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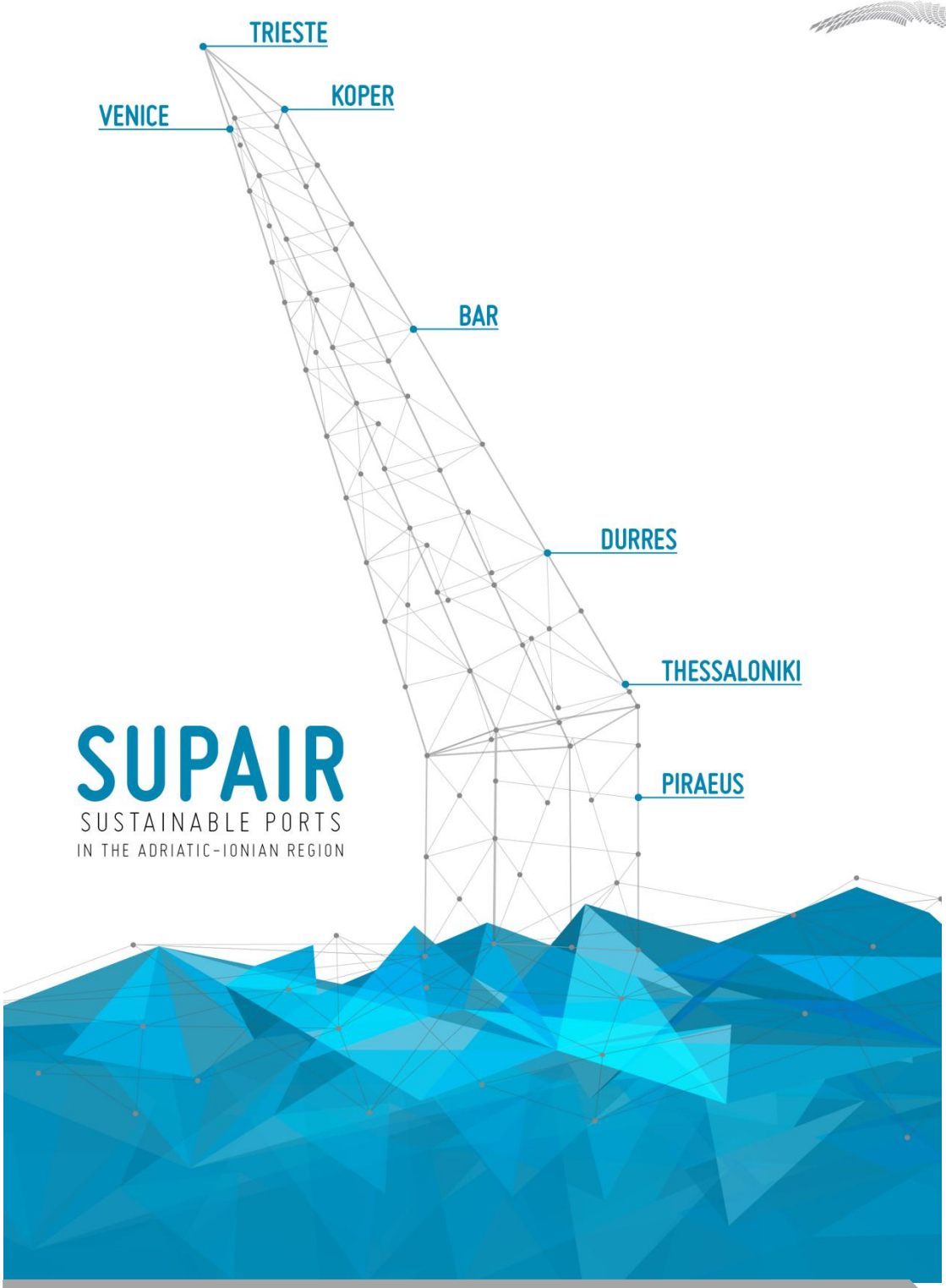

T1.2.1 Guidelines for Sustainable and Low carbon Ports

WPT1

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The Guidelines present the common transnational methodology and the outcomes of focus group sessions. They outline sustainable ports as a strategic objective and address stakeholders' involvement, public procurement and integrated planning processes.

Partner responsible for the deliverable: VIU

Document Author(s): Marco Mazzarino, Lucio Rubini

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1. Introduction and main goals

The Guidelines present a common transnational methodology to deliver action plans aiming at improving the planning abilities of ports in the field of sustainability and low-carbon strategies. Guidelines are to be used by any port interested to join the "Network of ADRION Sustainable and Low-carbon Ports" that will be developed within the framework of the SUPAIR project for further driving the progress towards port sustainability.

It should be emphasized that the Guidelines would support port *action plans*, thus they refer in principle to the *strategic* level of planning by interested ports. For this reason, they consist of a straightforward methodological framework – enriched by added value supportive information derived from desk research – driving strategic planning. Moreover, since the type of proposed actions may vary significantly and in many ways among different ports, the Guidelines put forward a rather flexible methodology to be applied in different local contexts while, at the same time, ensuring the adoption of a common approach. Indeed the guidelines fulfill three based requirements:

- *Support*: The Guidelines consist of a common step-by-step framework with given structure and contents to support port authorities in the development and implementation of local low-carbon action plans.
- *Compare*: the common scheme will stress the transnational approach to the issue of Ports sustainability and it will allow a cross understanding of Action Plans among PPs Ports of SUPAIR
- *Transfer*: providing a methodological tool to be transferred out of the project as an outcome of SUPAIR.

Ports should use the Guidelines as the main methodological reference in the implementation of their plans and actions, which would also include financial, socio-economic and environmental feasibility studies. The Guidelines contribute to the SUPAIR project objectives of:

- reducing the environmental impacts of shipping and port operations through specific environmental-friendly (soft and hard) measures embedded in port Action Plans towards greener, safer and more efficient port systems;
- improving the ability of ports to plan and implement sustainable action plans.

2. Activities and WP Implementation structure

- Number of activities in WP Implementation: 9;
- Number of Deliverables: 9;
- Overall timeframe: from January 2018 to December 2019.

The overall structure and rationale of the activities follow an effective planning approach, including a participatory process which is mainly based on focus groups sessions bringing together all relevant stakeholders and decision-makers. The first Activity consists of the involvement of key stakeholders. Focus group sessions are organized at each project partner premises according to a common structure and

management model provided by the WPL. The main Deliverable associated with this Activity is D T1.1.1 "Report on focus group sessions", in which project partners manage focus group sessions locally and elaborate draft reports on the discussions undertaken and main findings. Draft reports are then collected into a final report prepared by the WPL summarizing main outcomes and findings. The timeframe is from January 2018 to March 2018.

