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Abstract:

This document depicts the progress achieved until M39, regarding the impact and outreach activities carried out in the 3-year duration year of the project (3-month extension included). More specifically, presents the execution plan toward the KPIs' fulfilment, reviews the achieved KPIs and defines potential correction measures.

Keywords:

Impact, Outreach Activities, methodology, categorization, target groups, KPI monitoring, survey, diffusion channels metrics, key messages

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Copyright Statement

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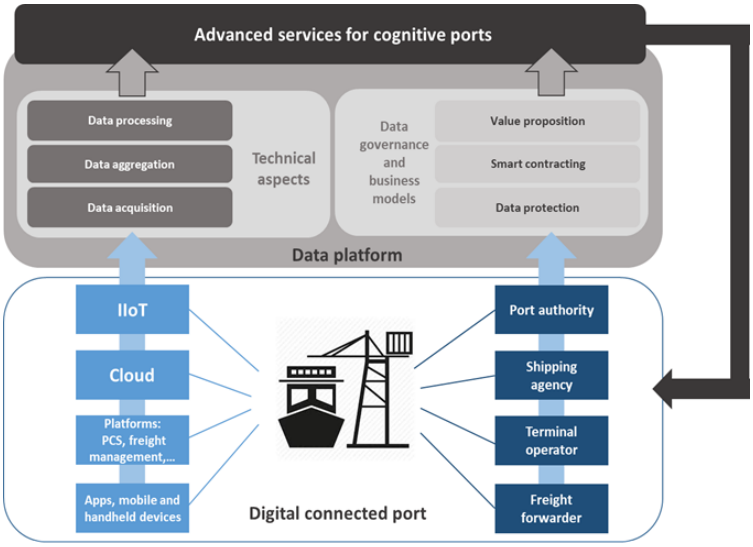
1 INTRODUCTION

1.1 DATAPORTS PROJECT OVERVIEW

DataPorts is a project funded by the European Commission as part of the H2020 Big Data Value PPP programme and coordinated by the Technological Institute of Informatics (ITI). DataPorts rely on the participation of 13 partners from five different nationalities. The project involves the design and implementation of a data platform, its deployment in two relevant European seaports connecting to their existing digital infrastructures and addressing specific local constraints. Furthermore, a global use case involving these two ports and other actors and targeting inter-port objectives, and all the actions to foster the adoption of the platform at European level.



Hundreds of different European seaports collaborate with each other, exchanging different digital data from several data sources. However, to achieve efficient collaboration and benefit from AI-based technology, a new integrating environment is needed. To this end, DataPorts project is designing and implementing an Industrial Data Platform.

The DataPorts Platform aim is to connect to the different digital infrastructures currently existing in digital seaports, enabling the interconnection of a wide variety of systems into a tightly integrated ecosystem. In addition, to set the policies for a trusted and reliable data sharing and trading based on data owners' rules and offering a clear value proposition. Finally, to leverage on the data collected to provide advanced Data Analytic services based on which the different actors in the port value chain could develop novel AI and cognitive applications.

DataPorts will allow establish a future Data Space unique for all maritime ports of Europe and contribute to the EC global objective of creating a Common European Data Space.

1.2 DELIVERABLE PURPOSE AND SCOPE

Specifically, the Description of the Action (DOA) states the following regarding this Deliverable:

Annual report of the outreach results and the impact of DataPorts. This document will review the achieved KPIs and will define potential correction measures.

This document D6.9 – Report of impact and outreach results (M39), is the revised version of D6.8 and the third annual report of the outreach activities in the context of maximizing the impact of DataPorts. This reports the progress, and the result of the execution plans for each KPI described in the DoA and presented in D6.3 (M12) and revised in D6.8(M24). D6.9 monitors the progress and proposes assessment mechanisms for each impact KPIs towards the adoption of DataPorts platform by the Shipping Port's Ecosystem. Each Impact KPI is associated with specific Tasks or WPs.

Deliverable D6.9 is produced within the context of WP6, and its general objective is to propose and measure outreach of project activities and results, to foster the adoption and use of the platform by the stakeholders in shipping ports communities, and the population by data and service owners and providers. The main objective of the associated Task T6.2 is to maximize the impact of the project in the identified target audiences, that is, the shipping port's ecosystem, internal and external stakeholders.

More specifically, the objective of this T6.2 is to measure the impact of the project in selected areas of the shipping port's ecosystem. It is achieved through surveys, webpages, organising or participating in workshops, and social media, aiming to gather the indexes that measure the DataPorts impact on selected areas, in the impact assessment of the revenue streams that will be created for the ports after the efficiency of the operations and through the data and services that can be potentially shared among the port ecosystem's stakeholders. Results can be used as input after the end of DataPorts to engage initiatives that will scale up at a European level.

1.3 DELIVERABLE CONTEXT

Its relationship to other documents is as follows:

Primary Preceding documents:

- Description of Action (DOA): Provide the foundation for the actual research and technological content of DataPorts. Importantly, the Description of Action includes a description of the overall project work plan.
- D6.3 Report of impact and outreach results M12
- D6.8 Report of impact and outreach results M24

1.4 DOCUMENT STRUCTURE

Deliverable (D6.3) on M12 provided the execution plans for each Impact Key Performance Indications (KPI), that were presented in DoA and proposed necessary adjustments to fit with the scope of the project and the port pilots, as these were defined by then. Deliverable (D6.8) was the 1st iteration on M24 and presented the progress, the status, and the assessment of each Impact KPI, as these were redefined in D6.3. Similarly, proposed necessary adjustments. Finally, D6.9 as the 2nd iteration, reports the results of Impact KPIs. It also includes the full description, the execution plan, the milestones, and the evaluation of each Impact with criteria set at D6.3

The document includes an introductory section with a basic summary of the Task 6.2 and its objectives with its specific scope. In the following sections, the deliverable is divided into the following sections:

- **Section 1:** Introduction that includes the purpose and the scope of the document
- **Section 2:** Key Performance Indicators (KPIs) that presents the impact KPIs and the execution plans
- **Section 3:** Outreach activities
- **Section 4:** Conclusions.

2 KEY PERFORMANCE INDICATORS (KPIS)

2.1 IMPACT OBJECTIVES

Measuring the impact of DataPorts is of great importance regarding its adoption by the stakeholders, the expansion and enhancement of the seaport ecosystem and its operations, on the way to its transformation.

Through the Impact KPIs that were initially presented in DoA, DataPorts aims to measure its impact on the seaport community, along with its level of adoption, not only by the seaports, but also for every involved-to-be party and therefore contributing to the objective of ICT13-2019 topic: "Supporting the emergence of data markets and the data economy". DataPorts addresses equally strategic high-level goals set by the European Union, as well as practical stakeholders' and end users' needs related with data platforms, data markets and the data economy. DataPorts reflects Europe's willingness to create and offer integrated data platforms within and across different application domains. KPIs are originally designed to have an impact on the European Union seaports transportation relevant agents (e.g., Port Authorities; shipping companies or infrastructure integrators and operators) and to provide integrated, secure, private, and interoperable data related services. Impact KPIs are following the previously mentioned categories in D6.3, and D6.8.

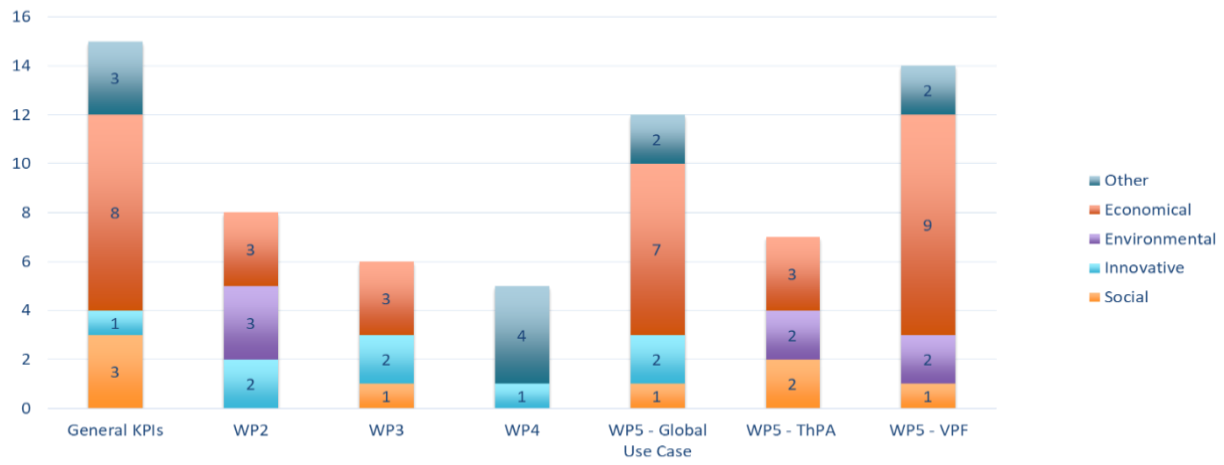


Figure 1 Impact KPI Categories / WPs

By achieving the KPIs set, DataPorts asserts its credibility with the seaport community and the public that will benefit by the proposed services. The insights that can be excluded from the project's impact and outreach activities will be the baseline for the DataPorts expansion and its adoption by the major European seaports and assist in making potential future investment decisions. Impact KPIs presented in DoA and proposed new ones aim to be realistic addressing the objectives of DataPorts as well as those of shipping and maritime community. For that reason, Impact KPIs were monitored and addressed continuously, and execution was planned and modified accordingly. Details can be found in each KPI plan, execution, and reporting section later in this document.

Disclaimer: Even if KPIs must be measurable to define a certain standard with a specific objective, there are several KPIs described in DoA that cannot be accurately measured or set a specific target, yet they meet objectives of DataPorts. In this deliverable, as well as previously reported in D6.3 (M12) and D6.8 (M24), KPIs have been modified to be more realistic, and able to be measured.

All Impact KPIs for which changes are made or proposed are accompanied with a proper justification. Hence, certain considerations have been taken. As was presented in D6.3 (M12) and in D6.8 (M24), Impact KPIs assessment follows the same approach as the one proposed in D6.2. The monitoring of each KPI is obtained

in a KPI Assessment excel dashboard[1] and is reported on an annual basis within the context of D6.3 [M12], D6.8 [M24] and D6.9 [M39]. It provides an at-a-glance view of the progress at specific periods. The excel dashboard includes the associated WP and Tasks, a brief description of the execution plan, the business rationale, the initial and the updated milestones, the impact category, the priority, the assigned partner if it is necessary and the Key risk indicator (KRI) on how risky an activity is. Similarly, every WP Leader and KPI owner, evaluates the execution steps and the progress of the fulfilment according to the categories set at see Table 1. Based on the evaluation and according to the phase of the execution, adjustments may be applied for each KPI.

Categories		General actions or measures
0	Immediate action necessary	KPI is below the expected value. Improve the impact activities relevant to KPI
1	Needs further attention	KPI is slightly below expectations. Further measures for improvement need to be discussed and addressed to partners
2	Good progress	KPI is on track with the execution plan and strategy. No corrective actions are necessary. Continue with the monitoring
3	Overachievement	KPI exceeds the expectations. The Impact execution plan is possibly under evaluated. Shift or concentrate efforts to other Tasks with lower performances

Table 1 On-site Impact KPI evaluation

2.2 IMPACT STATUS AND SUCCESS CRITERIA

Impact KPIs are reviewed and evaluated based on the progress of their execution plan and are dependent on the progress of each WP in order WP teams and KPI owners, to have the chance to fine tune – or change course entirely. KPIs of DataPorts are not static and therefore, there is always a need to evolve, update and modify as needed, otherwise the risk of not fulfilling a KPI is increased.

This monitoring and evaluation process resulted in the KPIs' continuous adjustments, such as, removing KPIs, replacing them with a more realistic ones, or adding new ones. The status and their progress can be seen in Figure 2.

The majority of the KPIs set have reached their fulfilment, therefore it can be concluded that DataPorts impact has achieved the desired penetration in the seaport ecosystems. However, it is considered logical that few KPIs have not reach fulfilment and that was mainly due to their dependency on external parameters. The reasoning behind this is mentioned as risks in each KPI's reporting. As it can be seen in Figure 2, Impact KPIs overall assessment report Good Progress, exceeded the 70% threshold that was set in D6.8. Thus, DataPorts footprint in the seaport ecosystem is considered as a success. It should be noted that all Impact KPIs would be successful upon the willingness of third parties to collaborate in a research environment. Details are given later in this document.

