarters throughout the year. Comparing the quarterly growth distribution over several years allows to detect whether certain quarters are becoming more important over time in explaining the annual growth figures.

A second benchmarking exercise focuses on the cargo distribution of a port. This results in the breakdown of the total throughput of a port over time based on the cargo groups (dry bulk, liquid bulk, etc.). In D1.5, we indicated that the same cargo distribution data can be used to calculate the container dependency and the degree of containerisation of a port over time.

The two benchmarking exercises discussed so far only require the performance data of one port. The benchmarking lies in the comparison over time of these data points for an individual port. Obviously, a richer benchmarking pallet is achieved when comparing data among ports.

Figure 2. Port grouping based on geography



Thus, a third benchmarking exercise compares the (quarterly or annual) data of an individual port to the data of the relevant port range (level 2 in figure 2) and to the data of all reporting ports in the RES (level 1). One could even consider to go one step further in terms of defining the peer group of ports in geographical terms (see level 3 in figure 2). As mentioned in D9.2, the internal IT system lists all ports with geographical coordinates. This would allow to measure the distance between the ports. Such a dimension can be highly relevant for benchmarking purposes. For example, a small port specialised in bulk could for example only be interested in similar ports within a 50km radius whilst a large diversified port could be interested in benchmarking against a much wider port group. Thus, the inclusion of the distance element gives users maximum flexibility to generate their own internal analysis and to geographically delimit a relevant peer group of seaports. This radius tool could be a simple slide bar from 0km to 1000km which allows a user to alter the relevant ports. Within the benchmarking system, the aggregation of ports based on geographical notions should allow the ports to compare themselves to other relevant ports in the vicinity.

A fourth benchmarking exercise based on the RES data could focused on benchmarking a port's performance against a peer group of ports of similar size (in maritime traffic terms). This requires a classification of ports based on size. In D9.2, we proposed a size classification for external dissemination based on the classification used in the ESPO fact-finding reports, i.e. small port means a maritime traffic of less than 100 000 tons; medium-sized port: 100,000 to 500,000 tons and large ports: > 500,000 tons. However, such a rigid classification is not recommended as ports can shift size groups over time rendering benchmarking impossible. During one of the workshops, a proposition of a more complex system was discussed based on the relative size in the geographical range with a moving average method allowing for a more consistent and long-term classification method. In the end, port users opted for the simpler slide bar system with greater accuracy and less hassle. The workshops with the port authorities made clear that aggregation in the system has to be as flexible as possible. Thus, pre-set values or categories (such as small/medium/large or low/medium/strong growth) are to be avoided. In case of the size of ports, the IT system could be designed to allow for a more flexible approach. For instance, one could consider using a sidebar that can be adjusted to select a group of ports within a bandwidth (i.e. lower/upper limits) in terms of size to benchmark against.

2.2.3 Benchmarking of modal split data in the RES environment

One of the goals of the PORTOPIA project is to incorporate modal split data into a benchmarking exercise. In D1.1 we analyzed modal split figures in a sample of European ports and concluded that the methodologies used to gather and report on modal split data differs substantially between ports, which would therefore make it very difficult to develop meaningful benchmarking among ports and groups of ports.

A first best approach to enable benchmarking on modal split data would be to develop and implement a uniform and harmonized methodology among ports on modal split data collection and reporting, but such an exercise falls beyond the scope of the PORTOPIA project. Therefore, the project team opted for a second-best approach: we proposed to give every stakeholder the possibility to upload its own particularities on modal split data in the system after which we will offer a benchmarking perspective allowing for any discrepancies. We believe that by using techniques such as error margins and omitting certain 'incomparable ports' from the set, viable conclusions can be drafted from the provided statistical information.

A first modal split dashboard was presented in D1.1 which was still prone to change after discussion with stakeholders (mainly ESPO). The proposed dashboard consists of three main sections, inputs, methodology and output.

The input section is rather generic for every port and changes slightly depending on the methodology applied. The goal of the input section (as illustrated in Figure 3) is to offer ports a quick and easy access point for the provision of intermodal data. As we can see the name of the ports and past reporting years are presented. These are the years used in the analysis of the output section and were previously inputted by the user. Below this we find the tick box linked to any methodological change. If this box is not ticked the user can simply input the data as with the previous years, if it is ticked he will be redirected to the methodology section of the dashboard. Once the input year is provided (drop down menu) the user can input the data for that given year. He has the option of inputting containers or general tons based data (ton, ton/km altered in the methodology section).