The second Activity consist of the definition of a set of Guidelines supporting project partners in the development and implementation of local low-carbon action plans. The Deliverable associated with this Activity is D T1.2.1 "Guidelines for Sustainable and Low-Carbon Ports". The timeframe is from January 2018 to May 2018. Next Activities consist of the various local low-carbon action plans developed and implemented in each geographical area, including Trieste, Venice, Piraeus, Durres, Bar, Koper, Thessaloniki. The timeframe is from July 2018 to December 2019.

3. The methodological framework

The common transnational methodological framework consists of the description of the logical sequence of the activities to be followed in each geographical area in order to develop and implement local low-carbon action plans (Figure 1). It follows an effective planning approach.

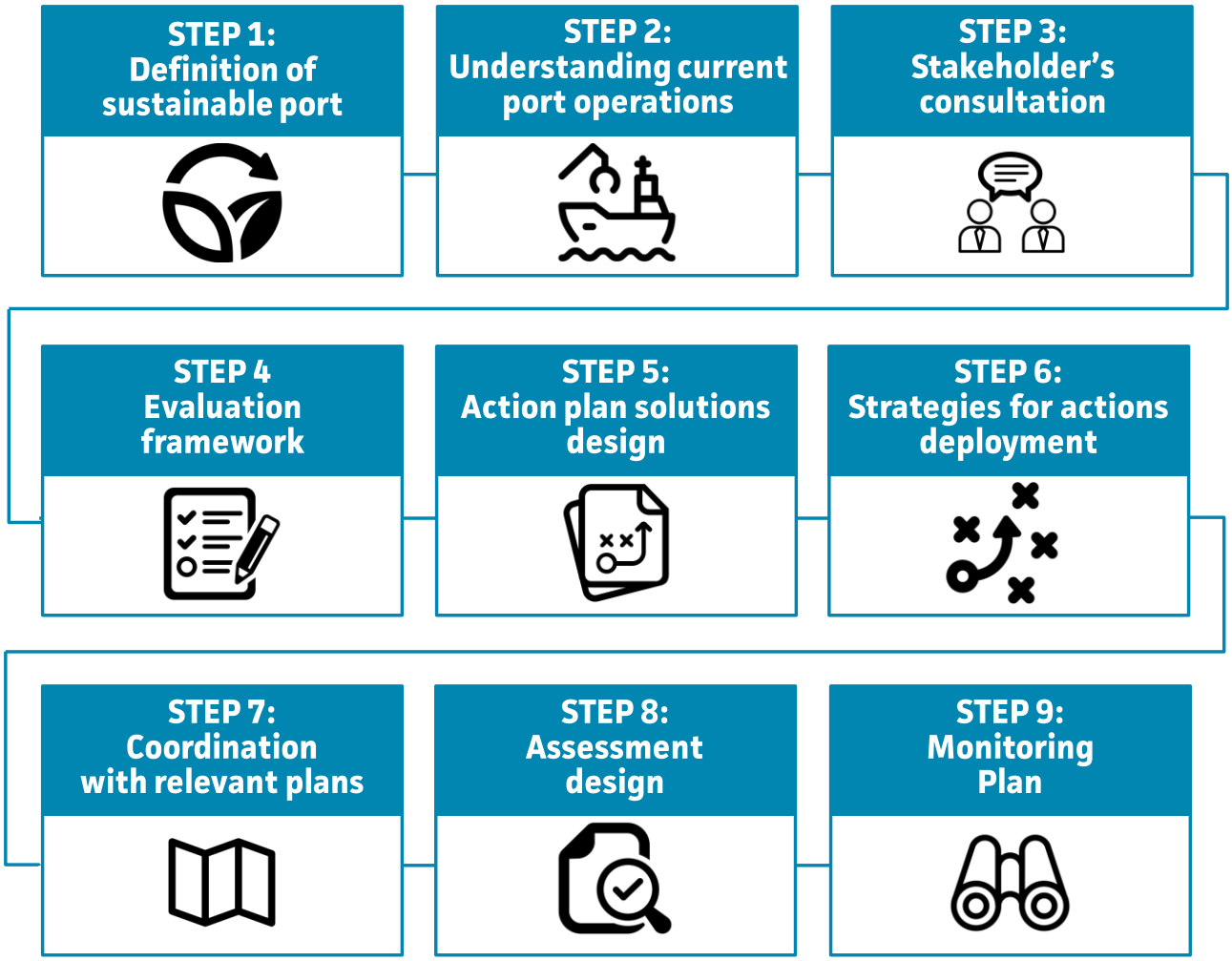
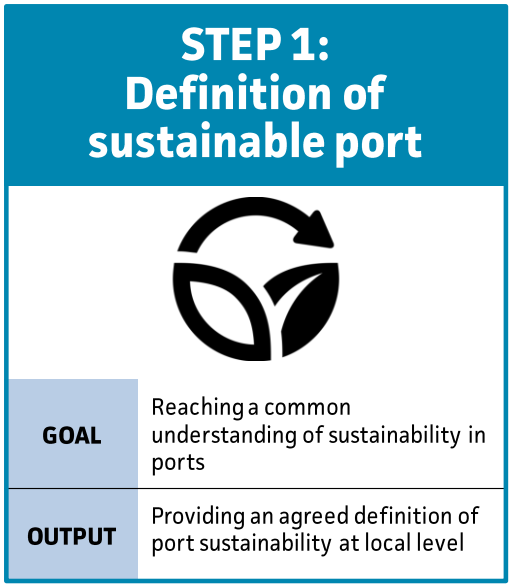


Fig. 1 The methodological framework

3.1. Definition of a “sustainable port” as a key element of wider low carbon strategies



Common methodological guidelines leading to port low-carbon action plans should be based on a common understanding of basic principles and concepts. A preliminary useful step should consist of defining port sustainability, as perceived in each local context.

The outcomes of this process can then be used in subsequent steps of the project (eg, mutual learning workshop) - the Network of ADRION Sustainable and Low-carbon Ports - to come up with a general shared definition of port sustainability. Focus group sessions, in particular, are useful to reach this aim (see

Stakeholders , section 0). The common management model of local focus group sessions provides for such a topic to be preliminary addressed.