[1] https://dataports.iti.upv.es/nc/index.php/s/tgkM8dyoPpnr3Bn

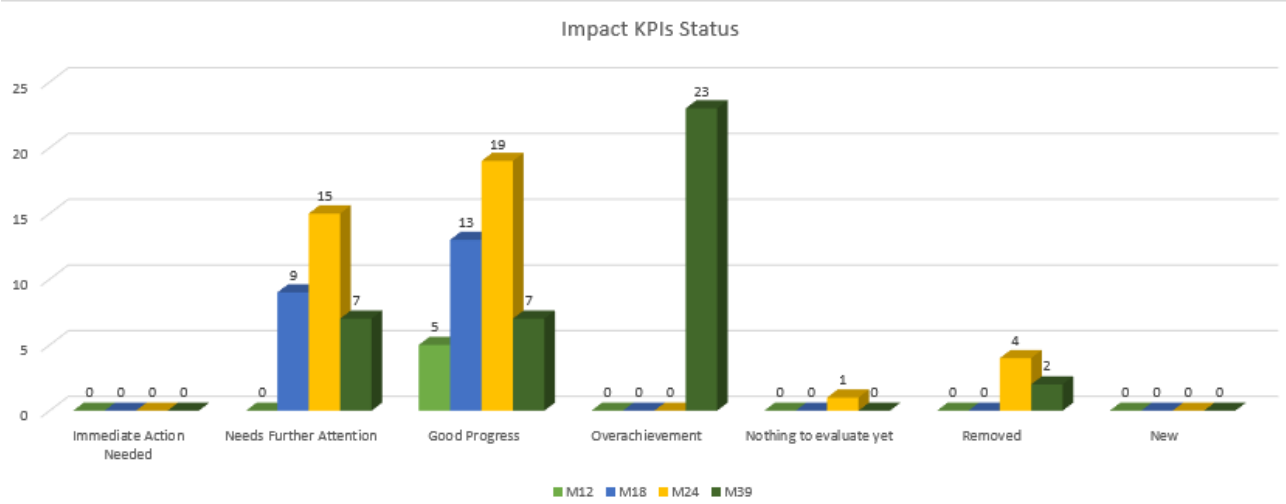
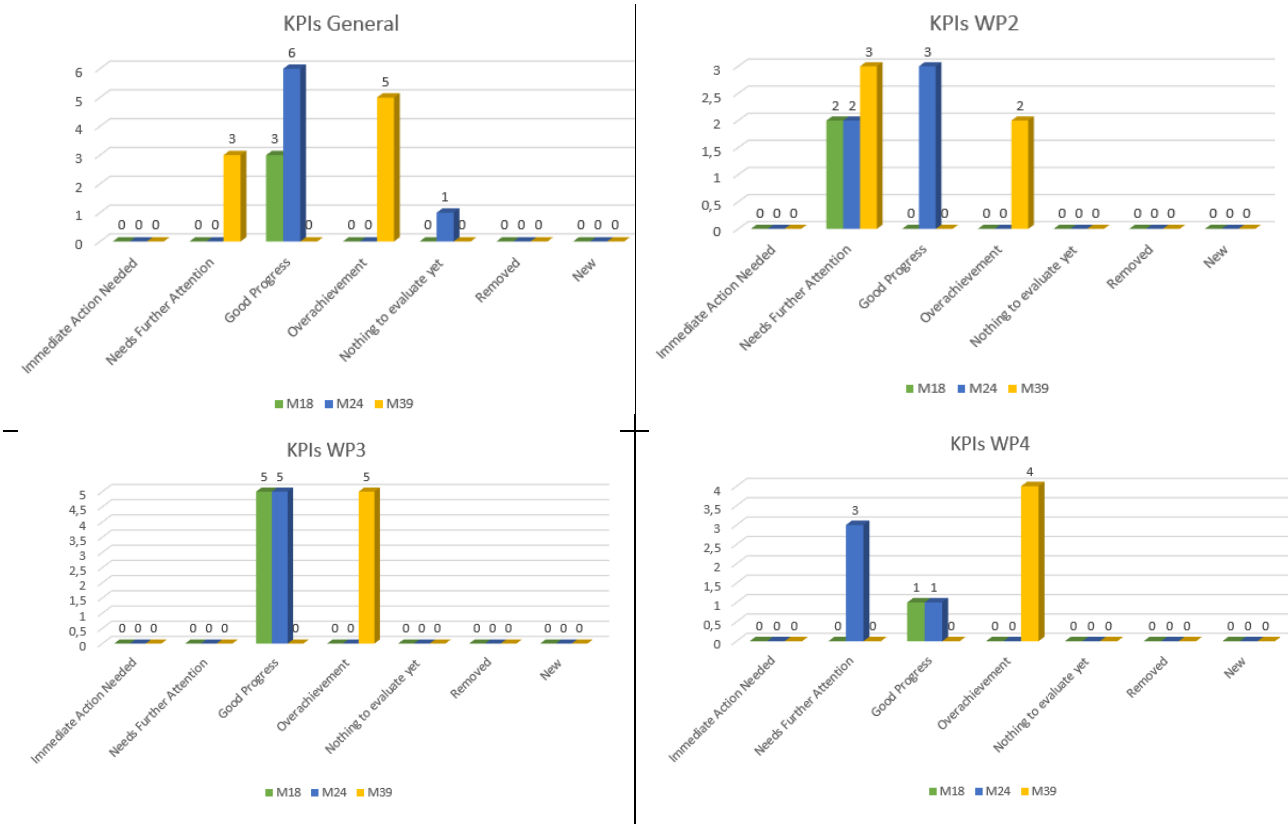


Figure 2 Current Status of Impact KPIs

Figure 3 shows the evaluation of the KPIs in association with the WPs. The progress in every WP is shown for the milestones set on periodically (i.e., M18, M24 and M39). WPs where their KPIs need further attention are related mainly with the communication with third parties, or delays caused at platforms' integration.



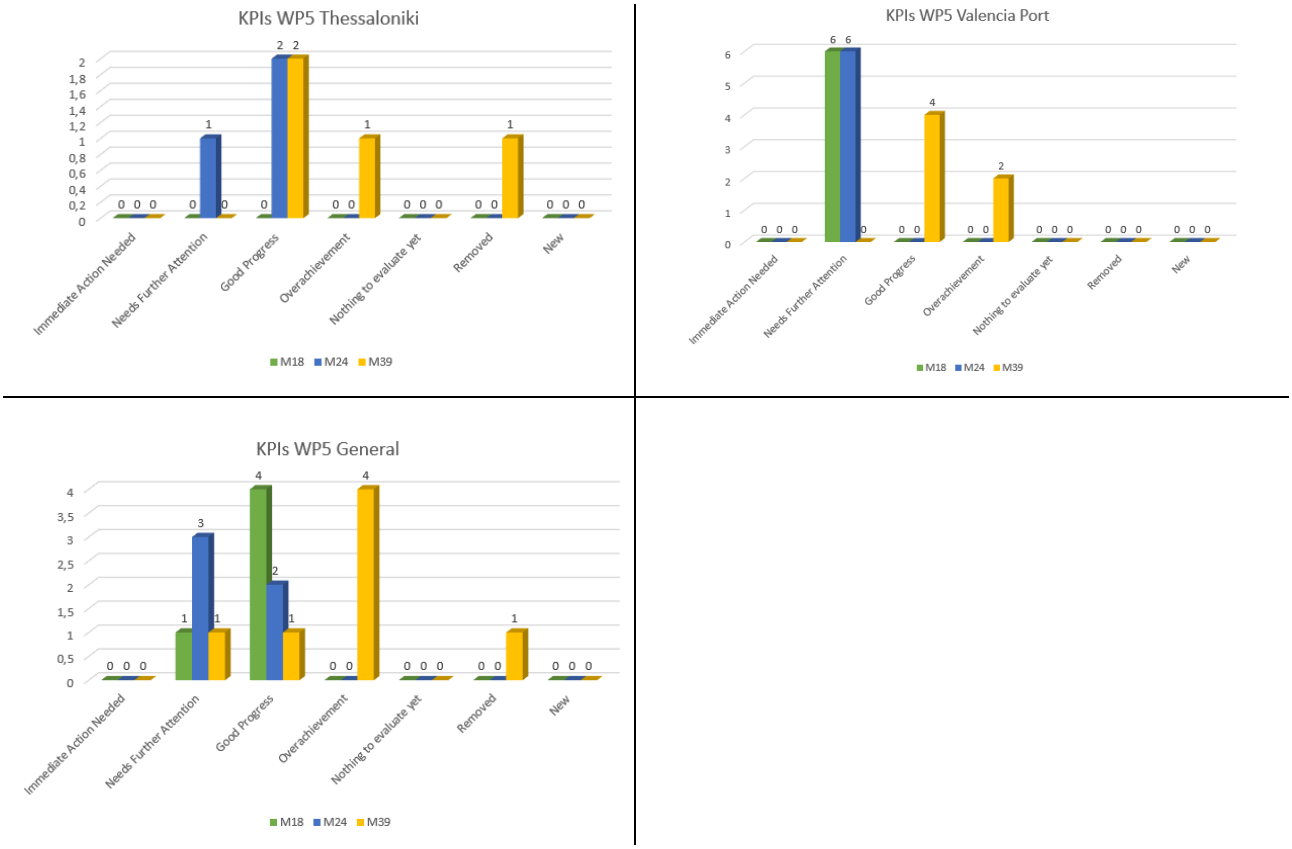


Figure 3 Impact KPIs' Evaluation per WP involved

Overall, it can be said that Impact KPIs' execution plan was followed well with minor delays or adjustments that are mainly caused due to difficulties in communication with third parties, as well as, due to the need for re-designing the KPIs, to meet DataPorts and partners' business objectives and to cope with integration delays of components needed to fulfil a KPI.

2.2.1 General Impact KPIs

This category contains more generic Impact KPIs that may be associated with more than one WP. The assigned partners collected information from all involved WPs. These KPIs contain both community engagement and platform's functional aspects that address the penetration of DataPorts in the seaports' ecosystem. As a result, a sustainable solution with benefits for the data providers, the DataPorts Platform owners and eventually for the external stakeholders, will be created. This will be a paradigm for additional users in a numerous categories and fields of operations, in public or private sector.

ID	Type	Category	Source	Priority	Associated Tasks
I.6.1	Non-Functional	Engagement	End-Users	MUST	WP6 / WP7
Title		30% annual increase in user/buyer organizations using industrial data platform			
Assigned Partner		ITI			
Description					
This KPI is intended to measure the increase of organisations that will adopt and use the DataPorts platform. It focuses on those organisations that are associated with the port pilots and the global use cases and aim to provide or consume data or services.					
Execution Plan					

This KPI is focused on the increase of organisations using DataPorts thanks to the global use cases. In M24 we will measure the users in the two pilots (VPF and ThPA), and in M39 we will add those of the Global Use Cases, and an increase of 30% will be expected.		
Currently, at M39, there are 10 DataPorts Organisations working in the pilots: PRO, OTE, VPF, ITI, TRX, UPV, NTTD, ICCS, CERTH and UDE. They are performing tests on the data platform components for the defined use cases.		
Milestone # 1	**M24**	Initial Measurement - Measure the organisations in the two pilots (VPF and ThPA)
Milestone # 2	**M39**	Final Measurement - Add the organisations of the Global Use Cases
Risk		The easiness of 3rd parties to access the platform
Evaluation		3
Results		
While in M24, ten organisations related to the DataPorts ports were using the platform, mainly the partners participating in the project, this number has dramatically increased. By the end of the project, the number of organisations is 14. Global use cases have made institutions outside DataPorts know and use the platform. Sealand (a Maersk company) is participating in the case of Thessaloniki. They are customers of one of the project partners, Traxens, which made collaboration more straightforward. They were the ones having to approve the installation of the devices. Furthermore, Thessaloniki Express participated in the global use case, overseeing container transportation. And moving to Valencia port, again Sealand had the same role as in Thessaloniki, while Intercontainer played a role in the transportation and the installation of the devices. Finally, Prodevelop has integrated its developments in the Balearic Port. Balearic Port Authority is not directly participating in any project activity but is expected to test the solutions after project finalisation.[2]		