Figure 3. Input section of intermodal dashboard

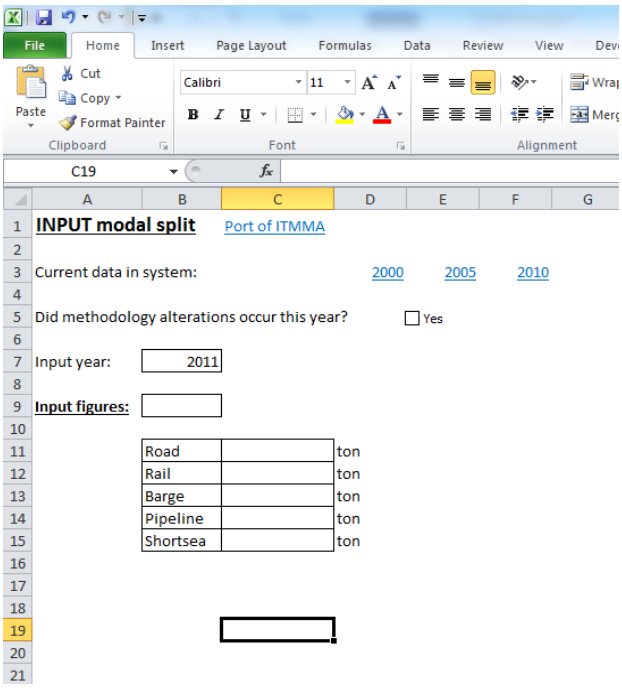


Figure 4. Methodology dashboard overview

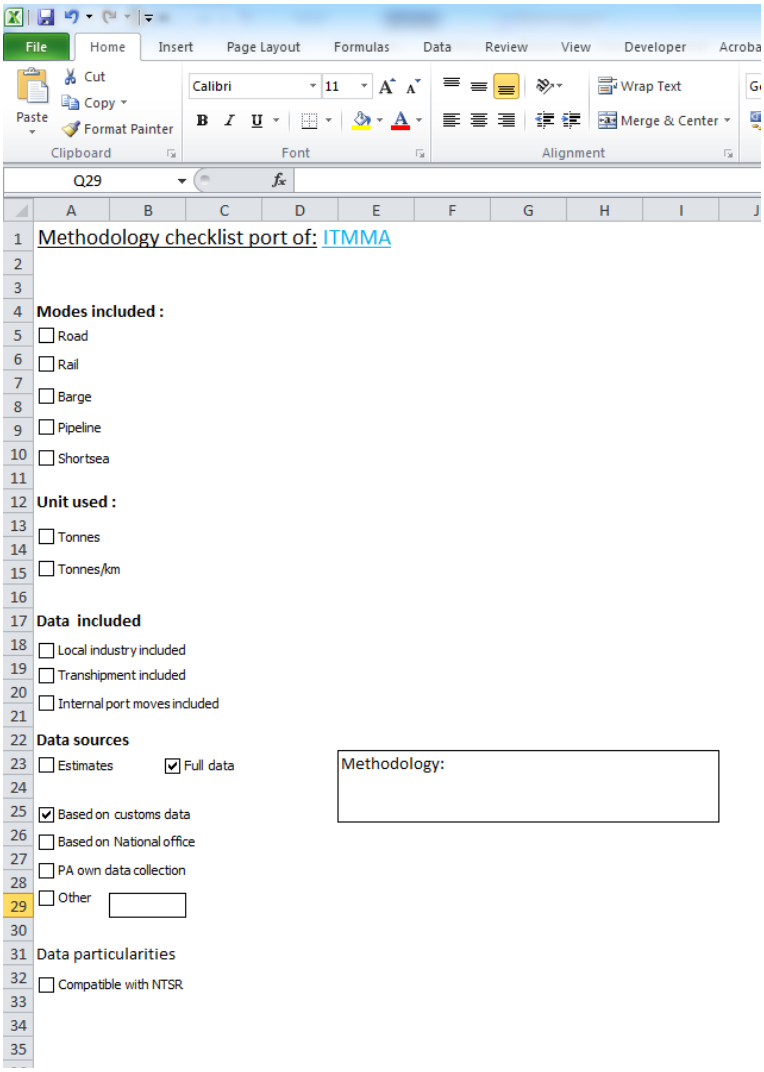
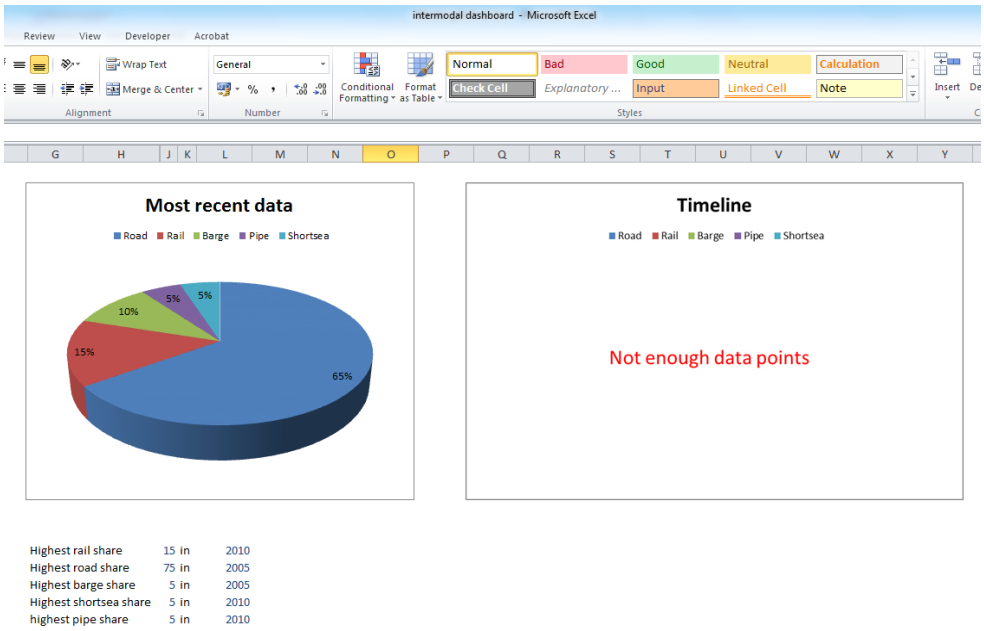


Figure 5. Output section of dashboard



The methodology sections can be altered if any particular alterations have occurred during the input year. The methodology section (as depicted in Figure 4) outlines the complexity of the applied statistical measures. All aspects mentioned are linked to the comparability of the different values across ports and could be used for benchmarking purposes. This section can be increased if any new specific facets are discovered within a certain procedure. In D1.1, the methodology section contained the following aspects:

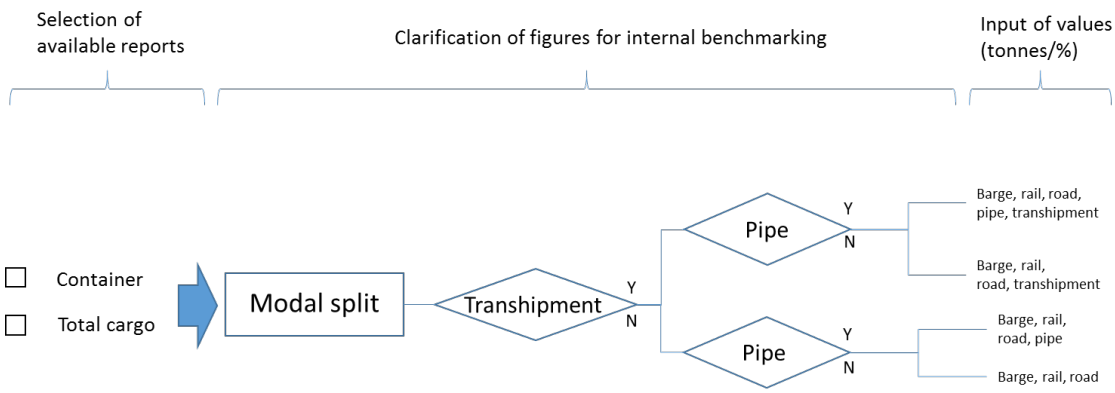
- Modes included: if a port only uses a specific set of modes it can be altered in this section
- Units used: intermodal data is provided in a variety of units
- Data included: all ports have different inclusions in their dataset. Some of these particularities are already mentioned in this version of the dashboard
    - Local industry included
    - Transshipment included
    - Internal port moves included
- Data sources: deals with the origin of the data
    - Full data or estimates: important for comparability issues
    - Real origin of data: customs, national office, own collection or other
- Data particularities: allows for future optimization of the data with further segmentation using different international norms
    - Compatible with NTSR: data is compatible with NTSR statistical norms

The output section provides an overview of the situation (as illustrated in Figure 5). In D1.1 we included two simple graphs for visibility purposes.

In the Technical Paper RES system "State and description of IT Rapid Exchange System" (part of D1.1) we have presented two methods for modal split imputation. The first one is a pre-constructed database gathered by the researchers involved in the project containing data of the main European ports. This database is compiled within the Portopia IT system and can be validated by the users (ports) in question. A second method for data imputation is manual, based on research performed in WP1. The majority of the ports has modal split figures for container cargo and/or total cargo. The

modal split input system will therefore guide the user as shown in figure 6. The idea was that ports would be prompted once a year to update modal split data. The moment of update will be near the end of the second quarter since most modal split figures are made available for the annual reports which are published during this period.

Figure 6. Modal split input method



In Spring 2016, Portopia-WP1 presented to ESPO a proposal to implement a tool to collect and report modal split data of EU ports. Members of the EA&S Committee were invited to review the proposal prepared by the project team and revert with comments on whether this proposal should be implemented or not in the existing platform.

On 21 October 2016, European Sea Ports Organization (ESPO) formally reacted to the Modal Split proposal presented in WP1. This reaction was based on the ESPO EA&S committee meeting of 13 October 2016 in which the PORTOPIA modules on modal split and forecasting were discussed.

As stated earlier, the proposal of the PORTOPIA consortium is to create a module in the PORTOPIA platform that collects and reports modal split figures of EU ports together with the methodology used by each port to produce these figures.

- Data collection: Ports will be asked to input their modal split figures on a yearly basis. The data collection system will require first the port to outline the methodology used, for instance regarding the inclusion of pipeline, transhipment, only container statistics or all cargo, unit tonnes or tonnes/km. The figures and associated methodology will be stored in the system to generate time series.
- Output: The platform will make available a tool allowing for comparison of modal split figures between ports that are using the same methodology. On the basis of the data collected, the platform will also generate a dashboard showing the evolution over time of modal split figures for individual ports, for ranges and at EU level.