According to desk research outcomes, the following (Box 1) broader definition could be suggested, along with the key issues of port sustainability as shown in the Box 2. It should be pointed out that low carbon strategies represent a key component of overall port sustainability, although not the exclusive one.

BOX1: SUPAIR DEFINITION OF "SUSTAINABLE PORT"

"A sustainable and low-carbon port is one that in close consultation with its users and stakeholders, commits into, proactively plans and responsibly and continuously works towards ensuring economic prosperity and long-term improvement of the quality of life in the port area and the urban community it serves. Considering existing needs as well as the needs of future generations, a sustainable and low-carbon port puts forward and deploys different measures, actions and strategies, following an integrated approach, for efficiently protecting and managing natural and human resources, ensuring environmental protection and climate change mitigation and exploiting and widening the use of environmentally-friendly technologies and renewable energy sources".

3.2. Understanding current port/terminal operations and management models

STEP 2: Understanding current port operations

GOAL	Understanding current port operations
OUTPUT	▪ Providing a description of existing port operations, processes and management models related to the foreseen action plans ▪ Providing a description of existing regulatory framework ▪ Identifying key issues driving action plans and solutions to improve port sustainability ▪ Identifying and analyzing local conditions affecting action plans ▪ SWOT analysis ▪ Benchmarking analysis

In this section an exhaustive description and analysis of the current **scenario ("as is")** of port / terminal operations and processes is conducted. The current planning and management models of port /terminal operations are analyzed and discussed, also by using graphical tools. The overall regulatory framework (at European, national and local level) is analyzed as well to envisage opportunities and potential constraints related to selected actions.

Some general references of EU regulatory framework to be taken into consideration include the following:

- Clean Power Transport Directive (March 2014)[1]
- Regulation 2017/352 establishing a framework for the provision of port services and common rules on the financial transparency of ports[2]
- Proposal for a Directive on port reception facilities for the delivery of waste from ships (https://ec.europa.eu/transport/sites/transport/files/legislation/com2018-0033-port-reception-facilities.pdf)
- New General Block Exemption Regulation (May 2017) [3]

Key issues and influencing factors driving port sustainability are identified and discussed (see Box 2).

It should be emphasized that **local conditions** in each geographical area vary significantly in terms of the type of actions to be put forward (strategic vs operational decision-making level), stakeholders' attitudes, existing regulatory framework (private vs public ports) and others features. Such features should be clearly identified and discussed.

Possible **macro/strategic visions** about port sustainability are developed in each geographical area. This section aims at developing a set of Sustainable Port Visions. Visions will be based on trends, key influencing factors and the like as identified in previous sections. The involvement of key stakeholders is suggested as well to provide in detail the profile of the port today and to draft realistic future goals of improvement.

The overall investigative framework will end up with the elaboration of a **SWOT analysis** framework highlighting major sources of risks, critical issues, trends, opportunities, threats, pressures, strengths and weaknesses leading to the adoption of selected actions to be implemented.

The **progress beyond state-of-the-art scenario** and a preliminary assessment deriving from the adoption of selected actions should be presented and discussed. The degree of underperformance in the field of sustainability should be discussed.

A **benchmarking analysis** and benefits assessment are performed with respect to relevant good/best practices at European and international level in the field to get insights (on issues, indicators, strategies) supporting/improving the implementation of selected actions[4].

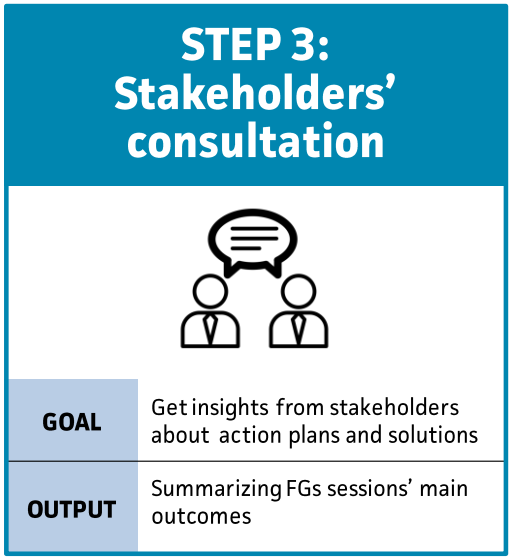
[1] Requiring all core ports to provide LNG and OPS facilities by 2025

[2] enabling variation of port infrastructure charges for attracting vessels which have an environmental performance, energy efficiency or carbon efficiency of transport operations better than the average

[3] facilitating investments in ports and in particular green port infrastructure

[4] The Boxes in the Guidelines provide partners with some effective supportive information

3.3. Stakeholders Consultation



This section summarizes the results of focus group sessions where all relevant stakeholders shared their views on the selected actions. In the following table, the list of these stakeholders have to be filled-in, with the main insights collected in terms of vision, needs, whether or not they have been involved in the Focus Group, if they are easy to involve and how important is their involvement for the success of the Action Plan for a Sustainable and Low-carbon Port.

STAKEHOLDER CATEGORY (i.e Privates: Shipper; Logistics operator; Forwarders; Carrier (road/rail/shipping); Terminal operator i.e. Public: Regional authority, Transport agency, etc.)	RELEVANT STAKEHOLDERS (Name of the Organization)	INVOLVED IN THE FOCUS GROUP (Yes or not)	Contribution of the Sustainable and Low-carbon Port	
			NEEDS (list 2/3 of the main relevant needs)	INVOLVEMENT IMPACT (Involvement: indicate if easy, medium, difficult Impact on the sector: indicate if small, medium, large)
	Stakeholder 1		- Need1 - Need2 - Need3	Involvement: Impact:
	Stakeholder 2			Involvement: Impact:
	Stakeholder 3			Involvement: Impact:
	Stakeholder 4			Involvement: Impact:
	Stakeholder 5			Involvement:

				Impact:
	Stakeholder 6			Involvement: Impact:
	Stakeholder 7			Involvement: Impact:
	Stakeholder …			Involvement: Impact:

Table 1 - list of the relevant stakeholders

BOX 2: KEY ISSUES, DRIVERS AND FACTORS AFFECTING PORT SUSTAINABILITY AND POSSIBLE TARGETS

ESPO identifies and ranks a number of port sustainability issues with the aim of driving and prioritizing sustainable action plans. The last rank was released on November 2017. According to ESPO, although sustainability factors ranking depends on port geographical location, type of port activities and management and governance models, air quality has been representing the most important sustainability issue since 2013, given that more than 90% of EU ports are located close to urban areas and any improvement directly affects public health and quality of life of people. Starting from 2015, for instance, the low sulphur areas (SECAS) have been implemented, thus generating huge benefits to the surrounding communities. Moreover, the global sulphur cap on marine fuels has been confirmed. Additionally, the need to make ships complying with lower NOx emission standards by 2021 is another top issue, which is being tackling with the NECA's.