ID	Type	Category	Source	Priority	Associated Tasks
I.6.2	Non-Functional	Usability	End-Users	MUST	WP3 / WP4
Title		Increase of data exchange between port authorities and internal stakeholders, as well as among ports managed by the same authority			
Assigned Partner		ITI			
Description					
This KPI is focused on the data exchange occurred between port authorities and internal stakeholders, to enhance data interoperability and measure the actual impact of DataPorts.					
Execution Plan					
Port authorities will be asked to provide the volume of data exchanged as part of the DataPorts demonstrations, only data not shared before. There should be an increase between M24 and M39. An attempt will be made to associate this KPI with the I.6.5, in which, we will investigate the possibility to involve 3rd parties (Innovators)					
Milestone # 2	**M24**	Initial Measurement - Measure the new data volumes exchanged internally in the two pilots (VPF and ThPA)			
Milestone # 3	**M36**	Final Measurement - Measure and compare the additional data volumes exchanged internally in the two pilots (VPF and ThPA)			
Risk		No risk is expected			
Evaluation		3			
Results					

- [2] Thessaloniki Express: http://www.thesexpress.gr/
- Intercontainer: www.intercontainer.es
- SeaLandMaersk: Sealand - A Maersk Company (sealandmaersk.com)
- Balearic Port Authority: https://seu.portsdebalears.gob.es

Valencia Port Authority and Thessaloniki port collect and manage data from several companies in the port activity for different purposes. Then this data is processed and compiled. There are diverse channels, such as web services or even paper documents by email. A common Data Sharing Platform for exchanging data with the port community, like the one proposed by the DataPorts project, has been proven that would increase efficiency and reliability, as shown within this document and the evaluation report D5.5 use cases and applications evaluation report.
During the DataPorts project, both ports have integrated some data sources related to port activities, including data from PCS related to port calls, road traffic, customs related to trade, vehicles accessing the port, and data from freight forwarders, among others. Once the DataPorts platform is in a production environment, other companies can start sharing data.
In the case of Valencia, for the tracking application, several companies can benefit from the platform and provide data. For instance, terminals and container depots need to plan the resources and inform when the containers arrive/leave, freight forwarders can give different events, including the container location, shipping lines can provide the containers on board, etc.
Regarding Thessaloniki port pilot, as a first step, they use the datasets from their systems, which include almost all their available data. As a second step, they plan to correlate this data with others, (e.g., truck companies and freight forwarders), for different planning purposes inside the port.
Hence, even if there is no measurable amount of data to be exchanged, DataPorts has enabled the possibility to increase the data exchanged between port authorities and other stakeholders.

ID	Type	Category	Source	Priority	Associated Tasks
I.6.3	Non-Functional	Usability	End-Users	MUST	WP5 / WP4 /WP7
Title		Increase of availability of external data by the Port Authority			
Assigned Partner		OTE			
Description					
Data providers, data consumers and data prosumers (Those who offer and consume data) need to be on-board the DataPorts platform. This may be achieved in collaboration with KPI I.6.4 when the platform is deployed.					
Execution Plan					
Working in parallel with KPI I.6.4, the idea is to use surveys, direct messaging, newsletters, or any other communication tools to inform the external stakeholders about the benefits of using DataPorts platform. Moreover, the possibility to offer through the platform access (links) to open data related to the seaports' operations and needs will be investigated. Towards the execution of this KPI and the increase of community's awareness, a survey was conducted (M9 – M10) aiming to identify the business needs of the shipping and maritime industry. In addition, the goal was to increase the awareness of data providers and data users and make DataPorts well known. The results were reported in D6.3 and presented in numerous events. Moreover, for DataPorts to be closer to the shipping and maritime ecosystem, OTE and CERTH co-organised a digital workshop with shipping community members (Ammitec). At the same time, DataPorts set a collaboration framework with ALICE ETP through a digital meeting that got access to Knowledge Platform and given the chance to promote the achievements of DataPorts among the Logistics and Transports funded projects. To increase the exposure of DataPorts and attract potential Data Providers a communication plan is agreed among partners. A list of startups and SMEs that operate in shipping and maritime sector and are related with services through data analytics was created and the communication has begun in M23. The approaching plan can be seen in ANNEX A: Additional Figures					
Milestone # 1	**M24**	Initial Measurement – Feedback from the communication with external actors			
Milestone # 2	**M36**	Final Measurement – based on the platform deployment, final measurements of externals on boarding DataPorts			
Risk		The willingness of 3rd parties to share their data			
Evaluation		3			
Results					

During M35, a survey was conducted after a workshop that was organised with participants from the European start-up community. The participants were start-up companies operating in the maritime sector but were also involved in data related services, mainly offering analytics or other products. As it can be depicted in the figure below, 18% responded that they would be interested in participating as data or service providers, and 25% could have both roles, acting as "prosumers". Such results are very promising since they show potentiality regarding engagement, especially, since the other 56,3% presented themselves as consumers.

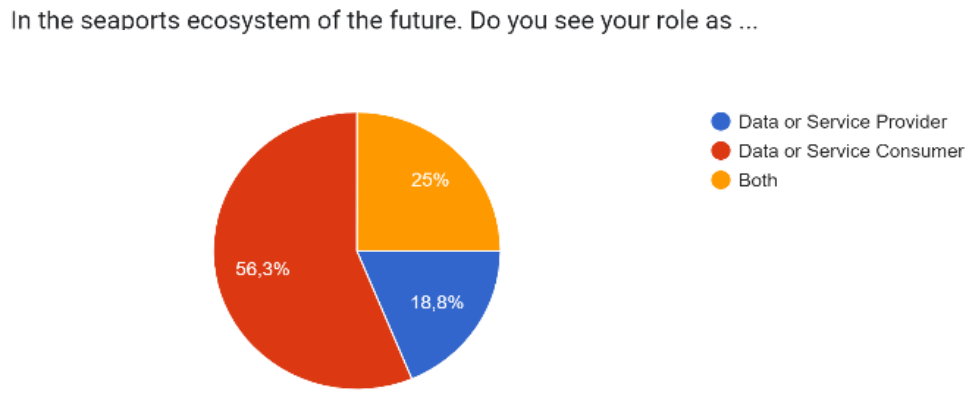


Figure 4 Ecosystem's actors willing to collaborate with DataPorts

In addition, all responders (16) positively replied that they would be interested in collaborating with the data-driven platform proposed by DataPorts offering Business Intelligence (BI) and Data Analytics solutions as providers with specialisation in Passenger Operations or are willing to define a news aggregation services that display local news, around the area of a port. As data providers, they can participate in data trading while as data consumers, to improve the quantity and quality of the services offered. Moreover, an interest was on developing services with new available data, or to offer marketplace services. Several of them had an interest in alerting mechanisms generated from data availability, to extract traffic information and travellers' notifications related with delays and queues at the ports.

ID	Type	Category	Source	Priority	Associated Tasks
I.6.4	Non-Functional	Internal Technical Analysts	End-Users	MUST	WP5 / WP4 /WP7
Title		The number of the data provider organizations participating in the data provider platform must increase by 20% annually			
Assigned Partner		OTE			
Description					
Currently, there is no data provisioning. Therefore, we should focus on the on-boarding data providers to increase the offered datasets. Actual numbers will be available when the deployment of the platform will be available.					
Execution Plan					
The process to engage data providers and on-board them to DataPorts will begin before M18 where technical discussions with third parties will be substantial. For that reason, a list for target groups will be created and will be categorised. Actual numbers can be set on M36 and get input from I.6.3 and I.6.5. In collaboration with I.6.5 discussions with start-up companies that can bring their own data and combine them with DataPorts available data to create services have begun. The contacts will continue through local start-up incubators and local equity Funds that invest in university teams, researchers, and start-up companies. The results will be available upon the replies of communications.					

Milestone # 1	**M24**	Phase 1: Results from communication with data providers and record their intention to offer their data
Milestone # 2	**M36**	Phase2: Measure the number of data providers joined DataPorts at the end of the project
Risk		The easiness of third parties to access the platform
Evaluation		2
Results		
The approach plan to engage data provides started during the participation of DataPorts partners at shipping related events and conferences. Slide2open Shipping Finance 2021 and 2022 and the Posidonia International Exhibition in Shipping are such examples. At these events DataPorts business aspects and more specifically, the opportunities and the benefits of data and their ability to gain the access to new markets were presented at business stakeholders of shipping and maritime. Moreover, as reported in I.6.3, a survey was conducted with participants coming from the European startup and SME community, and especially organisations acting as data providers are willing to be engaged with the DataPorts platform. This initiative was time delayed (few months) due to the readiness level of the components (needed as information to the responders), as well as the covid pandemic restrictions.		

ID	Type	Category	Source	Priority	Associated Tasks
I.6.5	Non-Functional	Performance Efficiency	Internal Technical Analysts	MUST	WP5, T5.5
Title		Increase of the number of innovators around port and logistics in the port cities			
Assigned Partner		OTE/PRO			
Description					
This KPI attempts to establish synergies with selected data providers/consumers with innovative services. In this category start-up companies are considered as a characteristic example.					
Execution Plan					
Based on available demo videos of the components the communication process via emails has begun with start-up companies at European level (innovators), to promote the concept of DataPorts and to investigate their interest to collaborate when the DataPorts platform components will be available. A list of Start-up and SME contacts can be seen at Table 3. Discussions with Data driven start-ups have been initiated and there is an interest to participate (use available data) to create retail services for the commerce community around Thessaloniki Port. In months M24-M25, an effort will be given in external stakeholders, either to enhance the existing scenarios set at D5.1 or propose new ones related to them. The approaching plan can be seen in ANNEX A: Additional Figures. Since innovators are considered mainly start-ups in maritime/shipping and data services, it is proposed to initiate discussions with the ecosystem, informing about the scope and the vision of DataPorts and have them onboard as service providers. A process to send introductory letters by email to collect their intentions and potentially to participate in DataPorts as external data consumers or data providers will be initiated.					
Milestone # 1	**M18**	Initial Measurement – Initiate communication			
Milestone # 2	**M24**	Mid period Measurement – Discuss connectivity and intentions			
Milestone # 3	**M36**	Final Measurement – Measure actual onboarding			
Risk		The easiness of 3rd parties to access the platform			
Evaluation		3			
Results					

Like the previous Impact KPIs, I.6.3 and I.6.4, the conducted survey was a significant source of information. During the workshop that was held before launching the survey, DataPorts informative videos as well as, architecture features were available to the audience. It should be noted that several of the workshop startups and SME participants had experience with European funded research and innovation projects. That was helpful enough since DataPorts platform is not a product yet. The responses given by the survey participants can be depicted the readiness of the market to exploit data. Moreover, the business scenarios defined at the DataPorts pilots are matching an actual market need. Figure 5 below, proves that transport, cargo, and logistics (operations) are considered the most important aspects in the seaport market, sectors that can be further improved through data exploitation and service creation.

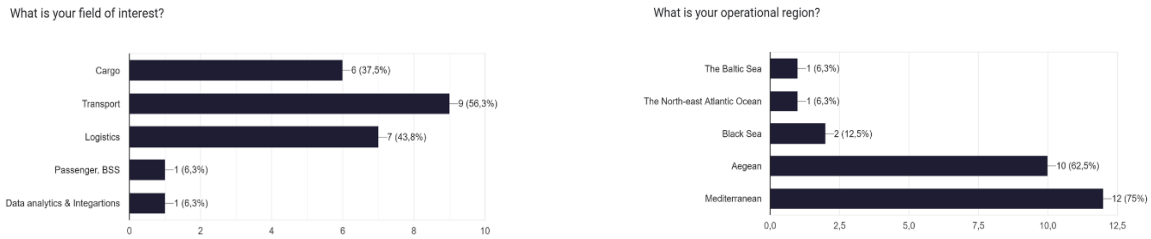


Figure 5 Cargo and Logistics Operations

Mediterranean ports can be considered as target groups for DataPorts to create business, especially since survey participants responded and verified the existing business status with port such as, the Port of Piraeus, Patras, Thira, etc. It can be seen from their replies that other ports are not excluded.