In its note, ESPO states that a number of ports responded positively, considering that the matter (collecting and reporting on modal split) is of increasing importance to ports, not least for policy making at local, national and EU level. It was also reconfirmed that various ports already collect and report on modal split data, but that the methodologies applied by ports differ very substantially. Therefore, ESPO argues that this makes comparing of modal split data between ports rather difficult because very few ports use a comparable methodology and therefore no conclusions can be drawn. In summary, ESPO argues little use could be made of the tool proposed by the project team.

The ESPO members do not entirely see the added value of the current proposals for the reasons explained below and suggest alternative solutions when it comes to their implementation. Also, it needs to be added that given the already committed efforts and the challenges encountered with the full/proper implementation of the other main priority modules (RES, Environment, Governance), modal split and forecasting are for ESPO only secondary priorities at this stage. ESPO feels that RES, environment and governance first need to be fully implemented before moving on with these two.

ESPO members agreed that the value added of any initiative was in the possibility to have a tool for comparison of modal split data (and developments) of individual ports. A number of ports proposed to explore the possibility to come to a uniform / harmonized methodology for modal split calculation, which could be used by most if not all EU ports. Adopting such a methodology as EU standard would be extremely useful for the European Commission and for the port sector. The reported modal split data, consolidated to a relevant level could serve as indicator for monitoring, for instance, modal shift targets set by the European Commission or whether the development of certain components of the TEN-T Core and Comprehensive Network is aligned with modal shift targets or other related targets. The ESPO Secretariat asked Port of Rotterdam to share their views on a possible methodology for modal split calculation with members of the EA&S Committee, to serve as basis for further discussion on this subject. This proposal for a common methodology to calculate modal split of ports (based on a proposal of Port of Rotterdam) was put forward and discussed with the EA&S committee of ESPO.

In a first step, the methodological approach of Port of Rotterdam considers two components of modal split: maritime cargo flows and hinterland cargo flows.

- Maritime cargo flows

In general terms, the following breakdown of maritime cargo flows can be made as follows:

a) Inbound (“from the sea”):

i) Deepsea / Shortsea imports

ii) Precarriage flows by feeder vessels (or other deepsea vessels)

b) Outbound (“towards the sea"):

i) Deepsea / Shortsea exports

ii) Oncarriage flows by feeder vessels (or other deepsea vessels)

The precarriage flows by feeder vessels eventually form part of the deepsea exports and vice versa the oncarriage flows by feeder vessels have formed a part of the deepsea imports.

In principle, the above breakdown can be applied for all cargo types, i.e. containers, dry bulk, liquid bulk, RoRo and breakbulk. However, the relevance of pre- and oncarriage flows differs per cargo type and per port.

The distinction between deepsea and shortsea cargo flows is primarily relevant for container flows but can also be applied for other cargo types. The shortsea market will be defined as the intra-European shipping market including maritime transport to/from North Africa, Russia and Black Sea area as defined by Eurostat and the European Commission. For the purpose of developing a methodology for modal split calculation

the distinction between deepsea and shortsea cargo flows is not really relevant. This approach however implies that shortsea transport is NOT considered as one of the modalities to be included in the modal split calculations.

The pre- and oncarriage flows are usually indicated as "transhipment" flows. When the pre- and oncarriage is performed by smaller vessels sailing only in a coastal (intra-European) schedule the related transhipment flows are indicated as "feeder" flows. In case the pre- and oncarriage is performed by other deepsea vessels sailing in a intercontinental schedule the related transhipment flows are usually indicated as "relay" flows. The latter mainly exists in container transport.

- Hinterland cargo flows

The following hinterland cargo flows can be identified:

a) Outbound ("to the hinterland"):

i) Maritime hinterland volume

ii) Continental hinterland volume from Port Industrial Area

iii) Continental hinterland volume from industrial area(s) around the port

b) Inbound ("from the hinterland")

i) Maritime hinterland volume

ii) Continental hinterland volume to Port Industrial Area

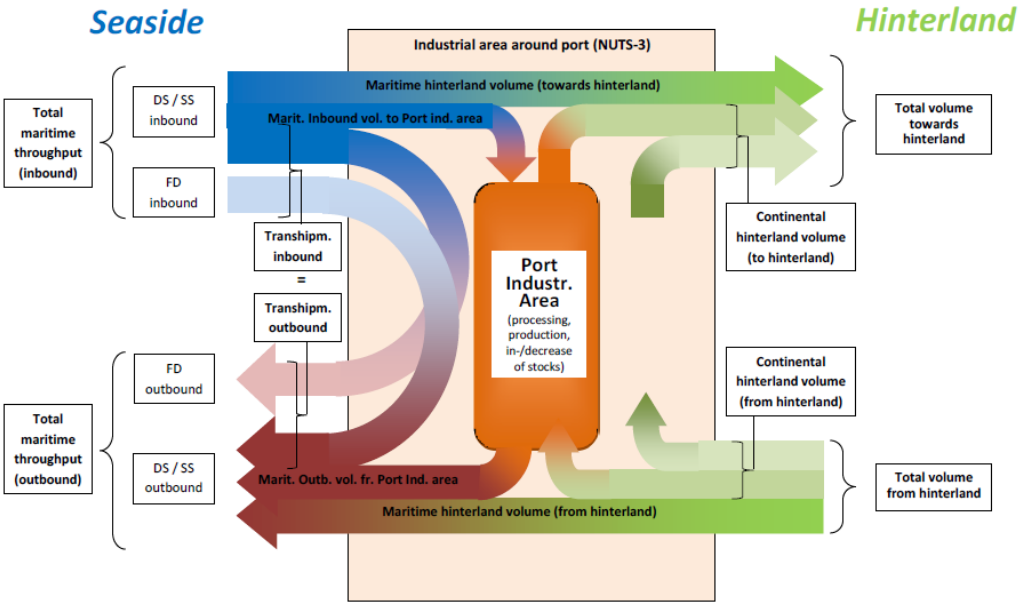
iii) Continental hinterland volume to industrial area(s) around the port

When deducting all transhipment volumes from the total maritime throughput volume (both inbound and outbound) one would expect to have the total hinterland volume. This would be right for ports which have no industrial area in or around the port to which certain cargo flows would be destined for further processing or from which they would originate after being produced there. Many ports however do have an industrial area in or around the port area. As a consequence, these volumes must also be deducted from the total maritime throughput volume to determine the "maritime hinterland cargo flows" (both inbound and outbound).

Similarly, in many cases the industries inside or around the port area produce cargo flows which must be transported to consumer markets or other industrial complexes in the hinterland, or vice versa receive feedstock supplies of half products from hinterland areas. As these cargo flows cannot be directly related to maritime throughput volumes and hence have no relation with maritime transport, they are usually defined as "continental hinterland cargo flows"

The total of maritime and continental hinterland cargo flows forms the total hinterland flows and related volumes (divided in inbound and outbound flows).