The second top port sustainability factor is energy consumption and this has been so since 2016. Energy consumption directly relates to carbon footprint and climate change. More broadly, the "climate change" issue includes energy efficiency and greenhouse gas emissions reduction and adaptation. Initiatives to reduce the carbon footprint in EU ports are of utmost importance and they could range from monitoring tools to investments in clean energy sources and decarburization strategies of the industries within the port. In this respect, the port of Amsterdam decided to become coal free by 2030.

The third factor is noise. Noise has increasingly become a factor determining differentiated port charging systems. Mitigating noise impacts from ships by means of the use of on shore power supply at berths – especially for cruise ships - represents an important priority for EU ports.

Water quality and port dredging are other sustainability issues in ports. Alternative ways to use dredging sediments are envisaged in various EU ports and various actions are being taken to monitor the impacts on the marine environment, such as in the case of Dublin.

Waste management is another issue, although it seems to have been less challenging in recent years (it was ranked at the top of sustainability issues back in 2004).

Interestingly, the port of Rotterdam has designed a sustainability performance system focused on a set of sustainability issues – so called PERS (Port Environmental Review System). The set of sustainability issues includes:

- Noise;
- Air quality;
- Waste;
- Dredging (operations and disposal);
- Dust;
- Relationships with local community;
- Energy consumption;
- Port development (land and water-related);
- Ship waste;
- Climate change;
- Conservation areas;
- Environmental risk assessment;
- Ship sewage;
- Cargo spillage;
- Sediment contamination;
- Water quality;
- Bunkering;
- Vehicle exhaust emissions;
- Hazardous cargoes (handling and storage);
- Soil contamination;
- Rain water treatment;
- Habitat/ecosystem losses;
- Contaminated land;
- Ship exhaust emissions.

Amsterdam – which represents a major energy port - is another example of the deployment of an overall sustainability strategy. The port of Amsterdam aims at being sustainable by focusing on 5 main issues and themes:

Fig 2 – Port sustainability issues (source: Port of Antwerp, Sustainability Report 2017)

1. Energy transition and the circular economy
   - Promoting the use of renewable sources;
   - Developing city/industry-port interactions in the field of waste management and recycling processes;
   - Promoting innovation and knowledge-based incubators in the port areas.
2. Environment and surrounding areas
   - Monitoring air quality, noise and CO2 emissions.
3. Clean and safe shipping
   - Improving safety operations in view of increasing maritime traffic;
   - Clean shipping: monitoring the emissions and waste produced by ships.
4. Work and knowledge
   - Monitoring the number of innovative, knowledge-based and highly-skilled companies in the port areas;
   - Monitoring employment features at the port.
5. Chain responsibility
   - Developing a constant dialogue with stakeholders and customers.

The port of Antwerp regularly releases a Sustainability Report highlighting major sustainability issues of

importance for the port and related sustainability goals (and sub-goals) to be achieved through specific action plans. The major sustainability issues and subjects are shown in the picture below.

Fig 3 – List of the different Sustainable Development Goals to which a contribution is made by the different subjects adopted by the Antwerp port community (source: Antwerp Port Authority)

According to the list of sustainability issues (or subjects), a number of Sustainable Development Goals are chosen by the port among those identified by the United Nations in 2015, namely:

- Affordable and clean energy;
- Decent work and economic growth;

- Industry innovation and infrastructure;
- Climate action;
- Partnership for the goals.

Next, a matching between contributing sustainability issues and goals are made (**Errore. L'origine riferimento non è stata trovata.**).

Freight traffic and ship sizes have been dramatically increased in the port over time. Following a stakeholder involvement approach, air quality has been identified as the most significant factor affecting port sustainability, particularly in the form of air emissions. The port monitors the number of ships complying with international standards and assigns them to a white, grey or black list correspondently. It also monitors the adoption of emission-reducing technologies employed by ships. The Environmental Ship Index (ESI) is estimated to assess ships performing better – in terms of emissions - than international conventions based on engine and fuel used. Various ship's waste – including water ballast, oil and oily water, chemical waste, sewage, garbage, air-polluting waste – are constantly recorded.

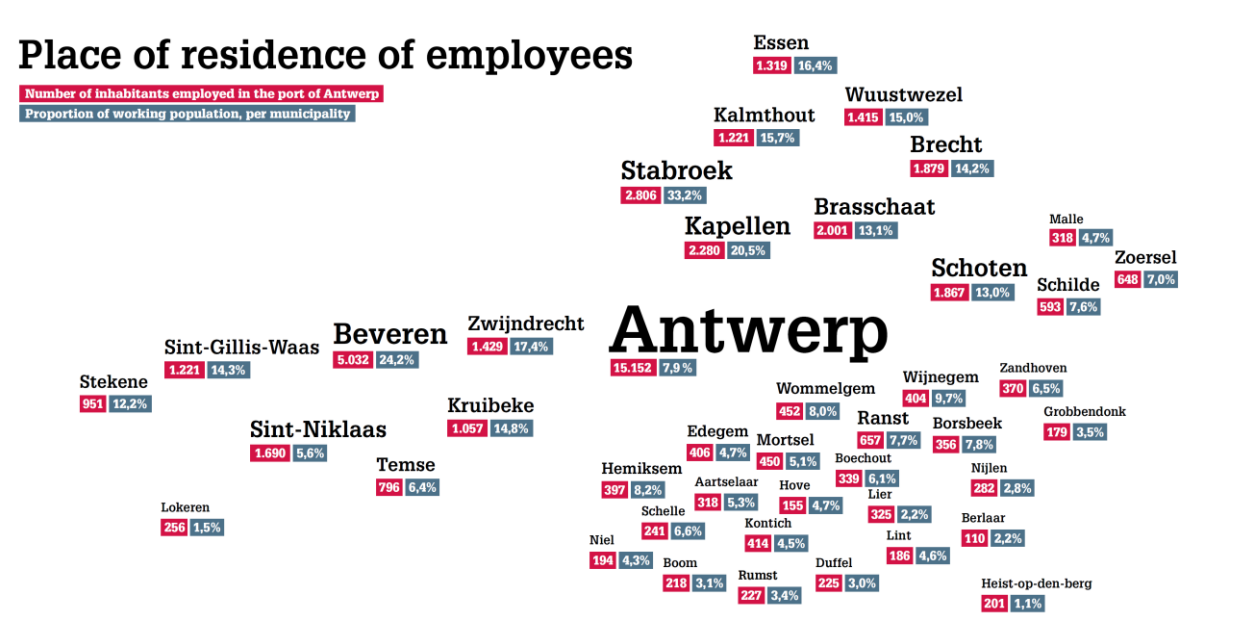


Fig 4 – N° of residents in the neighbouring municipalities employed in the port of Antwerp in 2014 (source: Antwerp Port Authority)