ID	Type	Category	Source	Priority	Associated Tasks
I.6.6	Non-Functional	Usability	End-Users	MUST	WP7, WP5
Title		30% annual increase in volume of business (turnover) channelled through the platform for companies in the ICT sector			
Assigned Partner		FHG			
Description					
This KPIs cannot be monitored during the project, as it requires an established platform community and user base, which is outside of the project scope. Moreover, this is dependent on external factors, like the appetite and acceptance of the platform for external stakeholders. There are two main ways this KPI can be targeted in the project: First, the KPI can be achieved in the project scope by associated project partners, namely OTE/PRO (I.6.6) and THPA/VPF (I.6.7), as representatives of the associated categories in the use cases. Second, the exploitation plan can target these issues during development, providing incentives for the respective industry sectors to take part in the platform.					
Execution Plan					
1. Internal KPI observation As the percentage points are too high for a use case to be feasible, decreased percentage points of 5% (I.6.6) and 2.5% (I.6.7) are proposed as measurements for the pilot settings. They will be finalised in the following months and will be aligned with WP5 planning. High involvement of WP5 and WP6 Partners is expected. Extrapolation from a smaller time of active usage should be performed with a forecast for expected turnover for each partner. 2. Exploitation planning Targeted Business Models and exploitation plans are expected and to be considered when inspecting this KPI. Non-conformity with these KPIs will result in deliverable overhaul to guarantee KPI conformity. Higher priority is given to incentives for the named industry sectors to participate with a focus on their gains through platform usage. Additionally, awareness of the platform is to be considered, with marketing and community building aimed at these stakeholders being of higher priority. 3. KPI estimation An effort will be given to define more realistic values through market research: By investigating other sectors, where digitalization and platform usage had impact on business turnover (e.g., Amazon Web Services (AWS), Microsoft Azure,					

etc.). By communicating with the target groups (logistic sector actors, ICT sector companies) on their expected revenue increase on platform adoption, as well as their desired increase.
Market research shows that a typical data platform is experiencing a sharp increase. In recent years, data platforms have grown steadily at a high double-digit rate. An assumption of 20% or 30% for DataPorts can therefore be considered realistic for the time being. However, measurement is not possible now due to the lack of implementation. Only after go-live will it be possible to measure business turnover. To make the data more concrete, questionnaires will be used to find out the actual interest of external stakeholders. This should provide information about further participation.

Milestone # 1	M24	Mid-period Measurement – Re-evaluate realistic targets - marketing and community building
Milestone # 2	M36	Final Measurement – Set up realistic number related to market research
Risk		The easiness of 3rd parties to access the platform
Evaluation		1

Results

The KPIs I6.6, which aimed for a 30% annual increase in business volume channelled through the platform for companies in the ICT sector, was not achieved in the project. The KPI focused on the annual increase in business volume. While the platform was fully integrated in year 3, it was difficult to measure an annual increase from year 1 to 3 based on the lack of reliable sales data. Since the platform was ready in late stage of the project, it was difficult to realize this milestone. To address that issue, external events were used to discuss with external partners their interest in the platform and possible turnover scenarios. In first discussions we were able to estimate a realistic annual turnover, which was determined to be between 10-20% for all partners.

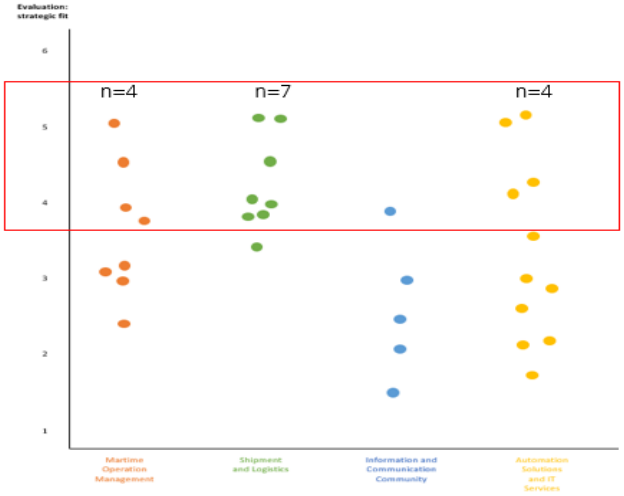


Figure 6 Strategic Fit of customer groups and turnover impact ICT sector

Discussions with external partners also emphasized that the business turnover depends on the use cases and pricing model. The partners mentioned that their personal growth target for their business will be in the range of 10-15%. We also compared our collected customer data and their strategic fit for DataPorts. Only four companies from the ICT sector (see Figure 4) which are strategic partners can deliver suitable services for the platform, in comparison to 11 strategic data providers (logistics provider and maritime operation). Considering all information, the identified range of 10-15% business turnover for companies in the ICT sector will probably be achieved.

ID	Type	Category	Source	Priority	Associated Tasks
I.6.7	Non-Functional	Usability	End-Users	MUST	WP7, WP5
Title		20% annual increase in volume of business (turnover) channelled through the platform for logistics actors			
Assigned Partner		FHG			
Description					
Like KPI I.6.6					
Execution Plan					
Like KPI I.6.6 but targeted to logistics actors.					
Milestone # 1	**M24**	Mid-period Measurement – Re-evaluate realistic targets - marketing and community building			
Milestone # 2	**M36**	Final Measurement – Set up realistic number related to market research			
Risk		The easiness of 3rd parties to access the platform			
Evaluation		1			
Results					

The KPIs I6.7. was not achieved in the project (same reason as in I6.6). We also used the events to determine an approximation for the business turnover.

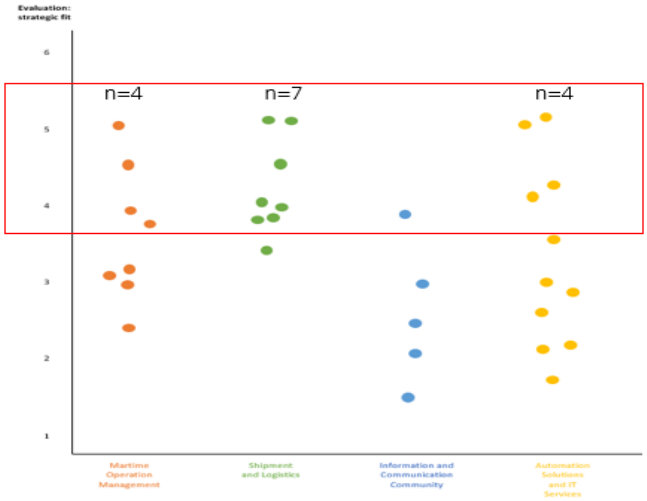


Figure 7 Strategic Fit of customer groups and turnover impact logistics actors

Discussions with external partners highlighted that logistic actors as data provider will be an important factor in the ecosystem. Based on their feedback, it highly depends on the use cases and pricing model of DataPorts. But they said that personal growth target is in the 15-20% range by joining such a platform. Our internal customer analysis shows that the logistics actors (shipping and logistics, maritime operations management, n=11) have a higher strategic value and therefore are likely to have a higher turnover (especially at the beginning of DataPorts' operations). Considering all information, the identified range of 15-20% business turnover for companies in the logistics sector will probably be achieved.

ID	Type	Category	Source	Priority	Associated Tasks
I.6.8	Non-Functional	Performance Efficiency	End-Users	MUST	WP2 / WP4 T2.3, T4.1
Title		The newly introduced data services must exhibit 40% faster time to market			
Assigned Partner		OTE / TRX			
Description					
To achieve faster time to market of DataPorts platform there is a need to identify the available data/services. Therefore, a plan was created based on the conducted survey that identifies the market's need for data and services as well as the creation of a product catalogue by DataPorts partners.					
Execution Plan					
Results from Survey #1 that will be included in D6.3 [M12], along with the Product Catalogue from D7.1 will give a valuable insight regarding the newly introduced data services. A matter of investigation within this KPI is the current time to market and the availability of the Data that can directly go to market. For data services to reach the markets in a faster pace and eventually create more revenues to the stakeholders, there is a great need to increase the available data services and enrich them with added values such as analytics. Therefore, in order KPI I.6.8 to be fulfilled I.6.4 and I.6.5 are considered as prerequisites. By then, the demand for new data services will be increased and hence the time to market will be improved to a faster degree. Within the context of DataPorts, outreach/dissemination activities should be designed towards that goal. Moreover, the available to offer data services should follow certain requirements as those described in WP3 and WP5, regarding their accuracy, interoperability, completeness, etc.					
Milestone # 1	**M36**	Final Measurement- Finalise a Product Catalogue and evaluate survey results			
Risk		The easiness of 3rd parties to access the platform			
Evaluation		1			
Results					

Since, DataPorts is not a commercial product, any ambition for data services to achieve faster time to market is difficult to be measured. However, following the execution plan, new data/services (product catalogue) were defined. Based on a survey conducted in year 1 that identifies the market's needs for data and services, we concluded (Figure 8) that the market-base exists and there is a will to use and benefit from data driven services. From the figure below can be depicted that DataPorts (during a commercialization process in the future) should reach the shipping companies since they are considered as influential actors in the sector, as well as organisations that can act as service providers. In parallel, other external data providers (e.g., cargo and logistics, transportation, etc.) should also be engaged to provide data for cognitive services.

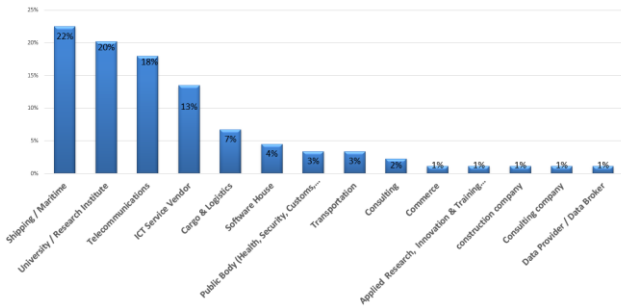


Figure 8 Stakeholders' Interest

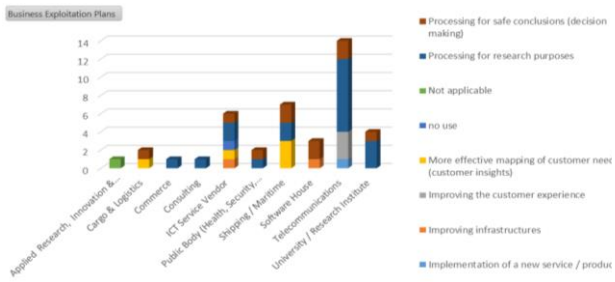


Figure 9 Stakeholders' Importance on Data Sharing

Moreover, the newly introduced services should match the market's needs, as are shown in the figure above. At some level this was achieved by VPF and THPA pilot scenarios. Hence, DataPorts has created a set of services to be fully aligned with the ecosystem needs. More specifically, based on the service catalogue for DataPorts service market as was initially presented in D7.5 and the categories of Smart Container, Telecom, Port Community and Port Operation services, DataPorts created the following services:

- Container Tracking Application
- Good Tracking Application
- Transport Operations Application
- Predictive Process Monitoring Application
- conPESO Application
- Digital Consignment Note Application
- TOS (FRETIS)
- Statistics for THPA Prediction
- Facilitation of Passengers, Professionals, and Visitors of the Port
- Statistics for Passengers/Visitors Covid-19
- Posidonia Management
- Posidonia PCS
- Posidonia Operations VAL, THPA, BAL
- Posidonia Notification

2.2.2 WP2 Impact KPIs

This category contains Impact KPIs that are related to WP2 and the functionalities of a data-driven platform, such as compatibility, scalability, and performance efficiency, that are needed to create an easy-access environment. These KPIs are referred to the contributions related with the outcomes of the project, and address the need of an easy access, will increase the impact and therefore adoption by the end-users.

ID	Type	Category	Source	Priority	Associated Tasks
I.6.2.1	Non-Functional	Certification	Internal Technical Analysts	SHOULD	WP2 / WP6 T6.1
Title		Participation in at least 3 standardization bodies and alliances related with the submission of four contributions related with the outcome of the project.			
Assigned Partner		UPV			
Description					

Regarding KPI I.6.2.1 and considering that there are not any standardization activities explicitly devoted in the work programme, efforts are not directly devoted to this Impact KPI, no further action is necessary. Nevertheless, since it can be related to dissemination activities, it was proposed in D6.1 [M6], that DataPorts will collaborate and position properly in different trending open´source initiatives.

Execution Plan

During the progress of DataPorts and the deployment of various platform components, the activities envisaged are to contribute to open source projects such as FIWARE [2], Eclipse [3], BridgeIoT[4] and also feed the AI4EU platform [5]. The plan related with open-source contribution is reflected in D6.5, the final version of the Dissemination and Communication plan. M18. The section "Plan overview according to the project stages" provides an overview of the initial plan expected to follow.

The ongoing status of project plan related with open-source contribution will be reflected in D6.6. During M23 the partners are providing its status, the D6.6 will be delivered in M24.

M18 - The plan related with open-source contribution is reflected in D6.5, the final version of the Dissemination and Communication plan. The section "Plan overview according to the project stages" provides an overview of the initial plan expected to follow.

M23 - The ongoing status of project plan related with open-source contribution will be reflected in D6.6. During M23 the partners are providing its status, the D6.6 will be delivered in M24.

M39- Deliverables of WP6.