Figure 7. Summary scheme on modal split data



When calculating modal split data per port, ESPO presented the following assumptions:

a) The basis for modal split calculation is restricted to land transport only (hence no maritime transport such as shortsea or feeder transport included)

b) The following modalities are considered:

i) Rail transport

ii) Inland waterways / barge transport

iii) Road transport

iv) Pipeline transport

Obviously not all modalities are relevant for each port. Each port should only take those modalities into consideration which are relevant for hinterland transport to / from the port concerned.

c) Intra-port transport (using any modality, but in most cases truck) is excluded from the basis for modal split calculation as these volumes are not relevant for analysing the development of the modal split of the true hinterland flows in Europe.

d) Any remaining difference (positive or negative) between the total maritime throughput (per direction) and the sum of the above defined cargo flows, calculated over a certain time period, is considered as "increase / decrease of cargo stocks" held in the port area. This factor is mainly relevant for dry bulk of liquid bulk cargo types which are usually kept in storage at terminals in the port.

The modal split calculation should then be done as follows:

a) Collect data concerning modal split on the four modalities concerned for each of the main cargo types relevant for the port concerned, either by retrieving data from existing

data sources or by sending enquiries to terminals and/or transport operators (on confidential basis).

b) Consolidate all data to total hinterland volumes per modality per (main) cargo type, ideally split in maritime and continental hinterland flows.

c) Make the dataset as complete as possible by adding estimated volumes per category for cargo flows for which no data could be collected (or have not been provided by the terminal or transport operators concerned).

d) Calculate the modal split results for the reporting period concerned on the basis of the hinterland cargo flow data collected / composed for this period.

The calculation is, in essence, simple but collecting the relevant data will be the main issue in many ports. It was proposed that the last step of the methodology (calculation of modal split) could be done by a tool in PORTOPIA. Depending on the level of detail of the uploaded data, the tool should calculate separate modal split results for maritime and continental hinterland cargo flows respectively, and/or for the total hinterland cargo flows (per main cargo type).

In a further step, a structured survey was conducted among European ports to figure out which methodology ports are using to gather and report on modal split figures. In total 14 ports provided detailed feedback on these issues. The survey aimed at providing a more detailed view on the kind of data ports are gathering on modal split and which methods are used. The Port of Rotterdam proposal was used as a means to structure the survey questions.

During the EA&S Committee held on 30 March 2017 (which was attended by the leader of WP1), it was again confirmed that methodologies differ substantially and that it would therefore be very difficult to gather and report modal split data on European ports in a standardized way. The earlier proposal of Port of Rotterdam was considered as a valuable exercise, but Committee members argued it might be best to try to develop a simpler (read: less ambitious) modal split methodology which would focus on a general modal split for all cargo and one for containerized cargo. Such a simplified methodology could then form the basis for a step by step development and implementation of a more comprehensive standardized methodology for European ports. The Port of Rotterdam is currently working on such a new simplified proposal, but at the time of the writing of this report (early June 2017) the results of this exercise were not available yet.

In summary, the project consortium opted for the structured reporting of modal split data by taking into account existing differences between the methodologies adopted by individual ports. ESPO does not follow the approach proposed by PORTOPIA. ESPO believes in the development of a standardized methodology on modal split data gathering and reporting for European ports. The initial methodology proposed by Port of Rotterdam and the survey conducted among European ports revealed that the road to such a standardized methodology is not easy. Therefore, ESPO is opting for a step by step approach. The first step is an attempt to develop a simple methodology to report on the overall modal split and the modal split for containerized cargo. Such a first step could be a stepping stone for a more comprehensive standardized methodology in the future, which can form the basis for benchmarking on modal split.

Since this exercise at the ESPO level is still ongoing, and the feasibility of the approach still needs to be demonstrated, the project team argues it would not be wise to include a model split module in the PORTOPIA dashboard and to engage in benchmarking using the data provided. Such a module would constitute a premature exercise as the outlines of any standardized methodology are still too vague. Also, in discussions within the EA&S Committee it became clear that at present the willingness among the ESPO members to report on modal split data remains low as long as a standardized methodology has not been properly outlined and implemented.

2.2.4 Benchmarking of short-term forecasting data in the RES environment

The selection of the methodologies for the forecast implementation outlined in D1.3 was based upon the overview table below. Figure 8 provides an overview of the forecast methods available. Accuracy depicts the usefulness of the tools on short (0-1y), medium (1-5y), and long-term forecasts (+5y). Identification of turning points expresses the ability of the methodology to indicate trend reversals. Data required offers an overview of the necessary data.

Figure 8. Overview of forecast methods

		Delphy	Market research	Panel Conscensus	Visionary forecast	Historical analogy
Qualitative	Accuracy					
	Short Term	Fair to good	Excellent	Poor to fair	Poor	Poor
	Medium term	Fair to good	Good	Poor to fair	Poor	Fair to good
	Long Term	Fair to good	Fair to good	Poor	Poor	Fair to good
	Identification of turning points	Fair to good	Fair to good	Poor to fair	Poor	Poor to fair
	Data required	Questionnaires	Market data	Expert pannel	Scenario set	Raw data
	Possible within Portopia forecast	Yes	Yes	Yes	Yes	Yes
		Moving average	**Exponential Smoothing**	**Box-Jenkins**	**X11**	**Trend projections**
Time series	Accuracy					
	Short Term	Poor to good	Fair to very good	Excellent	Excellent	Very good
	Medium term	Poor	Poor to good	Poor to good	Good	Good
	Long Term	Very poor	Very poor	Poor to good	Good	Good
	Identification of turning points	Poor	Poor	Very poor	Very poor	Good
	Data required	2 year raw data	2 year raw data	2 year raw data	3 year raw data	5 year raw data
	Possible within Portopia forecast	Yes	Yes	Yes	Yes	Yes
		Regression	**Econometric model**	**Intention to buy**	**IO model**	**Economic IO model**
Causal methods	Accuracy					
	Short Term	Good to very good	Good to very good	Poor to good	NA	NA
	Medium term	Good to very good	Very good to excellent	Poor to good	Good to very good	Good to very good
	Long Term	Good to very good	Good	Very poor	Good to very good	Excellent
	Identification of turning points	Very good	Excellent	Good	Fair	Good to very good
	Data required	Quarterly data	Quarterly data	raw data	raw data	raw data
	Possible within Portopia forecast	Yes	Yes	No	No	No
		Diffusion index	**Leading indicator**	**Life cycle analysis**		
	Accuracy					
	Short Term	Poor to good	Poor to good	Very poor		
	Medium term	Poor to good	Poor to good	Poor to good		
	Long Term	Very poor	Very poor	Poor to good		
	Identification of turning points	Good	Good	Poor to good		
	Data required	raw data	raw data	raw data		
	Possible within Portopia forecast	Yes	Yes	No		

Not all discussed methodologies were deemed applicable in the Portopia forecast. Some issues may be present due to lack of available data, in other cases some methodologies might not allow the necessary precision or achievement of goals. In order to provide the best possible results, we decided to only take into account the methods which score above "fair" (all green values in the table).

For short term forecasting this would limit the selection (in order of quality) to:

- Market research
- Box Jenkins
- X11
- Trend projections
- Exponential smoothing
- Econometric model
- Regression

We decided that Box Jenkins and X11 techniques were too complex to be included in the project on a continuous basis. The best match for short term forecasting was estimated to be a combination of a qualitative techniques with a time series analysis. In addition, all methodologies needed to be fully automated and should be able to run with minimum input from system administrators.

The project team introduced a confidence index as a way to implement **short-term forecasting**. This forecasting technique is based on the qualitative market research/Delphi method methodology. This parameter can be introduced within the RES system in combination with the quarterly update of data.