Accessibility to/from the port is another sustainability issue, particularly in terms of modal shift. The port regularly monitors such a parameter and a target of road traffic reduction of 43% (to be achieved by means of a number of strategies and action plans) has been set by 2030 (currently it is 56%). At the same time, improving road accessibility is of concern for the port. Traffic is constantly monitored by the port authority and related information are provided to port users, thus allowing them to better plan their trips. Moreover, trucks accessing the port are monitored in terms of their environmental performance.

Despite a downward trend in recent years, the port is largely the biggest employer in the region, accounting to some 140,000 jobs – more important than the city itself. As such, employment and safety at work ("people") is a relevant sustainability issue in terms of commuting trips, safety and career development (education and training, late retirement). Port workforce commutes from a large surrounding area, thus worsening road congestion around the port (**Errore. L'origine riferimento non è stata trovata.**).

A safe working environment is a top priority for the port and effective actions are taken to prevent accidents. The trend of accidents has been positive in recent years.

Improving education and training is a major sustainability issue in the port. As a whole, the port-maritime cluster shows less people with higher level of education than the non-maritime labor market, although the demand for higher education jobs has been increasing in the last few years in the port sector.

The contribution of the port to the economic development of the region is another issue. The port should be seen as an economic "engine" and as a mean to improve the quality of life. That means that employment and added value should be the parameters to be monitored for a port aiming at being sustainable. Added value and employment together show the overall port labor productivity.

For instance, the contribution of port activities to regional GDP in Antwerp is more than 8%. At the national level, the contribution of the port (around 5%) is smaller than that of the construction sector only. However, indirect added value turns out to be significantly bigger than direct valued created in the region. Moreover, by comparing various port-related economic sectors, industrial activities are those generating the biggest proportion of added value, while land transport is the one with the lowest value. Land transport, along with shipping-related activities, is also the sector with the lowest profitability.

The – strictly speaking – environment of the port areas is another major sustainability issue. For instance, the port of Antwerp employs the so-called Cleanliness Index to measure how much clean public spaces in port areas are. An app supports the measurements by stakeholders. Dock litter (including empty drink cans, wood, plastic and so on) ending up into the water is another issue. The Port Authority is in charge of cleaning up such a kind of litter constantly by using specialized barge systems.

Soil quality is constantly monitored through surveys on soil pollution and contamination and proper measures are taken to minimize the impacts.

Water management is another issue and it deals with the monitoring of the quality of water in port areas (in particular, oxygen conditions). Further parameters include salinity, nutrients levels and overall chemical conditions. Emissions of metals and polyaromatic hydrocarbons are additional parameters to be monitored. Overall, water consumption is a major sustainability issue, happily showing a decreasing trend in recent years.

Air quality should be monitored looking at the various components, including SOx, NOx and particulates. Various tools can be employed here (see, for instance, the "We-nose" and "E-nose" initiatives in the port of Rotterdam and Amsterdam respectively).

Noise is another issue to be tackled by noise surveys in port areas coming up with noise level maps.

Port areas are usually home of habitats of endangered species under various EU Directives (eg, EU Bird and Habitat Directive – Natura 2000). Ecological networks should be developed to ensure long-term conservation of a good number of species. Biodiversity should be preserved.

Energy and climate change targets set by various international agreements are significant for sustainability, although such agreements do not consider the port and shipping industry. Thus, energy consumption and energy efficiency are monitored. They show a declining trend from 2011, mainly due to energy-saving measures. Attention should be paid to the monitoring and developing of sustainable forms

of energy, in particular those from renewable sources. In the port of Antwerp, the proportion of renewable sources is expected to double in the coming years. Clearly, CO2 emissions should be monitored at the port: in the case of Antwerp a declining trend since 2012 has been in place due to the increased energy efficiency of various activities (CO2 emissions/output).

Research and innovation activities, including digitalization, automation, etc. are also fundamental to reach a sustainable economy in the port. They can be monitored through the investments in R&D made by companies within the port. In Antwerp, an upward trend is reported, especially in the petrochemical sector, while in the maritime cluster the trend is negative, despite many initiatives and projects launched by the port authority and local public bodies.

Another key issue of sustainability consists of the ways in which the port community interacts with overall local society and citizens. The port community should not be seen as an independent cluster. In Antwerp, an annual survey is carried out about how citizens perceive the activities in the port with respect to a number of sustainability variables. The port is usually perceived positively with regards to economic development and employment and in negative terms with respect to the impacts on local mobility. Initiatives of the kind of "open port" should be promoted and events ("the port as a social experience") should be organized correspondently to improve the interaction between the local and the port community. Surveys about port perception should be conducted with respect to a wider surrounding area as well (regional, national).

The contribution of the port to the circular economy model represents another key feature of port sustainability. That means focusing on the goal of maximizing recycling and reusing activities in the port areas. Suitable parameters to be used could consist of employment and added value in the related recycling activities as well as the amount of waste produced and processed within the port. In Antwerp, the circular economy sector has been growing in the last years.

Security is another issue: the port should be a safe place for everyone. Correspondently, a number of measures and actions should be taken in the field of infrastructures, procedures and organization models. Cooperation among various organizations involved (police, customs, fire departments, etc.) in the development of security plans and emergency procedures should be fostered to create a real network. Incidents in various port sectors should be regularly recorded.