Milestone # 1	**M24**	Initial Planning
Milestone # 2	**M36**	Final Contribution
Risk		No risk is expected
Evaluation		1

Results

The DataPorts project is actively collaborating with several initiatives. The results of this are explicitly provided in the final reports of the WP6 (communication, dissemination, clustering and scaling-up). As an overview the project is involved in the following initiatives:

- Smart Data Models and Fiware Foundation: Contribution to the Smart Data Models initiative. Components fully compatible with the Fiware Ecosystem.
- EUHubs4Data: Collaborate with Data Innovation Hubs to have greater impact and enable the platform to participate in a broader data federation.
- OpenJS Foundation: Via the Node-RED contribution of DataPorts project.
- IDSA: DataPorts is in the Data Space radar[3] as a committed cross-domain use case. DataPorts has defined an architecture aligned with the IDS based principles.
- Big Data Value Association: Participation in books, and publications periodically.
- Data Spaces Support Centre: ensuring handover of knowledge as a project related with supporting the emergence of data markets and the data economy. DataPorts participated in a survey[4] aimed to assess the work done on dataspaces by the ICT-13 and DT-ICT-05 projects.
- AIOTI: Participation in several AIOTI Working Groups related with IoT. DataPorts has contributed to the report of IoT and Edge Computing EU funded projects landscape[5].
- ALICE: DataPorts Is part of the running projects liaised with ALICE[6].

Finally, the DataPorts Data Model is focused on the integration of concepts from existing ontologies and data models, like, Fiware Smart Data Model, the UN/CEFACT Transport & Logistics, DCSA standards, the SAREF ontology and the IDSA Information Model.

Furthermore, at the beginning of the project, a member of the consortium was part of UN/CEFACT and DCSA to push concepts that DataPorts project has contribute to develop.

[3] https://internationaldataspaces.org/adopt/data-space-radar/

[4]https://forms.office.com/pages/responsepage.aspx?id=krXWaAhQtUObBCO-xOhs96PcEs_liJxPk4Fo8c3NfTZUNzlaRkNXRTQ1SDBWTE40OUw0WVNXUUdFQy4u

[5]https://aioti.eu/wp-content/uploads/2023/01/AIOTI-Report-EU-funded-research-projects-landscape-IoT-Edge-Final.pdf

[6] https://www.etp-logistics.eu/liaised-projects/

ID	Type	Category	Source	Priority	Associated Tasks
I.6.2.2	Non-Functional	Compatibility	End-Users	SHOULD	WP2 T2.3
Title		Improved synchro-modality in multi-modal terminals			
Assigned Partner		UPV / NTTD			
Description					
A data-oriented ecosystem should be created around shipping ports. Therefore, access is an important penetration factor and APIs and any other form of connectivity with other platforms is a necessity and should be feasible.					
Execution Plan					
The concept of Synchro-modality is effectively an evolution of a multimodal supply chain. It integrates different transport modes and gives shippers and logistics service providers the freedom to deploy different modes of transportation in the same chain and in a flexible way to gain the desired outcome according to their priorities. This will apply to the project in the data access and data processing services of the Platform, ensuring a secure way for the client to access and verify the data. The platform has been designed (WP2), developed (WP3, WP4), and then deployed and validated in the ports (WP5). It provides to seaports a secure environment where data coming from heterogeneous data sources can be shared by the stakeholders in a trusted and reliable way, to get real value from those data, providing a set of novel AI and cognitive tools to the port community.					

Milestone # 1	M24	Evaluate Progress – Propose execution plan.
Milestone # 2	M36	Final Contribution
Risk		No risk is estimated yet
Evaluation		3
Results		

The results can be reflected in D5.4 for the Valencia Port Scenarios, in which the entire platform is used as a hub for tracking events generated by the Port's agents. In D3.1 for the Data Access agents it is explained how different data sources share data between one another, which is essential to synchro-modality as no data can be exchanged otherwise. D3.5 also covers data access via the Semantic Interoperability and Data Abstraction and Virtualization components and furthermore D3.6 goes over data analytics in order to optimise seaport's business processes, a great step forward for syncro-modality.

The access to the DataPorts building blocks has been secured thoroughly across the four biggest access points in the platform, ensuring connectivity among all components. The four main ways this has been achieved are using:

- Using the existing agents or with the creation of additional ones: while developing the platform multiple agents were created in conjunction with the other components, allowing users and other agents to send information to one another and granting connectivity.
- Through the existing API's, using the KrakenD component as a gateway among components to control access and increase security in the platform. To authenticate the user the software Keycloak is used, receiving a token previously obtained from keycloak to validate every access through the gateway. This way if the user is authenticated and has the correct permissions it can send data to other endpoints across the platform or receive it in the same way.
- Through the existing UI facilitating the use of the platform to the users.

The Data Governance component enabling the sharing of datasets, monitoring its complete availability lifecycle, from dataset registration to access requests to its updating or removal from data governance. Functionalities developed in the platform are explicitly focused on improving the penetration factor in the shipping ports sector solving the needs of the potential users, for example:

- The results of the data processing services focused on offering mechanisms, enablers, data models and interfaces to facilitate the Common Access and Management of the different Data Sources integrated in the DataPorts Platform. They are focused on guaranteeing the access to the digital infrastructures of the port. The components allow the connection of heterogeneous Data Sources, offering a System of systems and port environment focused Data Models. This is reflected in a framework and API to describe and provide ports data together with mappings to standard vocabularies to simplify the reuse of data by other applications and components.
- Facilitation of the creation of Ports Cognitive Services, management of the existing Cognitive Services, analysis of model predictions and providing decision making based on models results. This solution aims to reduce the effort in creating cognitive services by non-AI experts.
- The fostering of secure intra-organisational cooperation is achieved through dataset sharing using the Data Governance component.

ID	Type	Category	Source	Priority	Associated Tasks
I.6.2.3	Non-Functional	Scalability	Internal Technical Analysts	SHOULD	WP2 / T2.3
Title		The solution concept shall ensure scalability to be able to be adopted in similar contexts where passengers traffic is very high during specific seasons			
Assigned Partner		ICCS			
Description					
DataPorts platform should leverage the ports transportation as well as passengers' capacity. In order this goal to be achieved the platform should be designed and developed in a scalable manner. Developing a flexible and scalable architecture for data-driven platform may be a significant challenge. Public and private organizations around the shipping port community want to be able to grow their customer base and increase their benefits with a minimum effort. Therefore, achieving a scalable data-platform to be able to support multiple end-users and services should be considered. Passenger oriented services will lead to increase of the passengers to be served by the port and increase accordingly the number of the companies that will provide services to them, besides the local Port Authority.					
Execution Plan					
This KPI is a technical one and not totally related with Impact activities within DataPorts, hence it will be implemented within the context of WP2. The execution plan of this KPI will be defined by the completion of the platform's design (context of WP2) and will be presented on deliverable's D6.3 revisions (D6.8, M24).					

Scalability issues have been considered while designing the high-level DataPorts architecture, as well as the different functional layers that compose the platform. Generally, the architecture follows the concept of the International Data Spaces Association (IDSA) reference model. The high scalability of this model is attributable to the fact that it proposes a decentralized architecture that includes Peer-to-Peer (P2P) data exchange with redundant replicated connectors and brokers, without a central bottleneck. Regarding the data processing services layer of the platform, the selection of Kubernetes, as the containers orchestrator, ensures the scalability of the virtual data repository where all the cleaned data are stored. Concerning the analytics services layer, the distributed training approach, using Dask framework and a cloud infrastructure, enables performance at scale for the most common Machine Learning (ML) frameworks.		
Milestone # 1	M24	Definition of Execution Plan and set up a new Milestones
Risk		No risk is estimated yet
Evaluation		3
Results		

The experiments, whose results are depicted in Figure 10, aim at validating the scalability of the Virtual Data Repository (which is actually the data lake of the DataPorts platform) against big data scenarios. In a nutshell, the results prove that VDR is indeed capable of properly handling large datasets in terms of reducing both the CPU utilization and the response time of the platform. Regarding the scalability of the virtual data repository using Kubernetes, a proposed framework has been implemented and published, named "SCAL-E", which is solution to the issue of optimal load balancing in bigdata streams, by presenting a smart auto scaling agent (by whom the proposal took its name from - "SCAL-E")[7]. The architecture is based (on) and tested in Kubernetes, in a classic structure of master and worker nodes, along with a MongoDB sharded cluster deployment. SCAL-E proved to be an efficient choice for balancing the computational resources in (incoming) big dataset scenarios. With SCAL-E's final goal being to host all incoming data in a temporary data pool, the Virtual Data Repository, this agent proved itself as a worthy software tool. The functionality of SCAL-E is dual and consists of upscaling or down-scaling the sharded cluster. These events are triggered by SCAL-E if specific CPU utilization thresholds are met.

The system got evaluated across two main points: resource allocation and response time. In terms of resource allocation, a baseline cluster architecture (without SCAL-E) utilizes 65%-100% of the CPU capacity of the initial two nodes, while the CPU utilization of the system with the SCAL-E agent deployed ranges from 50%-65%. In terms of the system's response time, results are evident in Figure 10. The blue line corresponds to the response time of the baseline model, whilst the orange line represents the system when SCAL-E is deployed. This visualization approach enables the detection not only of the faster response times the system can offer contrasted to the baseline model, but also of the greater number of requests the system can serve because of an overall performance increase at the same amount of time. It also worth noting that the specific points in time when an up-scaling event took place can be pinpointed by the noticeable decrease in response times of the automatic scaling system. The SCAL-E agent, namely, decreases the response time of the system by 8% in the scenario of the two users and by 24% in the scenario of the three users.

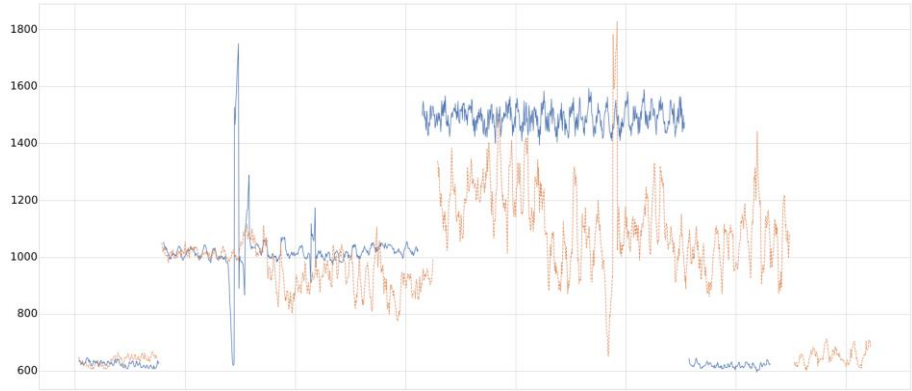


Figure 10 Response time for the baseline (blue) and automatic (orange) model

To sum up, SCAL-E proved to successfully provide an automatic way of scaling in and out the MongoDB sharded cluster according to incoming workload. By up-scaling the database resources, more available nodes are utilized in return of maintaining a response threshold, while the number of requesting users increases.