The idea is that each of the ports/users is asked to input his output for the last quarter (for e.g. tonnage) in the rapid exchange system in combination with an estimate (UP, DOWN, LEVEL) for the next quarter. These values are then averaged and shown in a confidence index on the Portopia platform. Thus, for each cargo group reported in the RES, each port is requested to submit an outlook for the next quarter. The outlook to be provided is not a number but just an up, down or stable expected tendency (e.g. Liquid bulk, next quarter higher throughput than previous quarter). This input is submitted quarterly as an additional field of the RES form/web tool.

Such a confidence index would open some possibilities for benchmarking:

- A port could benchmark its expectations for the next quarter against the performance in the previous quarter or the same quarter of earlier years.
- A port could benchmark its expectations for the next quarter against the average expectations of all ports in the RES system, the ports of a specific range or the ports within a specific radius from the port under consideration (see the three levels in figure 2 earlier).

Table 3. Qualitative forecasting/confidence index implementation

CARGO TRAFFIC FORECAST FOR Q2 2013

Forecast for: **Liquid bulk**

CARGO HANDLED	PORT	RANGE	RES
(A21) Crude oil	↘	→	→
(A22) Refined (petroleum) products	↗	↗	↗
(A23) Liquefied (petroleum) gas	→	→	→
(A24) Other liquid bulk	↗	→	→

Forecast for: **Dry bulk**

CARGO HANDLED	PORT	RANGE	RES
(A31) Cereals	↘	→	→
(A32) Fodder & Oil seeds	↗	→	→
(A33) Coal	→	↗	↗
(A34) Ores	↗	↗	→
(A35) Fertilizers	↗	↗	↗
(A36) Other dry bulk	↗	↗	↗

Forecast for: **General Cargo**

CARGO HANDLED	PORT	RANGE	RES
(A41) Containers	→	↗	↗
(A42) Ro-Ro Cargo	N/A	↗	↗
(A43) Other General Cargo	↘	↗	↗

Forecast for: **Passengers**

CARGO HANDLED	PORT	RANGE	RES
(B21) Cruise passengers	↘	→	→
(B22) Non cruise passengers	N/A	→	→

Forecast for: **Containers**

CARGO HANDLED	PORT	RANGE	RES
(B31) Number of Containers (in units) (EMPTY)	→	→	→
(B32) Number of Containers (in units) (FULL)	↗	↗	↗
(B41) Number of Containers (in TEU) (EMPTY)	↘	→	→
(B42) Number of Containers (in TEU) (FULL)	→	→	→

In order to facilitate benchmarking, the Portopia platform could generate a dashboard (see table 3 above) so that each port will be able to compare their own forecast to the average forecast of all participating ports and to its range average. In order to calculate the "average" forecast (i.e. confidence index), and to ease a graphical representation of that average, a numeric value is applied to each forecast possible value: Up = 45, Stable = 0 and Down = -45. So, if we have 3 ports indicating the forecast, of which 2 ports are saying that crude oil will go up and one port says it will go down, we will have (45+45-45)/3 = 15. This value will be applied to the graphical element (the arrow) in order to define its angle of inclination. It will also be used to calculate the color of the graphical element (from green, at 45 degrees, to red, at -45 degrees). Only averages of more than 3 ports are shown.

The idea was to make the resulting index available to participating ports on an aggregated level and split up in the already defined geographical ranges.

During the spring of 2016 Portopia-WP1 presented to ESPO a proposal to generate a sort of 'confidence index' for the port sector based on a forecasted traffic tendency for the following quarter submitted by ports participating in the Rapid exchange system (RES). Members of the EA&S Committee were invited to review the proposal prepared by the project team and revert with comments on whether this proposal should be implemented or not in the existing platform.

On 21 October 2016, ESPO formally reacted to the PORTOPIA confidence index. This reaction was based on the ESPO EA&S committee meeting of 13 October 2016 in which the PORTOPIA modules on modal split and forecasting were discussed.

ESPO considers that the proposal is an interesting one and may assist smaller ports in developing an own forecast on the basis of an average indication of expectations of other

individual ports. The concept of the tool is nice in its simplicity and creative in the way to present the outcome of the forecasts in a dashboard.

However, the ESPO members do not entirely see the added value of a European wide implementation of the proposal for the reasons explained below. Also, given the already committed efforts and the challenges encountered with the full/proper implementation of the other main priority modules (RES, Environment, Governance), modal split and forecasting are for ESPO only secondary priorities at this stage. ESPO feels that RES, environment and governance first need to be fully implemented before moving on with these two.

ESPO identifies the following major drawbacks to the proposal:

- Great complexity to predict the throughput of volume to be handled in the port because of the large variety of factors that may to some extend affect the forecast. Volatility varies per commodity, i.e. for import containers you may follow the loading trend on the other side of the trade lane but this covers about one month. For bulk cargo this might be very complex. For example, oil products are very much dependent on the number of scheduled crude runs of the refineries which are located in a port or supplied through a specific port. This is obviously highly sensitive information from a commercial perspective and will not be revealed by the refineries in any way or form.

- Source of data may not be the port authority: it is considered that this data will in many cases have to be collected from stevedoring companies as only they can give more or less accurate forecast and even they could be reluctant to forecast as explained earlier (commercial sensitivity);

- Not relevant: very few ports work with short term forecasts as it is considered not relevant or needed. Yearly forecasts are in some cases used for internal and budgetary purposes;

- Timing issue: quarterly forecast is too often; if the aggregated data will be available after a month or two, there will be small interest in prognosis for the next quarter;

- The level of detail is also too high for example for the containers: units / TEU for full and empty containers. Since customer information is highly sensitive and therefore strictly confidential, ports are not keen on disclosing that kind of information, since a disaggregated approach, per commodity, might give too much away on certain customers.

- The “average” forecast is not “calculated” on a weighted average basis, hence the forecast of each port, irrespective of its size, will count in the same manner. This means that an individual forecast of a small port (which may in itself be very correct for that port, but could also be driven by local circumstances or developments in terms of opening or closing of terminals etc.) will have a more than realistic impact on the calculation of the “average” forecast, in relation to the (possibly different) forecasts of larger ports. ESPO has important concerns that the proposed concept will lead to the correct “average” forecast.

For the above reasons, which all relate to commercial confidentiality issues and relevance of the proposal and the lack of a proper aggregation method, ESPO believes that the proposed forecast tool is not relevant for ports and hence should not be further developed by Portopia. ESPO proposed that PORTOPIA reflects on a new indicator which would be a "four quarters moving average" to know the tendency in annual basis (i.e for the % variation of 2Q 2016 /2Q 2015, it could add the % variation of 3Q + 4Q (2015) + 1Q+2Q (2016) / 4Q 2015.

As ESPO members have serious reservations and criticism on the PORTOPIA proposal, it is very difficult to implement such a short-term forecasting tool. In the end, port authorities would be the ones who should provide the inputs following the proposal. A lack of cooperation from European port authorities on this point undermines the whole exercise.

Furthermore, the fundamental nature of comments and criticism on the confidence index does not leave room for the project team to find remedies. For instance, the commercial sensitivity of short-term forecasts and the fear that many port authorities might not be able to generate such short-term expectations themselves, are elements which are beyond the control of the project team.

We do acknowledge that the ESPO proposal to introduce a new indicator based on a "four quarters moving average" can generate some indications. However, we believe the seasonality of port traffic and the lack of further substance/market intelligence to support such outcomes, makes such a moving average a rather poor indicator from a methodological point of view.

For the all the above reasons, the project team believes that the proposed forecast tool (and the associated benchmarking dashboard) should not be implemented in Portopia. However, we do hope that the proposed methodology as outlined in D1.3 can help individual port authorities to develop short-term forecasting tools in the context of their port management and planning activities.