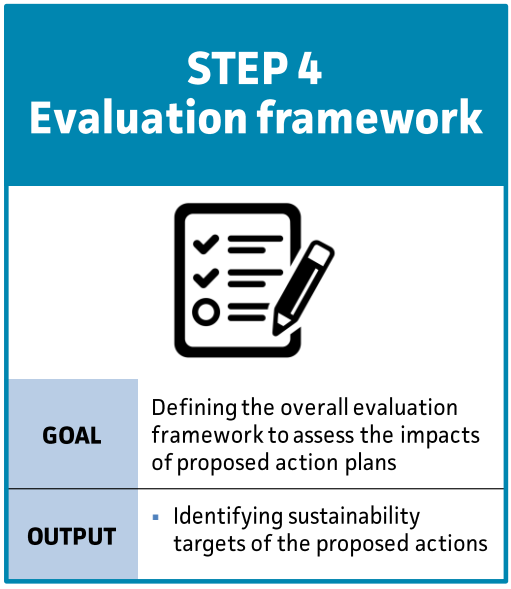
In the port of Amsterdam a number of indicators has been defined to deal with sustainability issues, namely:

SUSTAINABILITY ISSUE	INDICATOR
Sustainable supply of energy	Investments made in renewable sources
	Space (ha) allocated to innovative start-ups
Air quality and noise	Monitoring suitable parameters
Port-hinterland connections	Modal shift

Labor market	Development of low/high skill jobs
Clean shipping	Number of ships accessing the port having adopted environmental-friendly measures to deal with emissions
	Waste management and ballast water
Safety	Number of incidents and inspections
Social and stakeholder engagement:	Number of regular meeting on various issues.

Tab 1 – Indicators of sustainability issues (Port of Amsterdam)

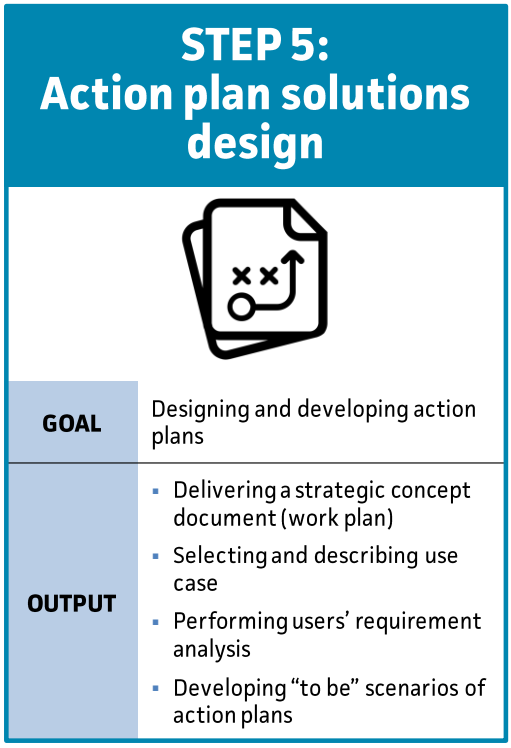
3.4. Evaluation framework



An evaluation framework is developed and discussed to holistically address and identify the **sustainability targets** and indicators of the proposed actions since the beginning. It should be emphasized that assessment relates to strategic port planning and addresses measures of different types and levels of maturity. During the development of the ports' low-carbon action plans, technical partners could assist port authorities to address specific needs depending on the specific action and local context characteristics.

The Framework would follow a **before/after** ("as is" vs "to be" scenarios) assessment approach. Box 3 would support project partners to identify and discussed indicators. This step would be linked with the evaluation design of the step 8.

3.5. Action plan solutions design



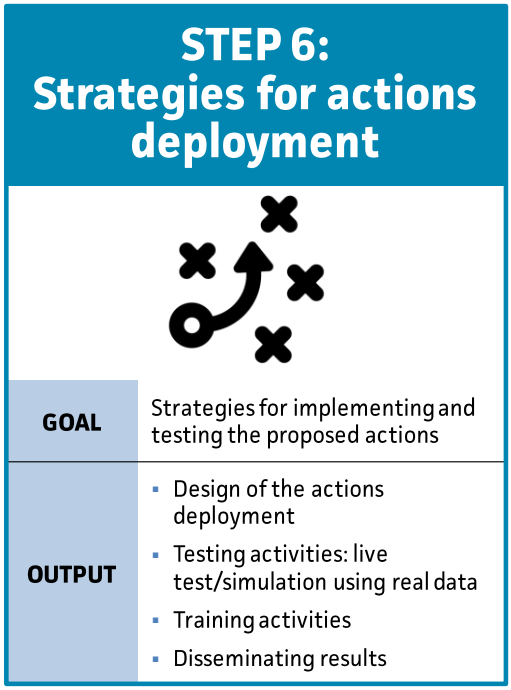
In this section the selected actions are designed and developed to be implemented. First, a strategic **concept document** of the selected actions and solutions is produced to be shared with the stakeholders. A meeting is expected to be organized to involve all relevant stakeholders, including port users. The aim of this preliminary step is to draft a **work plan** of the proposed actions defining objectives, role and responsibilities of main actors and stakeholders, activities, timing and implementation steps.

From a methodological point of view, a number of suitable fine-tuning pilot scenarios (**use cases**) should be selected and described. Such scenarios would refer to current practices in ports for which critical issues and opportunities arise and a number of strategies and solutions can be put in place. In this section, a general description of each pilot scenario is carried out.

A thorough analysis is next performed to identify and assess relevant **requirements** of selected actions. Requirements are specified both with respect to users and – if needed – from a technological standpoint. Following action requirements, strategies for data collection and analysis are developed employing various available tools by project partners. Requirements should be defined through a cyclical/iterative processes providing input to user needs.

Subsequently, a number of **"to be" scenarios** and business models are built to support testing activities. Scenario-building approaches are employed at this stage, both of quantitative or qualitative types.

3.6. Strategies for actions deployment



In this section, depending on the local context and proposed measures, the specific actions and solutions are **actually implemented and tested** in the selected use cases. For the other cases of long-term actions, strategies for actions deployment should be identified. This section aims at demonstrating the impacts of proposed actions whereby validating and adopting proposed actions and solutions. Demo activities can consist of trials as close as possible to real-life conditions.

Major **relevant activities** contained in the Ports' strategy would be:

- fine-tuning selection of end users;
- data and information usage (real data are employed);
- testing (a relevant set of test cases is defined) and – depending on specific action and local context - running solutions;
- on site training activities;
- dissemination of results.

In action plans in which no specific pilot action is foreseen, this section should describe and discuss the way in which actual implementation is expected to be carried out.

The overall approach should be exploited not only to involve specific users, but also as an **opportunity to involve additional users and stakeholders**.

BOX 3: SUSTAINABILITY STRATEGIES IN PORTS

Considering a number of international practices, some examples of effective strategies and actions that can be implemented in ports to improve sustainability can be found.