ID	Type	Category	Source	Priority	Associated Tasks
I.6.2.4	Non-Functional	Performance Efficiency	End-Users	SHOULD	WP2 / T5.2
Title		20% increase in the container reuse rate in the Valencia port			

[7] DOI: 10.1109/CITS55221.2022.9832990

Assigned Partner		TRX /VPF
Description		
Mobility data with approaching to port assistance, along with routing optimization will improve cargo and container transport operations. This will result to a reduction of unnecessary container transfers, to more secured operations, and on the other hand will improve the efficiency of operations, increase the cost cutting and increase revenues. Moreover, performance efficiency in the operations will lead to increase of socio-economic impact to the local community (region, commercial associations, etc.) and offer additional monetization opportunities that will be brought by emerging data-driven business models.		
Execution Plan		
Smart containers enable terminal operators to verify the exact location of each container in real time, to estimate their Estimate Time of Arrival (ETA) for a given containers and plan their operations accordingly. M18 - 24 devices planned to be installed in Valencia and 16 in Thessaloniki. The intent of the project was to work with Shippers (BCO or FF) to have these devices installed and containers shipped but no partner was found to manage these shipments and the evaluation. M32 – Devices installed with the participation of Maersk Sealand (Asset Owner) instead.		
Milestone # 1	M18	Equip containers with IoT devices – Moved to M24
Milestone # 2	M24	Sign a contract with Asset Owners that are willing to share the data.
Milestone # 3	M36	Port of Valencia will compare the use rate of the smart containers versus regular ones
Risk		Ability to find an asset owner willing to share data with the ports. Risk not to have enough relevant data points to compute the KPI. The use case may not happen straight away for actual production use due to the devices data being owned by Asset Owner (most often Shipping Lines). Hence, specific contracts will have to be discussed with, obviously, a cost for the port. The value can be weighted by the port by M36.
Evaluation		1
Results		
The real-time availability of data will eventually increase the reuse of container. Although in the pilot we are using real data, it is only for demonstration and evaluation purposes on a limited sample of devices, so we have not been able to measure which could be the real increase. In addition, without a commercialisation of the services related to the Smart Container, it will be difficult to evaluate this KPI. It is also important to consider the time to market factor. The massification of the container digitalisation was hardly affected by the pandemic and Shipping lines are just initiating this massification phase. Within the scope and the duration of the project, we have been able to evaluate that, in ports with a low level of automation and digitization, we would need to have almost all containers equipped with tracking devices to allow a local fleet management to improve container reuse rate. In this case, pilot participants feel we could reach the 20% increase, but it requires a sizeable deployment of devices on containers going through the ports, and a real commercialisation of the smart container services. We could imagine installing devices when containers enter the port and remove them at gate out or vessel loading but, in addition to the operational hassle, such temporary devices not requiring the container doors to be open do not exist in Traxens portfolio. In ports with a high level of automation and digitization, container tracking through reach-stackers and crane OCR can already allow most of the benefits of what smart containers could bring to local fleet management.		

ID	Type	Category	Source	Priority	Associated Tasks
I.6.2.5	Non-Functional	Performance Efficiency	End-Users	SHOULD	WP2 / T5.2
Title		10% reduction in the number of containers not loaded due to delays in the Valencia port			
Assigned Partner		TRX /VPF			

Description		
Similar as I.6.2.4		
Execution Plan		
Smart containers enable terminal operators to verify the exact location of each container in real time, to estimate their time of arrivals (ETA) for a given container and plan their operations accordingly		
M18 - 24 devices planned to be installed in Valencia and 16 in Thessaloniki. The intent of the project was to work with Shippers (BCO or FF) to have these devices installed and containers shipped but no partner was found to manage these shipments and the evaluation. M32 – Devices installed with the participation of Maersk Sealand (Asset Owner) instead		
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Evaluation		1
Results		
The same considerations as for the I.6.2.4 apply here: it is difficult to obtain a real benefit and to be able to measure it given the low rate of digitalised containers.		

2.2.3 WP3 Impact KPIs

The following KPIs are related with the functionality of the data platform. A fully functional data platform will lead to an adoption by many users. It should offer a well governed data products and services, with an easy access and delivery mechanisms. Within the offered benefits lies their abilities to give end-users a cohesive view of data from multiple sources and make data available to those users with proper permissions. A more analytical description of WP3 related KPIs can be found in D6.3 (M12) deliverable.

ID	Type	Category	Source	Priority	Associated Tasks
I.6.3.1	Non-Functional	Functionality	End-Users	MUST	WP3 T3.4 / WP5
Title		The newly introduced data services must exhibit less development effort by 50%			
Assigned Partner		UPV / ITI			
Description					
This KPI is intended to measure the improvement of development effort of new services using DataPorts platform. The KPI is focused on the improvement of services provided by the seaports to share data following a cognitive approach, including AI and big data analytics. We expect using DataPorts platform it will be possible for a company to offer new data services to their customers with 50% less development effort.					
Execution Plan					
We will establish as baseline an expert estimation of the development time of a specific service, using its current development approach. We will define several tasks to be accomplish according to the requirements specification from the pilots. Then we will compare the development using the DataPorts platform.					

M12 - Some development efforts estimation analysed and presented. Pending to take a common decision in order to select a methodology for the project. The final decision and the methodology will be ready before the next milestone.
M18- This KPI will be implemented, considered the demonstrations (July), to get a first draft of the initial estimations. But the real KPI monitoring will take place during use cases.
M23- Periodical WP5 meetings oriented to deploy WP3 solution in the Use Cases. This will be measured starting on M25.
M30 – Measurement of the development effort of the new services.

Milestone # 1	**M12**	Select and define a development effort estimation approach.
Milestone # 2	**M18**	Analyse and measure the initial development effort
Milestone # 3	**M30**	Measure the development effort of the new introduced data services and the % of improvement
Risk		The easiness of Data Consumers to access the platform
Evaluation		3
Results		

There are multiple aspects in the platform that can be used to reduce effort in the development of new services based on the DataPorts platform. Some of these are:

- Interoperability plays a huge part in this since it means big portions of the base code can be easily reused. It also allows the multiple agents to communicate between one another and easily work in conjunction, meaning the developer does not need that much time worrying about how the components communicate among themselves. The platform provides a common API to access the data from the different data sources, as well as a common data model to represent the data. In addition, the Data Access component provides an SDK to ease the development of the agents and reduce the effort associated to the connexion of new data sources to the platform.
- AI knowledge abstraction allows a developer inexperienced in AI to have an easier time creating new services based on the platform. In this sense, the Automatic Model Training Engine allows the creation of predictive services in an easy and intuitive way.

The following results highlight the improvement of development effort of new services using DataPorts platform:

- The development of new agents since the beginning of the project until the end shows the following progress in the time needed to develop new ones:
    - On average, 60% of the code is reused from one agent to another, especially the methods used to send notifications to the DAC's API, send data to Orion and to Cygnus.
    - There are multiple examples on how to do the data mapping to create entities from input data[8], reducing development times significantly. The time reduction depends on how many data fields need to be mapped, but the problem is reduced to replicate lines of code and change the name of the property in which to store the data.
    - Agent configuration variables have been consolidated in an external script (constants.py), which only requires defining environment variables used by the agent.
    - Agent containerization has also been improved to provide multiple examples and fit different use cases (e.g., regular agent with no configuration, agent with parameters set via env variables, agents with special needs such as an exposed TCP port, etc). These examples only require updating the LABELS defined and used by the DAC.
    - On average, if a new agent like a running one needs to be developed, the development time can be reduced to up to 2 hours. The development from scratch (without template and/or examples) would take at least 3 days.
- The **development effort of a new Cognitive Service** without the use of Dataports' platform is estimated to roughly take several days assuming that the user masters the data to be used, whereas by using Dataports' platform it may take from seconds to hours, depending on the training complexity.

Development platform1	Development effort of 1 technical user	Improvement
Without Dataports	Several days (*)	> 50%
With Dataports	From seconds to hours (**)	

(*) It is based on the estimation of the development time required by an expert in Machine Learning
(**) It strictly depends on the type of Cognitive Service and the training strategy desired.

- As an example, the training of a specific **new Cognitive Service utilizing Dataports** (Figure 11) platform with a "Standard" training strategy, took **58 minutes 26 seconds**, as evidenced in the picture below, which represents the detailed info of the cognitive service trained. Circled in red, the total training time of the service can be observed:

[8] https://pypi.org/project/pyngsi/

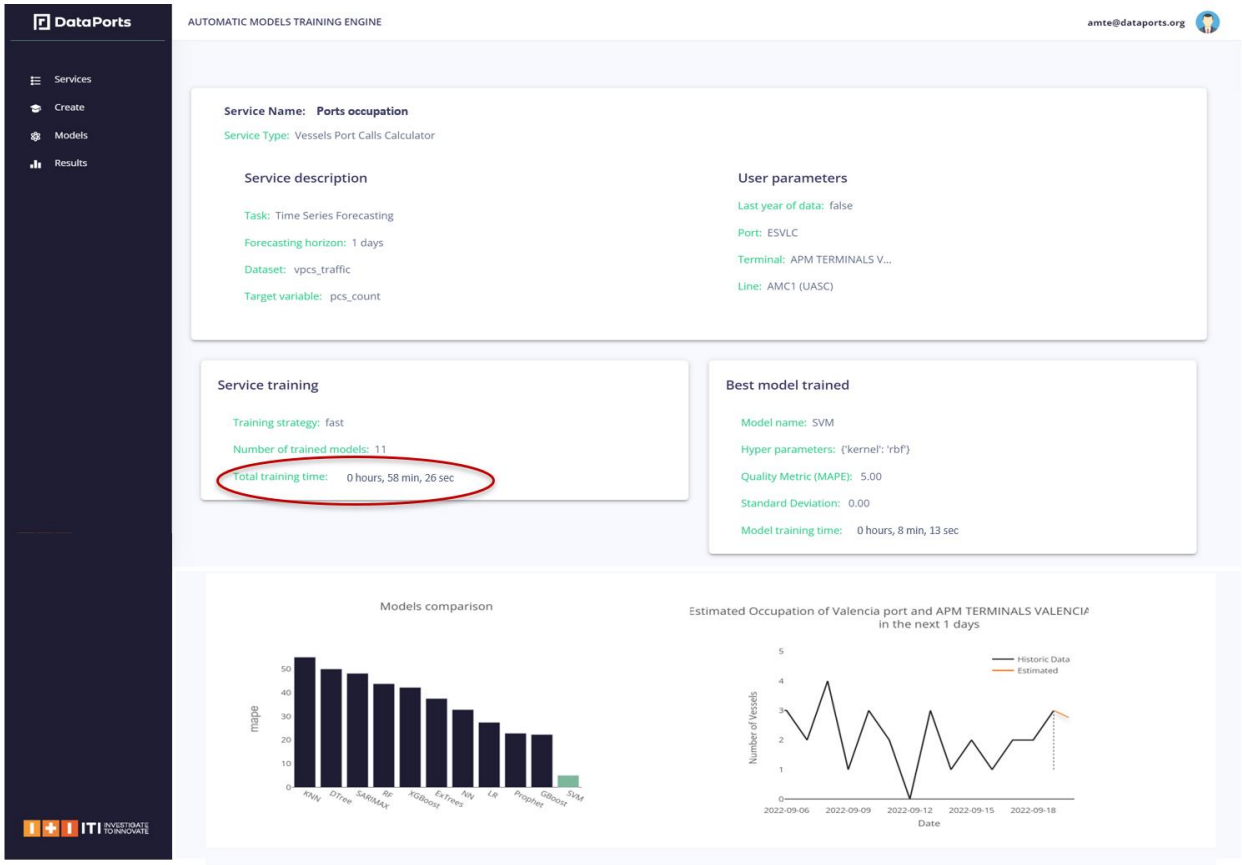


Figure 11 Result of training a Cognitive Service using Dataports

ID	Type	Category	Source	Priority	Associated Tasks
I.6.3.2	Non-Functional	Functionality	End-Users	MUST	WP3 T3.1 / WP5
Title		The newly introduced data/cognitive services will use at least a 20% of the data volume available for the pilot			
Assigned Partner		UPV / PRO			
Description					
This KPI is intended to measure the volume of data used in an effective way of during the project. An aim of DataPorts platform is to increase the value of the data and their aggregated, collaborative usage having thus a further impact on the way that port is relying their business on the data economy. The platform should make efficient use of data in order to achieve a certain degree of effectiveness. A more realistic estimation is that using the newly introduced data/cognitive services will use at least a 20% of the data volume available for the pilot.					
Execution Plan					
We are going to measure the evolution of % of data volumes that are being used by the Big Data and AI services. This KPI needs to be measured during the pilots' execution. **M12-** Ongoing- Analysed some possible ways to monitor this information in the data model and first meeting done to reach a common agreement in the data model definition and this metadata fields. The final decision and the metadata fields will be ready before the next milestone. **M18-** This KPI will be taken considered the demonstrations (July), to get a first draft of the initial estimations. But the real KPI monitoring will take place during use cases. **M23-** Periodical WP5 meetings oriented to decide which data sources and agents are needed to cover the scenarios of the use cases and be aware about which data volumes are needed to be measured. **M30-** Final measure of the data volumes used by analytics services in the pilots.					

Milestone # 1	**M12**	Define a metadata or some log information to measure the data volumes.
Milestone # 2	**M18**	Take the information from the first running instances with data and measure the increase in data volumes.
Milestone # 3	**M30**	Take the information from use cases deployment and measure the increase in data volumes.
Risk		The willingness of Data Providers to share data
Evaluation		3
Results		

The agents on-demand are collecting big amount of historical data from heterogeneous data sources located in the pilot ports. These data translated to the common data model of DataPorts are filtered and pre-processed by the Data Abstraction and Virtualization component. Finally, this data is used by the cognitive services of the platform and the end-user applications of the project. For that reason, the result of the KPI is focused on the measure which volume of the data source information is effectively used by these cognitive services in contrast with the initial volume of data: Based in the results of the pilot applications, more than 20% of the data volume available for the pilot is used by cognitive services.