3 CATEGORY 'SOCIO-ECONOMIC INDICATORS'

This category of indicators typically includes the following indicators:

- Direct employment: The amount of employment directly sustained and/or created by port activities at a given moment or over a given period, within a given geographical area. Jobs or employment is a measure of the number of jobs required to produce a given volume of sales/production or added value. Possible sub indicators include: gender; nationality; type of employee.
- Direct value added: The amount of welfare directly sustained and/or created by port activities at a given moment or over a given period, within a given geographical area. Possible sub indicators include: maritime company/non-maritime company; industrial company, non-industrial company; industry type.

Work package 2 extensively reported on the possibilities and methodological challenges concerning socio-economic indicators. Benchmarking exercises based on indicators of this category are not possible as there is a lack of a European wide methodology to assess the socio-economic impact of ports. Some countries and ports present data on the socio-economic importance, but it is highly dangerous to start comparing the results obtained for ports located in different European countries and when different methodologies are used.

Comparisons for ports within the same country and based on the same methodology (see e.g. the reports of the National Bank of Belgium on Belgian ports or the Port Monitor on Dutch ports) might be possible, but even then, the interpretation of the results must be done in a cautious way, taking into account the functions and scope of the ports concerned.

4 CATEGORY 'LOGISTICS AND SUPPLY CHAIN INDICATORS'

This category of indicators mainly includes indicators on maritime and landside connectivity such as maritime connectivity, intermodal connectivity and roro connectivity. Work package 4 extensively reported on the possibilities and methodological challenges concerning logistics chain and operational performance indicators. WP4 reported that there are serious data availability problems for most of these indicators.

Given the data availability issues, none of the logistics indicators were considered to be integrated in the PORTOPIA system, although methodological ideas were put forward in WP4 on how to develop such connectivity measures and indices.

5 CATEGORY 'ENVIRONMENT AND SAFETY'

Work package 3 extensively reported on the possibilities and methodological challenges concerning environmental and safety indicators.

In view of benchmarking, two environmental modules which are aimed to be part of the PORTOPIA platform need further discussion, i.e. the Port Dashboard and the EU Dashboard. The Port Dashboard will provide benchmark figures in key areas of port environmental management. The EU Dashboard will highlight variations and trends over time. A basic principle for benchmarking exercises in this category of indicators is that ports benchmark against the European performance indicator values.

Ports that contribute to these platforms are part of the EcoPorts network. They provide the requested data by completing the Self Diagnosis Method (SDM) checklist.

As mentioned in WP4, a new methodology (the Tool for the identification and implementation of Environmental Indicators in Ports - TEIP), available to all European ports was developed, so that they are able to identify their most adequate indicators with a scientific procedure behind it.

The environmental performance indicators (EPIs) that have been selected to be included in the PORTOPIA Service Cloud are classified in four categories: i) Environmental management; ii) Environmental monitoring; iii) Top 10 Environmental priorities; and iv) Services to shipping. We refer to deliverable D3.2 for a full list of these indicators. In the remainder of this section, we discuss the benchmarking possibilities in each of these categories.

5.1 Benchmarking environmental management indicators

First, the category 'environmental management indicators' are measures of a port authority's capability to deliver environmental protection and sustainability. It is composed of ten environmental management indicators, all related to terminology recognised in international environmental standards, presented in a Yes / No response format. Given the binary nature of these indicators (Yes/No), only limited benchmarking opportunities exist, mainly by comparing the share of 'Yes' cases with the total number of cases. However, using the environmental management indicators, one could also try to develop a more comprehensive index that allows benchmarking based on an overall figure/index. For this purpose, the Environmental Management Index was developed in WP3. The Environmental Management Index is a single figure that summarizes 10 Key Environmental Management Indicators. A specific weighting is attributed to each of the 10 indicators/components of the Index that reflects its relative significance for environmental management. The Index (final score) is then calculated by multiplying the weightings associated to each environmental management indicator to the percentage of positive responses as described in the formula below:

$$A\times1.5 + B\times1.25 + C\times0.75 + D\times1 + E\times1 + F\times1 + G\times0.75 + H\times1 + I\times1 + J\times0.75$$

Where:

A = Certified Environmental Management System (EMS)
B = Existence of an Environmental Policy
C = Environmental Policy making reference to ESPO's policy documentation
D = Existence of an Inventory of relevant environmental legislation and regulations
E = Existence of an Inventory of Significant Environmental Aspects
F = Definition of objectives and targets for environmental improvement
G = Existence of an environment training program for port employees
H = Existence of an environmental monitoring program
I = Documented environmental responsibilities of key personnel
J = Publicly available environmental report

Each indicator scores as follows:

Input	FTP File Mapping	SDM Source	Score
A	*iso*	answers to Port Profile section 6:Environmental Management, question 6.3	1 point for each positive answer (at least one granted certification), divided by the number of answers
	emas		
	pers		
B	*env_policy*	answers to SDM section A:Environmental Policy, question A1	1 point for each positive answer divided by the number of answers
C	*reference_to_espo*	answers to SDM section A:Environmental Policy, question A16	1 point for each positive answer divided by the number of answers
D	*port_stakeholders*	answers to SDM section A:Environmental Policy, question A19	1 point for each positive answer divided by the number of answers
E	*inventory_sea*	answers to SDM section A:Environmental Policy, question A21	1 point for each positive answer divided by the number of answers
F	*objectives_targets*	answers to SDM section A:Environmental Policy, question A83	1 point for each positive answer divided by the number of answers
G	*training_program*	answers to SDM section C:Environmental Awareness and Training, question C5	1 point for each positive answer divided by the number of answers
H	*monitoring_program*	answers to SDM section G:Environmental Issues and Monitoring, question G2	1 point for each positive answer divided by the number of answers
I	*responsibilities_documented*	answers to SDM section B:Management Organisation & Personnel, question B8	1 point for each positive answer divided by the number of answers
J	*public_report*	answers to SDM section D: Communication, question D1	1 point for each positive answer divided by the number of answers

Source: WP4

As the Environmental Management Index is a value, it is very easy to use for benchmarking purposes. For example, one could compare the index for a port with the index for the EU average or the average of a relevant port range.

5.2 Benchmarking services to shipping

The category 'services to shipping' takes into account three green shipping actions: the availability of on-shore power supply, differentiated fees for clean shipping, and Liquefied Natural Gas (LNG) bunkering. Also, here only limited benchmarking opportunities seem to exist, again by comparing the share of 'Yes' cases (referring to the availability) with the total number of cases. However, one could develop a methodology to score each of these indicators (1 point per positive answers). For example, each green service indicator can be scored as a simple percentage of the actual value (positive answers) compared to the target value (negative, positive and unanswered). The individual scores could be obtained by calculating the score as 100×(Actual÷Target). The results can also be represented in a graphical format by showing whether the port considered has positively answered and the EU percentage of positive answers. The results can also be graphically representing over time, to show the changes that have taken place in the past years. Additionally, detailed information can be provided on the distribution of Low and High voltage percentage for positive answers on the provision of onshore power supply.

5.3 Benchmarking the top 10 environmental priorities

The category 'Top 10 environmental priorities' provides the possibility to ports to rank, from an extensive list of 35 port environmental issues, the top 10 environmental issues that the port considers as its main priorities, being 1 the most important. The results are useful to identify the main concerns for the European ports. This indicator set is interesting from a benchmarking perspective:

- First, individual ports could compare their top 10 list to the overall top 10 for the entire European port system or the top 10 list for a specific geographical port region (for example the Atlantic range). One can think of presenting the Top 10 Environmental Priorities in a graphical format, providing a comparison between the port and the EU Top 10 Environmental Priorities;

- Second, individual ports could compare their top 10 list to the top 10 list of the group of ports in a similar size class (based on maritime traffic volume);

- Third, analyzing the changes over time demonstrates how these priorities have evolved over the years in a specific port, a group of ports or the entire European port system.