In the field of shipping, investments made in non-fossil energy sources, including LNG and methanol, have been promoted in recent years. Based on ESI values, ships performing well in terms of emissions (cleaner ships) are granted discounts on port dues (sustainable incentives for shipping) according to predefined incentive programs. Moreover, ships investing and employing cleaner technology and running on cleaner fuels are rewarded as well. On shore power supply is another strategies to be employed for certain types of traffic (cruise, inland).

Waste Management Plans are implemented to deal with various ship's waste on the basis of a "pollutor pays" principle. Waste Management Plans deal with the collection, transport and processing of waste in the port area, including recycling processes (see for instance the "Too good to waste" plan in the port of Rotterdam).

Action plans to divert hinterland traffic towards more sustainable modes have been developed in various ports. This strategy addresses both infrastructure upgrades and organizational models. Technological tools are also employed to support port users in the choice of various transport opportunities (eg, the Antwerp Connectivity Platform offering interactive maps, route planners and other features). Also, commuting mobility has been addressed by promoting cycling and collective forms of transport.

In the field of employment, accident prevention procedures are fostered, as well as education and training, especially for future employees.

In the field of energy and climate, investments in renewable source systems – including wind power – have been developed, thus increasing overall wind power capacity in many EU ports considerably.

Measures related to the circular economy are also implemented. For instance, in Antwerp a strategy to convert methane gas produced by industrial activities in the port into ammonia has been put in operation. A pilot project for scrap cars aimed at reusing components, parts or to exploit them as raw materials has been deployed.

The following table summarizes overall desk research and international good practice outcomes to provide useful guidelines to project partners in the development of port action plans.

SUSTAINABILITY ISSUES/GOALS	INDICATORS	STRATEGIES/ ACTION PLANS
Air quality	➢ emissions (SOx, NOx, CO_2, particulates, dust) Clean shipping: ➢ emission standards/ESI ➢ emission-reducing	Tools: ➢ We-nose/E-nose ➢ discounts on port dues/incentive programs

	technologies ➢ fuel used ➢ type of engine	
Energy consumption	➢ CO_2 footprint ➢ energy efficiency (CO_2/output)	➢ clean energy investments (renewable, LNG, methanol, wind) ➢ decarbonisation strategies
Noise	➢ emissions (surveys, maps)	➢ differentiated port charging systems ➢ onshore power supply
Water quality and management	➢ ships 'waste: water ballast, oil & oily water, chemical waste, sewage, garbage ➢ cargo spillage ➢ dredging sediment contamination ➢ oxygen conditions ➢ salinity ➢ nutrients levels ➢ chemical conditions ➢ emissions of metals and polyaromatic hydrocarbons ➢ water consumption	➢ alternative ways to use dredging sediments ➢ ship waste management plans ➢ cleaning tools and equipment
Waste management	➢ clean shipping (ships 'waste) ➢ dock litter (empty cans, plastic, wood, etc.)	➢ port waste management plans (collection, transport, processing) based on the "polluter pays" principle ➢ specialized barge systems
People: society, employment & safety	➢ perceptions (surveys) ➢ job market: skills, career development paths ➢ incidents, inspections	➢ "open port" initiatives ➢ events ➢ EDU & training programs ➢ cooperation strategies among in charge organizations (police, fire department, customs, etc.)
Innovation and r&d	➢ innovative companies (numbers and allocated spaces) ➢ R&D investments	➢ development programs fostering innovation (e.g. allocating port spaces to innovative companies), also in cooperation with the city
Economic development and	➢ employment	➢ developing recycling and

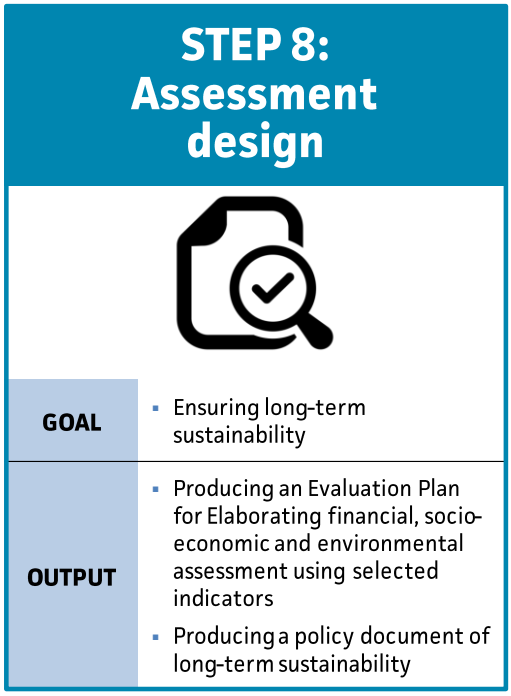
	the circular economy	➢ added value ➢ profitability ➢ productivity ➢ GDP contribution ➢ recycled waste (quantity)	reuse processes and activities
	The natural environment	➢ Cleanliness index ➢ biodiversity ➢ hectares of conservation areas ➢ habitats and ecosystems	➢ ecological networks ➢ creating conservation areas
	Soil	➢ soil contamination (surveys on soil pollution) ➢ contaminated land	➢ actions minimizing impacts
	Supply chain responsibility and stakeholder engagement	➢ meetings with stakeholders and customers	➢ promoting regular meetings
	Accessibility and mobility	➢ modal shift ➢ information provision to port users ➢ commuting trips	➢ technological tools providing information to port users and stakeholders ➢ EDI systems and platforms involving port users and stakeholders ➢ promoting modal shift, also for commuting trips ➢ infrastructures upgrades

3.7. Coordination with relevant plans

In this section, issues concerning the coordination of proposed actions and solutions with respect to other relevant plans – at different levels – are properly addressed. The aim is to ensure proposed actions are as much as possible linked and coherent with overall strategies at various territorial levels (local – e.g. SUMPs, regional, national, EU) and interdependent sectors (e.g. SEAPs, SECAPs, etc).

A thorough analysis of existing strategic documents would be carried out so as to produce a coordinated planning framework of proposed actions. Stakeholders' meetings should be organized as well to address relevant issues of related plans.

3.8. Assessment design



In this section, a collection of feedback information and derived benefits from users and stakeholders is carried out. Feedbacks could relate to additional requirements, updated needs and potential new features of proposed solutions and actions.

Following the overall Evaluation Framework ("what" to assess), the main goal of this section ("how" to assess) is to present the detailed way in which the assessment of proposed action plans is expected to be carried out to improve port sustainability. Issues regarding data collection methods (for the "as is" and "to be" scenarios) should be addressed as well as the estimation of indicators and evaluation criteria towards the elaboration of financial, socio-economic and environmental final assessment.