There are 3 different data sets available for the Valencia Pilot:

1) Vessels Port Calls – Traffic of the port of Valencia – VPCS traffic
2) Spanish Tax Agency - AEAT
3) Vessels Port Calls – Traceability of the port of Valencia – VPCS traceability

There was implemented a collection of 6 distinct Cognitive Service types, as shown in the table below, each of them utilizing a different data set available in Dataports platform. Consequently**, 100% of the data available is utilized** by the whole set of Cognitive Services.

Cognitive Service Type	Dataset used
Vessel Time of Departure Estimator	(1)
Vessels Port Calls Calculator	(1)
Average Vessel Berth Time	(1)
Customs Trade Volume	(2)
Missing Origin/Destination Identification	(3)
Container Goods Volume	(3)

As illustration, the following screenshot shows the available datasets in Dataports' platform for an end user to train a cognitive service.

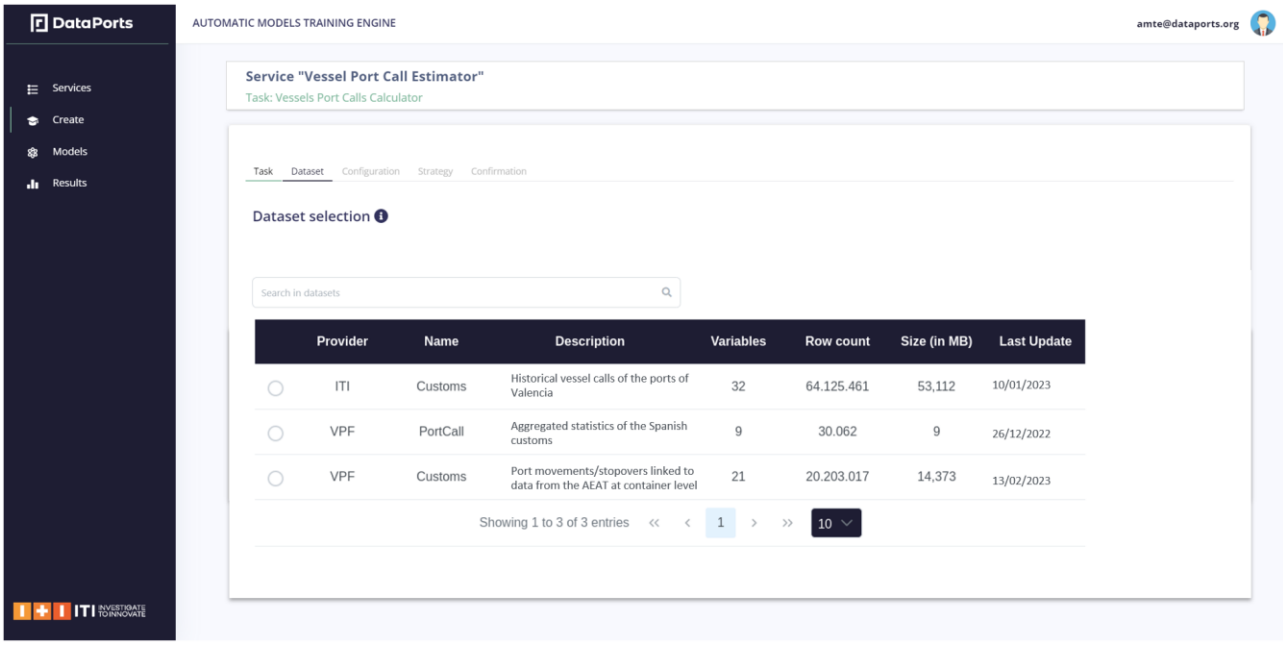


Figure 12 Dataset selection to train a cognitive service

ID	Type	Category	Source	Priority	Associated Tasks
I.6.3.3	Non-Functional	Functionality / Compatibility	End-Users	MUST	WP3 T3.4 / WP5
Title		Increase of the portfolio of services and data driven business models concerning the port management integration			
Assigned Partner		UPV / ITI / UDE			
Description					
The main outcome from DataPorts project is a platform for a secure and trusted sharing, trading, and brokerage of data, on top of which novel AI and data driven applications could be developed to improve existing processes and discover new business models in the seaport's environment and the logistics value chains in general. For that reason, the aim of this KPI is to measure the portfolio of services and data driven business models.					
Execution Plan					
This KPI is related with the services designed and developed in Task 3.4. It considers the number of a set of data analytics services for supporting the development of descriptive / predictive / prescriptive models using the different sets of data available at the DataPorts platform. This KPI can be monitored during the evolution of said task and the pilots. The increase will be measured considering the existing services before starting the project and those deployed once it is finished. **M18-** The status of this KPI is reflected in D3.3. In addition, it was presented in the project demonstrations of M20 (review of the project). **M23-** Ongoing meetings between T3.4 partners and Use Cases partners to decide the services that will be deployed. **M30** – Obtain the number of services developed at the end of the project.					
Milestone # 1	**M18**	Obtain a first estimation of the services that will be developed in T3.4.			
Milestone # 2	**M30**	Obtain the number of services developed at the end of the project			
Risk		The easiness of Data Consumers to access the platform Overall Evaluation:			
Evaluation		3			
Results					

By month 36, a set of 6 different cognitive services have been implemented in AMTE (Automatic Model Training Engine) component. Each of the cognitive services addresses a specific real business need of the seaport's environment. To obtain the best results out of the data available in the Dataports platform, AMTE trains multiple machine learning algorithms to find the model which is capable of outcoming the most precise insights for each service. The Figure 13 below, shows the collection of the implemented cognitive services enabled to the end-user throughout the AMTE's front-end.

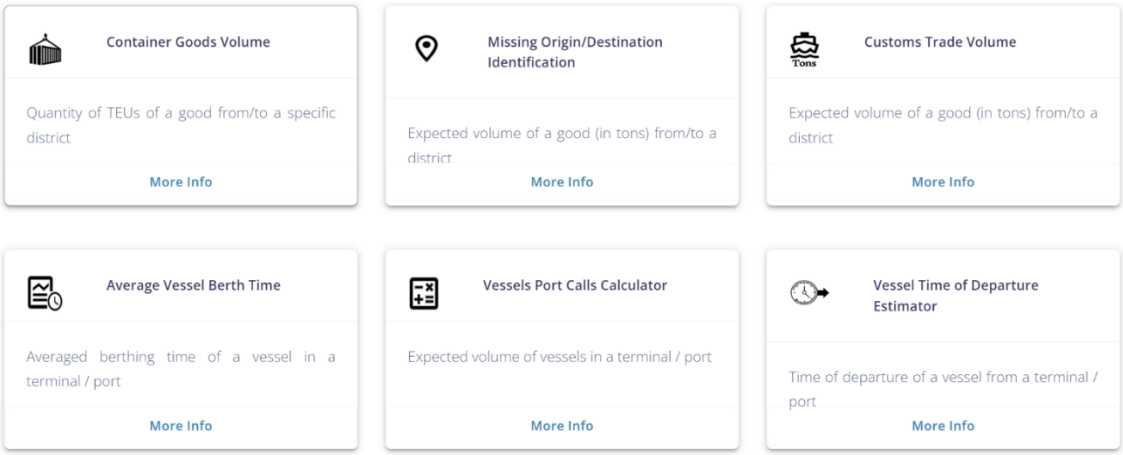


Figure 13 collection of the implemented cognitive services

The detailed explanation of each cognitive service is described as follows:

- Vessel Time of Departure Estimator (VTDE). This service estimates the date and time of departure of an arriving vessel.
- Vessels Port Calls Calculator (VPCC). Service that calculates the amount of port calls that will be expected to occur in a specific port/terminal for a determined time horizon selected by the user.
- Average Vessel Berth Time (AVBT). This service calculates the averaged berth time of a potential vessel docked in a port/terminal for a determined temporal horizon.
- Customs Trade Volume (CTV). Estimation of the volume of a certain type of good (in tons) from/to a specific district in a certain time horizon, in months.
- Missing Origin/Destination Identification (MODI). Prediction of an unknown district in the historical data of the dataset "port traceability (hinterland)" from ValenciaPort.
- Container Goods Volume (CGV): Estimation of the quantity of TEUS of a certain type of good from/to a specific district in a certain time horizon specified by the user.

ID	Type	Category	Source	Priority	Associated Tasks
I.6.3.4	Non-Functional	Functionality	End-Users	MUST	WP3
Title		Number of agent templates provided by the Data Access SDK			
Assigned Partner		UPV / PRO			
Description					
The data access framework will reduce the development effort and complexity of the software connectors that guarantee the transmission of the raw data from the Data Sources to Semantic Broker using their own native protocols (agents) created to access to the data sources. The templates (i.e., a predefined piece of code used to implement some functionalities of the agents) provide a clear development guide for the most common data sources. The data source integrators (Pilots' Technical Partners) do not need to develop anything from scratch. They only need to focus on the logical part of their data. This KPI aim is to measure the number of types of heterogeneous data sources that can be easily connected to the platform and, for that reason, reduce in a considerable way the development effort in connect a new data source to the platform.					

Execution Plan		
The number of agent templates generated and provided to integrators during the project will give us a reliable estimation of pre-set software components provided to connect the heterogeneous data sources to DataPorts platform. Milestone #1 analyses the heterogeneous data sources to estimate an expected number of templates provided during the project. Milestone #2 will count the number of different templates provided in the data access layer. At this point, the Task related to the Data Access SDK ends. Milestone #3 in the pilots will probably generate new templates, therefore a new indicator will be reported on this date. **M12-** Finished- Internal Meeting with PRO (T3.1 and WP6 leader) and UPV (WP3 leader) where we have identified the kind of agents needed from a technical point of view and the expected templates. Documented in architecture draft (D2.4). **M18-** Proof of concept agents developed to demonstration and integration issues. The templates are related with Publish/Subscribe Agents (to access to APIs, Excel files, MQTT listener and API listener) and On Demand Agents (to access to APIs and local text files). In total six complete templates are available in M18. **M23-** Periodical WP5 meetings oriented to decide which data sources and agents are needed to cover the scenarios of the use cases. M30 – Obtain the number of templates developed at the end of the project.		
Milestone # 1	**M12**	Estimate the number of templates needed in the project based on available or interesting data sources.
Milestone # 2	**M18**	Obtain the number of templates developed once the data access component has been completed.
Milestone # 3	**M30**	Obtain the number of templates developed at the end of the project.
Risk		The willingness of Data Providers to share data
Evaluation		3
Results		

At month 36, **8 different agent templates** have been added to the DAC to support all the use cases required by the two pilots (VPF and ThPA). Figure 14 shows a screenshot from the DAC's user interface wizard to download these templates. The wizard consists of 4 steps that gathers all the required data to tailor the template to a specific deployment.

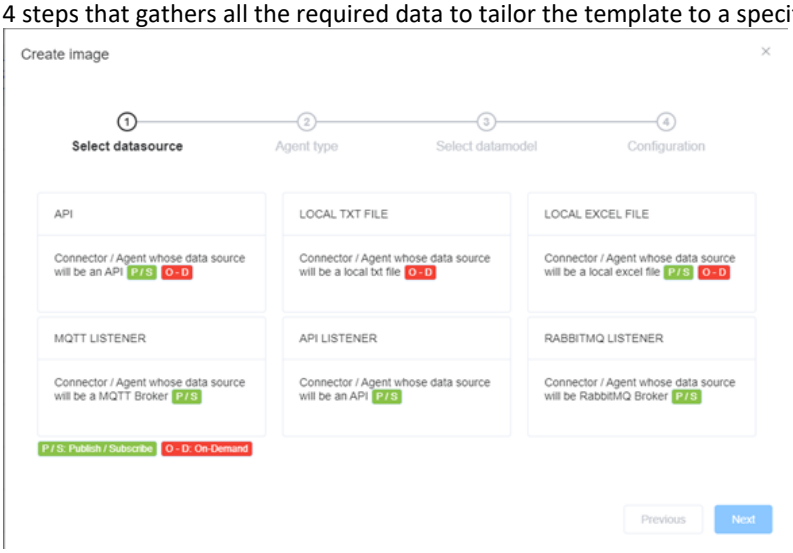


Figure 14 DAC's user interface

These tailored templates contain the mapping of the data source to the DataPorts model, but require special features (e.g., security and/or authentication) to be added by the agent developer before it can be deployed to the DataPorts platform.