5.4 Benchmarking indicators on environmental monitoring

Indicators on environmental monitoring provide information about the current condition of the environment. This information may help port environmental managers to better recognize the potential impacts of the port authority's activities, products or services that may interact with the environment, and consequently, assist in the planning and implementation of environmental performance evaluation. These indicators investigate whether the port monitors a set of parameters regarding the condition of the environment. Air, water, soil and sediments quality indicators aim at measuring the state of these compartments, including its chemical, physical and biological characteristics. Terrestrial habitats and marine ecosystems indicators monitor the flora and fauna of these sites. Noise is defined as unwanted sound and it concerns the percentage of ports that monitor these emissions. Energy and water consumption are the amount of energy and water that have been consumed to satisfy the various needs of the port authority and the industries located within the port area. Carbon Footprint is a measure of the total amount of greenhouse gas (GHG) emissions. In this particular case, carbon footprint calculates the tons of CO2 equivalent that have been emitted to the atmosphere during a period by the port. The indicator of waste management provides information on the percentage of ports that monitor waste. Waste may originate from ships, port industries, the port authority activities or construction works.

Also here, one could think of developing a score per indicator. Each EU Environmental Monitoring Indicator can be scored as a simple percentage of the Actual value (positive answers) compared to the Target value (negative, positive and unanswered), again using the formula: Score =100×(Actual÷Target). This can be done for each of the indicators on environmental monitoring, i.e. air quality, water quality, soil quality, sediment quality, terrestrial habitats, marine ecosystems, noise, waste, carbon footprint, energy consumption, water consumption. A score of 1 (positive answer) means that the indicator is being monitored/measured in the port.

The environmental monitoring indicators can also be represented in a graphical format, for example by comparing the answers for an individual port with the EU percentage of positive answers. A temporal overview can be provided by plotting the EU percentage of positive answers per indicator and per year (i.e. a line for each indicator).

6 CATEGORY 'GOVERNANCE INDICATORS'

6.1 Introduction

Work package 5 extensively reported on the possibilities and methodological challenges concerning governance indicators.

The governance part in the PORTOPIA platform uses data collected through the Fact Finding surveys 2010 and 2015 when available. Port authorities that did not participate in the Fact Finding surveys can create the profile directly in the PORTOPIA platform. From 2016 onward, the system will show the 2015 data by default and port authorities are invited to update their governance profile whenever changes occur.

Three indicators on port governance were selected, next to the broad range of qualitative data contained in the factual reports. The first one is the integration of port cluster, which expresses the extent of port authorities' initiatives that aim towards the integration of various stakeholders composing a port cluster. The second one measures the extent to which port authorities undertake and report activities in a way that enhances corporate and social responsibility (CSR). Finally, autonomous management provides information on whether port authorities maintain features that enable them to develop vital initiatives.

Next to governance indicators, the survey also asks about specific characteristics of the port which are useful for further categorization and benchmarking of ports and port groups:

- Number of ports under the jurisdiction of the port authority
- TEN-T status: 'TEN-T core port', 'TEN-T comprehensive port', 'non TEN-T port'
- Geographical range
- Location characteristics:
    - estuary river, natural protected coast, engineered coastline or other
    - urban area, island, located in Sulphur Emission Control Area (SECA) and or outermost regions or peripheral area
- Traffic figures:
    - Freight volume category in tons (0 to 10 million tons, 10 to 50 million, more than 50 million)
    - Ferry passengers per year (0 to 300.000, +300.000 to 1 million, +1 to 4 million, more than 4 million)
    - Cruise passengers per year (0 to 100.000, +100.000 to 500.000, +500.000 to 1 million, more than 1 million)

In the following sections, we will discuss the benchmarking possibilities based on the information that will be contained in the governance module of the PORTOPIA service cloud, based on Factual Finding survey data.

6.2 Benchmarking of port authority ownership and legal framework

The survey collects data on the port authority ownership and legal framework. This includes information on:

1. The port authority official name and definition
2. The ports under the responsibility of the port authority
3. The legal form of the port authority (independent public entity, independent commercial entity, other).
4. Is the port authority organisation governed by one or more legal acts (e.g. Port decree, Port law) specifically created to define port management matters and scope? (Yes/No answer)
5. Does the port authority company have shares? (Yes/No answer)
6. Is the port authority (or the company owning the port authority) listed on the stock exchange? (Yes/No answer plus percentage in case of yes)
7. Is the port authority subject to private commercial law? (yes, fully; yes, unless incompatible with the provisions of the port authority own specific legislation; no)
8. Ownership of the port authority (public ownership, mixed public private ownership, private ownership). In case of a mixed public private ownership the following options apply: public sector owns a majority share, equal public and private ownership and private sector owns a majority share). In case of public involvement, the respondent also has to specify the percentage of public entity that is involved: state, municipality, region, province, other (values between 0 and 100 and sum must be equal to 100).

The above information offers plenty of opportunities for simple and straightforward benchmarking, also in combination with the geographical/locational and functional characteristics of the port concerned (see list in the introduction). We propose to benchmark as follows.

As regards the ownership of port authorities (item 8 in the list above), this indicator can be scored as a simple percentage of the actual value (1 point per selection) compared to the target value (unselected, selected and unanswered) using the same formula as introduced earlier: score =100×(Actual÷Target). The 3 types of ownership distribution for all surveyed EU port authorities can be shown in the PORTOPIA platform by using a bar chart (adding up to 100%) or a pie chart. This will allow individual ports to see whether their ownership structure is very common in the EU or not.

One can also consider to provide further information on public ownership or mixed public-private ownership, for example, by indicating the distribution for the corresponding ownership per government level using percentages. So, the ownership of the port authority per government level could be represented through a stacked bar chart or a pie chart, including the six levels of ownership distribution registered in the PORTOPIA platform.

The legal form of port authorities (item 3. In the list above) can also be scored as a simple percentage showing the distribution for all surveyed ports using a pie chart or stacked bar chart. This will allow individual ports to see whether their legal form is very common in the EU or not.

For the number of ports managed by a port authority, one could form categories of ports and express the share of each category in the total sample of port authorities. For the

categories of port authorities, we can for example use the following classification: port authority with 1 port under its responsibility, with 2 ports, 3 to 5 ports, 6 to 10 ports and more than 10 ports. The individual port can then benchmark its own position against the overall distribution for European ports.

In principle, it is also possible to benchmark the above indicators for an individual port against the situation for a group of ports. These groups can be formed based on the list of measures listed in the introduction, i.e. TEN-T status, geographical range, location characteristics and traffic figures. Thus, in that case, the bar charts or pie charts do not represent the situation for all surveyed EU ports, but only for a sub-group selected based on one of these measures.

The above indicators on ownership, legal form and number of ports managed can also be benchmarked by adding a temporal dimension, i.e. the evolution of the distribution over time and by adding a geographical dimension, i.e. the distribution per range. For example:

- one could compare how the share of public ownership evolved over time for all EU ports;
- one could compare the distribution of legal forms of ports (i.e. independent public entity, independent commercial entity, other) among the different ranges in Europe;
- for a specific period, one could plot the relative share of ports belonging to the five categories in terms of the number of ports managed by the port authority.