Traditional evaluation **methods** could be suggested, such as cost-benefit analysis and multi-criteria analysis in order to estimate the impacts of the proposed actions.

The assessment design would follow a **before/after** ("as is" vs "to be" scenarios) approach. Indicators would be selected and measurement techniques proposed to feed the assessment of the "as is" and "to be" scenarios (see Box 3), according with the target indicators selected in the step 4 "Evaluation framework".

Evaluation criteria, variables and indicators should refer to the **operational, financial, socio-economic and environmental dimensions of impacts**. Additional innovative methods, including behavioral and agent-based, could be employed to enrich the range of impacts considered and strengthen the overall evaluation exercise.

Proposed evaluation methods should take a **multi-stakeholders multi-criteria viewpoint**. The requirements of various stakeholders should be taken into account.

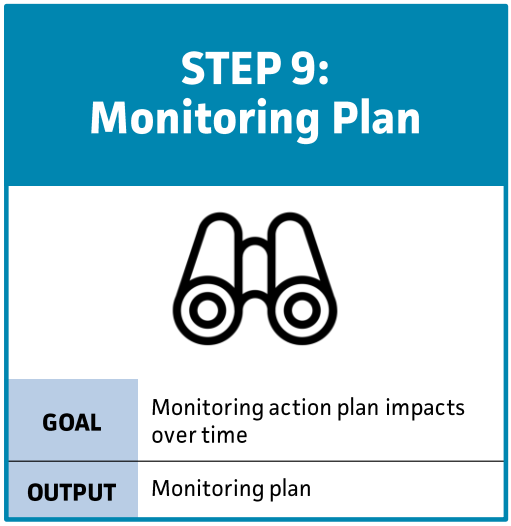
The overall methodology design and issues to be considered when assessing expected impacts should focus on the following key points:

- Designing and developing the overall evaluation framework on the basis of appropriate selected **methods**;
- Identifying relevant **stakeholders** and correspondent objectives, needs and requirements. This step is necessary to ensure that stakeholders' needs are successfully met;
- Identifying appropriate evaluation criteria and **indicators**[5];
- Identifying necessary **data and information** to be collected for the use cases following a before/after approach ("as is" vs "to be");
- Elaborating data to produce financial, socio-economic and environmental **impact assessment**.

In action plans in which no specific pilot action is foreseen, this section could be usefully merged with step 4. Moreover, strategies to address the long-term sustainability of proposed actions should be presented and discussed. In each geographical area, a **policy document** is produced to present long-term governance issues, roles of actors and stakeholders, risks and further actions to be taken to ensure sustainability.

[5] Indicators are action plan-dependent, given the fact that proposed measures by ports are of significantly different types and levels of maturity. Seemingly, indicators included in Box 3 should be seen primarily as means supporting the identification of overall strategic objectives by ports. Depending on the local context and specific action plan, technical partners could support ports in the design of local assessment activities, including needed data to estimate indicators.

3.9. Monitoring Plan



Once an action plan has been proposed in the port, an effective monitoring process should be envisaged to track the impacts and effects of proposed actions over time. In this section, the way in which monitoring activities will be performed should be presented. It is suggested that at least a three-year report should be issued to show results based on specific indicators. For instance, the port of Antwerp explicitly states that sustainability is an on-going process and releases relevant results every two years. Following various sustainability initiatives, the port of Amsterdam publishes intermediate status results.

It is also suggested that collecting monitoring indicators and results should be part of the broader statistical system of each port. Monitoring results should be used to deploy possible corrective actions when needed. Regular stakeholder meetings should be held at the port premises to discuss monitoring results.

A proposed monitoring plan could be the following:

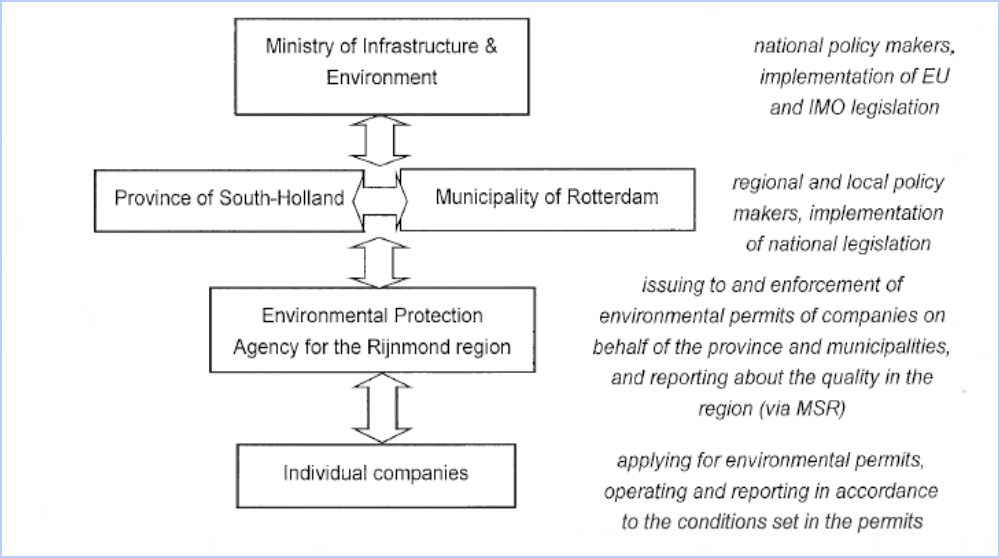
- Identifying targeted port activities and key issues of port sustainability;
- Identifying monitoring parameters and indicators;
- Collecting monitoring data from different sources (primary and secondary);
- Managing regular stakeholders meetings;
- Elaborating data to deliver periodic reports.

BOX 4: PORT GOVERNANCE AND SUSTAINABILITY: THE CASE OF ROTTERDAM

A clear-cut governance and management model in the field of sustainability is provided by the port of Rotterdam. Sustainability and environment issues and management are included in the overall structure of the port authority under various departments' responsibilities, namely:

- the Environmental Management Department, which is in charge of the development and implementation of policies in the field of environment, spatial planning and sustainable development;
- the Harbour Master's Division, in charge for the safe and efficient management of shipping with port areas.

On top of direct responsibilities, the port is part of an enlarged governance model to deal with environmental and sustainability issues and aspects, which includes the Ministry, the Province, the Municipality, the Environmental Agency and individual companies, as shown in the picture below:



ANNEX I – SUPAIR Action Plan template