6.3 Benchmarking of port authority functions

This part of the survey collects data on the port authority functions. This includes the following questions:

1. Does the port authority grant the use of port land to third parties for cargo handling activities, industrial activities, logistics and warehousing activities (Yes/No answer)
2. Over what percentage of port area does the port authority have power to lease, concession or sell land?
3. Please specify whether these land-related contracts are governed under public or private law (choice between most land contracts are under public law; most land contracts are under private law; there is a mixture of public and private contracts)
4. Does the port authority operate (directly or through subsidiary company it fully controls) cargo handling activities, industrial activities, logistics and warehousing activities (Yes/No answer)
5. Services to ships are operated by the port authority: Pilotage outside the port; Pilotage inside the port; Towage outside the port; Towage inside the port; Mooring; Waste reception facilities; Onshore Power Supply (OPS) for commercial vessels; Bunkering (Yes/No answer)
6. Does the port authority organise the provision of services to ships? (Yes/No answer)
7. Which services to ships are provisioned by the port authority: Pilotage outside the port; Pilotage inside the port; Towage outside the port; Towage inside the port; Mooring; Waste reception facilities; Onshore Power Supply (OPS) for commercial vessels; Bunkering (Yes/No answer)

8. Does the port authority provide any license, authorisation or establishes any minimum requirement to the service provider as a condition to perform the service in the port?
9. Is there a contractual agreement between the port authority and the service provider for the shipping services (pilotage, towage, etc.)?
10. Are the services to ships considered as a public service by the state or have elements of public service (e.g. SGEI, public service obligations)?'

The above information offers some opportunities for benchmarking. First, we focus on port authorities granting the use of port land, i.e. items 1 to 3 in the above list. We can score each of these three indicators (positive, negative, unanswered). By assigning a simple percentage of the actual values, we can obtain insight on the situation for all surveyed ports. Individual ports can benchmark themselves by comparing their positive answers with the percentage of positive answers registered in PORTOPIA platform by EU Port Authorities.

The same approach can be followed for port authorities' operating functions (items 4 to 7).

The above indicators can also be benchmarked by adding a temporal dimension, i.e. the evolution of the distribution over time, and by adding a geographical dimension, i.e. the distribution per range.

6.4 Benchmarking of the regulatory function of port authorities

This part of the survey collects data on the regulatory function of port authorities. This includes the following questions:

1. Does the port authority issue its own regulations?' (Yes/No answer per activity: Safety, Security, Environment, Use of port domain or infrastructure, Other). If not, the port authority has to specify which entities are responsible for issuing regulations.
2. Does the port authority exercise a law enforcement role in the port jurisdiction? (Yes/No answer). Also the port has to specify in which areas (safety, security, enforcement…).

The benchmarking options for this group of indicators mainly lie in comparing the result for an individual port with the share of positive answers for all surveyed EU ports. The comparison can also be related to a sub-group of ports selected based on geography, location, traffic, etc.

6.5 Benchmarking of accounting Principles

This set of questions is composed by specific questions on accounting principles and transparency:

1. Are the port authority's annual accounts maintained according to international accounting standards? (Yes/No answer)

2. Does the port authority make its annual accounts (balance sheet, profit and loss account, cash flow report) public? (Yes/No answer)
3. Does the port authority use internal analytical accounting process? (Yes/No answer)
4. Are the port authority's accounts audited by an external auditor? (Yes/No answer)
5. Does the port authority provides information about depreciations? (Yes/No answer)

In a similarly way as explained in section 6.4, the benchmarking options for this group of indicators mainly lie in comparing the result of an individual port with the share of positive answers for all surveyed EU ports. The comparison can also be related to a selected sub-group of ports based on geography, location, traffic, etc.

6.6 Benchmarking of Corporate Social Responsibility (CSR)

This section of the survey is composed of specific questions on CSR:

1. Does the port authority have a formalised Corporate Social Responsibility (CSR) policy? (Yes/No answer)
2. Is the formal CSR policy integrated in the port's mission and organisation? (Yes/No answer)
3. Does the port authority report on the performance of its corporate social responsibility policy with measurable objectives? (Yes/No answer)
4. In which areas does your CSR policy focus mainly? The following options apply: employees, environment and sustainable development, social and community activities, ethical issues, business practice and conduct (e.g. accountability, transparency, etc...)
5. Which main stakeholders do you involve in your CSR policy? The options include: employees, customers, tenants, providers, local community and the wider community (region and beyond)

For questions 1 to 3 (all answered with Yes or No), the most straightforward benchmarking exercise is to compare the individual port's answer to the distribution of positive/negative answers of all surveyed EU ports. For the main areas of CSR policy, it is useful to draw up graphs (bar or pie charts) that provide insight into the percentage of EU ports that are focusing on each of the areas (i.e. the percentage of positive answers per area). An individual port can then check whether they belong to the majority of ports or not. The same method can be applied to the main stakeholders ports focus on.

Also here, the indicators can be benchmarked by adding a temporal dimension, i.e. the evolution of the distribution over time and by adding a geographical dimension, i.e. the distribution per range.

6.7 Benchmarking of financial Capability

This section of the survey aims to obtain a picture of the financial autonomy and capability of a port authority. The questions included are as follows:

1. Is the port authority responsible for setting the level of the infrastructure charges? (Yes/No)
2. Can the port authority decide on the allocation of the financial result? (Yes/No)
3. Can the port authority decide on new investments on capital assets? (three options: Yes, fully; Yes, up to a threshold; No)
4. Does the port authority have financial targets to fulfil towards its owners or shareholders (e.g. dividends, return on investment, etc…)? (Yes/no)
5. Does the port authority pay corporate taxes? (three options: Yes, fully (e.g. for port dues, lease fees, services, etc..); Only for a part of the revenue generated by the port authority; No)

As all questions involve Yes/No answers or a choice between three options, benchmarking is ideally done by comparing the individual port's answers to the distribution of answers of all surveyed EU ports. Pie charts or bar charts can be used to visualize the results. Similar to the other indicators, it is also possible to benchmark an individual port against a group of ports. These groups can be formed based on the list of measures listed in the introduction, i.e. TEN-T status, geographical range, location characteristics and traffic figures. The benchmarking opportunities increase by adding a temporal dimension, i.e. the evolution of the distribution over time.

7 Conclusions

This report presented methodological and practical considerations in view of the selection of appropriate benchmarking techniques which need to be considered when developing the PORTOPIA service cloud. We took into account the specificities of the indicators considered and the needs of the respective port authorities and other users. This implies the benchmarking technique is customised thereby avoiding a "one size fits all" approach in benchmarking practices for all indicators.

The report was structured along five sections, each discussing the selection and customisation of benchmarking techniques for indicators of one of the five performance indicators groups considered in PORTOPIA.

The benchmarking possibilities for governance and environmental indicators are quite extensive. The PORTOPIA service cloud should fully exploit these possibilities. The discussion on benchmarking at the level of indicators of the category 'market trends and structure' only focused on maritime traffic, vessel traffic and call size. The reason is that the modules on modal split and short-term forecasting will not be integrated in the PORTOPIA service cloud (and the RES+ system) due to reasons extensively documented in this report. No benchmarking techniques were proposed for indicators in the categories 'socio-economic indicators' and 'logistics and supply chain indicators'. Benchmarking exercises based on the indicators of these two categories are not possible due to a lack of a European wide methodology to measure these indicators in a standardized manner and or data availability issues.