The different types of agent templates currently available are:

- API: template for agents that import data from an API endpoint in a unique operation. After that information is retrieved, the agent execution finishes.
- Local txt file and excel file: templates for agents that read data from a specific file format and map the data to the defined data model. The agent runs until the file is completely imported and the stops.
- API Listener: template for agents that polls periodically a remote API to retrieve just new data since the previous invocation. The agent runs until it is explicitly stopped.
- MQTT and RabbitMQ listeners: templates for agents that subscribe to a topic and map data in real time. These agents run until they are explicitly stopped.

Some templates offer the possibility to run a publish/subscribe paradigm (they are executed automatically by the system and transform data the moment it is available) or using an on-demand paradigm (the data is requested whenever a service needs them). This is precisely what step 2 in the wizard will setup, as shown on the following screenshot:

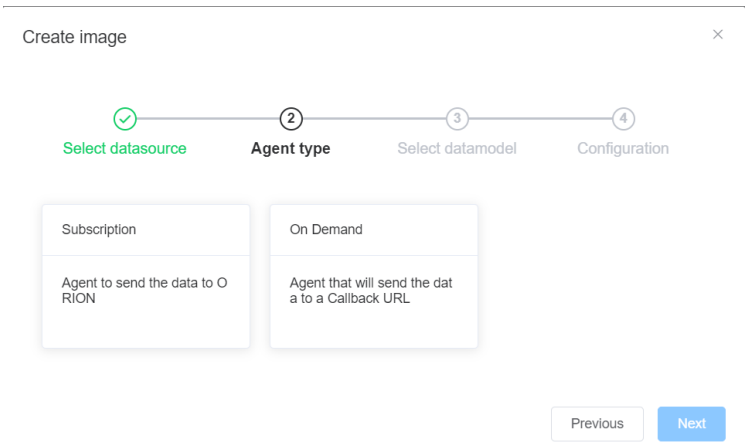


Figure 15 publish/subscribe paradigm

The third step in the wizard selects which input data model will be used to map the data from. The screenshot below shows two possible datasets:

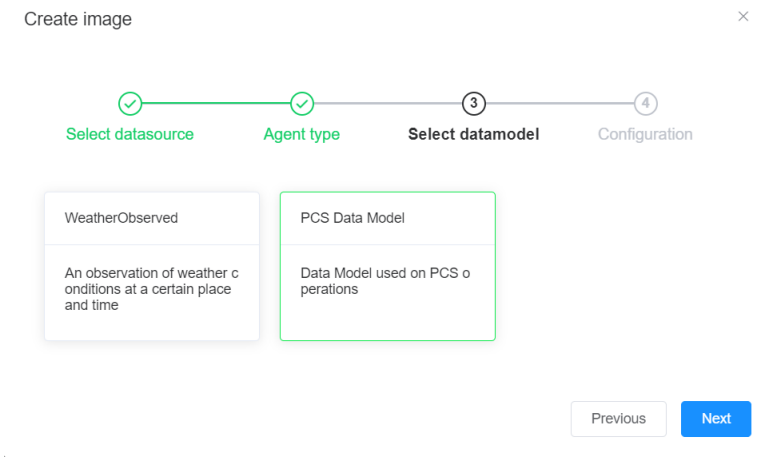


Figure 16 data model input

Finally, the 4th step in the wizard will fill in specifics in the agent setup. In the screenshot we can see an example for a publish/subscribe API agent using the PCS model, in which some mandatory fields, such as Orion's connection details and periodicity, are defined. Additionally, a list of fields in the dataset can be selected when not all of them are required (by default, all fields are mapped).

ID	Type	Category	Source	Priority	Associated Tasks
I.6.3.5	Non-Functional	Functionality	End-Users	MUST	WP3
Title		Number of Data Models integrated			
Assigned Partner		UPV			
Description					
One of the objectives of the project is to define ontologies, mechanisms, and enablers to provide semantic interoperability with data platforms and the heterogeneous other data sources. The data models used in the project need to be harmonised to enable data portability for different applications. Furthermore, standard interfaces and ontologies will be defined to allow semantic interoperability. They will be specially adapted to the logistics and freight transport sector to be used in the use cases and pilots. The aim of this KPI is to measure the impact achieved by the platform in the design of a secure interoperable system. Facilitating the exchange of data through standardized models is based on common semantics and is offering an advanced interconnection capability. This is leading to a cooperation between heterogeneous platforms.					
Execution Plan					
According to the FIWARE guidelines [2], "Data models are going to be stored in repositories. The lower-level repository is a Topic. Every topic repository is aggregated into Domain repositories. Domain repositories compile several topics. At the same time a topic could appear in several domains". We are going to provide the number of topics and data domains covered during the project. Milestone#1 generates the repository where the data models are going to be stored. Milestone#2 and Milestone#3 count the data models defined and integrated during the implementation of DataPorts Platform and during the pilot's execution. **M12-** Ongoing- Waiting for the Official DataPorts git repository. At this moment UPV is working in an internal git repository and UPV has defined the guidelines. The info will be migrated once the official repository will be available. **M18-** UPV organized biweekly meetings with all WP2, WP3 and WP5 partners to define a common Data Model. The use cases owners provide feedback about the current concepts and the data models and ontologies adopted currently in its organizations. **M23-** D2.2 is going to provide a list of the standards that are the basis of the DataPorts Data Model. The initiatives are: Fiware Smart Data Models, IDSA Information Model, United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) model, Blockchain in Transport Alliance (BiTAS), DCSA Interface for track & trace (DCSA), IPSO Smart Objects (OMA SpecWorks) and Smart Applications REFerence (SAREF) ontology. **M30** - Count the data models defined and integrated during the pilot's execution.					

Milestone # 1	**M12**	Generate the repository where the data models are going to be stored.
Milestone # 2	**M24**	Count the data models defined and integrated during the implementation of DataPorts Platform.
Milestone # 3	**M30**	Count the data models defined and integrated during the pilot's execution
Risk		The willingness of Data Providers to share data
Evaluation		3

Results

The DataPorts Data Model is available in the internal git repository of DataPorts Project (https://egitlab.iti.es/dataports/data_processing/datamodel). It contains all the Data Models defined during the project. The most relevant Data Models will be uploaded to the Open Source Github repository of the project. They will be available to everyone interested in DataPorts project mechanisms of interoperability. In addition, some Data Models that can be used for a wide community of open-source developers are aimed to be uploaded to the Smart Data Models initiative repository. Currently, the DataPorts Data Models are incubated in that location, waiting to pass the corresponding reviews to be adopted. The following picture provides an overview of the Data Models defined during the project:

Figure 17 Data Models

Specifically, at least 14 data models have currently been integrated during the development of the pilots. This integration in the pilots comes from the conversion of the data sources to the common model by the agents, the pass and use of information following the format defined by the Data Model by the functional blocks of the platform or end user applications that offers its results according to the data model. It is important to point out that some of the data models (such as TrackableEvent) are being used by several agents to send data from different data sources to the platform and that the two ports in some scenarios are using the same data model. For example, the following video describes the process performed by the agents: https://www.youtube.com/watch?v=mavzyOUphnI and the following screenshot shows an application of the Valencia Port using DataPorts data model:

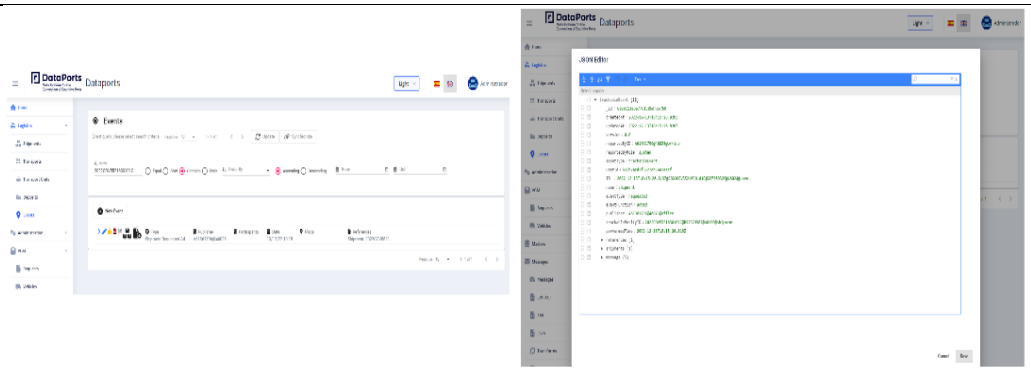


Figure 18 The Agents' Process

More details are available in the corresponding section of deliverable D5.4.

2.2.4 WP4 Impact KPIs

WP4 has the objective to define, implement and test a secure and reliable context to accommodate all data management methods and standards. Subsequently, it is integrated into the DataPorts platform. In addition, the use of blockchain is proposed in relation with smart contracts, to ensure the data exchange security mechanisms and assist DataPorts platform adoption by the seaports' ecosystem. A more analytical description of WP4 related KPIs can be found in D6.3 (M12) deliverable.

ID	Type	Category	Source	Priority	Associated Tasks
I.6.4.1	Non-Functional	Cybersecurity controls	Platform architecture	MUST	WP4 T4.1 / WP4 / WP5
Title		100% of the IT risks identified from the Security Plan obtained in D4.1 must have a security measure identified to mitigate, avoid, or transfer the risk.			
Assigned Partner		NTTD			
Description					
A Security Plan, including a Risk Assessment, is going to be developed in WP4, according to Task 4.1. Different impact scenarios will be identified, considering current threats that may affect to DataPorts assets. In this case, each risk identified may be aligned with a security measure, ensuring that the residual risk once treated is acceptable from the risk criteria acceptance defined in the project. In case that for any reason, a security measure cannot be deployed, it must be aligned with mitigated controls aiming to reduce the inherent risk value.					
Execution Plan					
This KPI is related with the services designed and developed in WPs related with architecture design. It is necessary to identify the assets (data and functions) available in the DataPorts platform, and therefore, subject to threats. This KPI must be obtained once the security plan is finished, considering all different existing scenarios. The increase will be measured considering the existing assets before starting the Security Plan and those modified once it is finished. Additional KPIs within this context might be investigated after M13. M13 - Milestone was fulfilled on time. M24 - All IT security risks have at least one security measure.					
Milestone # 1	**M13**	Initial Measurement and Evaluation (review that all security measures proposed mitigates at least one risk scenario identified)			
Milestone # 2	**M24**	All IT risks identified have been related to a security measure for mitigating them.			
Risk		Lack of matching between IT risk and security measures.			
Evaluation		3			
Results					
All the identified IT risks have been complied according to the Security Plan that is described in D4.1. It has set the System Risk Assessment for the DataPorts Platform and includes an overview of the design and system architecture.					

ID	Type	Category	Source	Priority	Associated Tasks
I.6.4.2	Non-Functional	Security	Organizational Systems	MUST	WP4 T4.3 / WP3 T3.5
Title		Blockchain will avoid the number of data transfers to unauthorized parties			
Assigned Partner		UPV / NTTD / IBM			
Description					
Blockchain for data governance will ensure that data exchange occurs only between authorized partners according to the governance rules enforced by smart contracts.					
Execution Plan					
To fulfil this KPI, specific test cases will be defined, to ensure that absolutely does not exist any data transfer to any un-authorised party. Pending the finalisation of smart-contracts and governance rules development, the necessary tests to validate the plan will be planned and defined.					
Milestone # 1	M24	Initial measurement (Review that governance rules, when testing some cases, exchange data only when necessary and authorized)			
Milestone # 2	M36	Final Measurement (Review that governance rules, when testing final defined cases, exchange data only when necessary and authorized)			
Risk		Not available digital reporting			
Evaluation		3			
Results					
Access to the data is authorized through the blockchain, reinforced with 2 levels of access to the shared data sets (organizational-level access and public-level access) as specified in D4.4 Data providers can accept or deny data access requests, revoke permissions, grant read, write, or share access directly from the blockchain-based data governance component. This mechanism ensures that access to data is only possible between users or organizations with granted permissions. In turn, the traceability of all transactions makes it possible to audit all transactions (both permit management and data consultation) carried out in the blockchain network. In turn, data consumers can make data access requests and consult the list of available data, thus allowing a tool that increases the amount of information available for sharing among participants. Deliverable D.4.4 details 2 use cases (VGM and CPU) in which information is shared between the stakeholders involved in the process through the blockchain.					

ID	Type	Category	Source	Priority	Associated Tasks
I.6.4.3	Non-Functional	Security	Organizational Systems	MUST	WP4 T4.2, T4.3 / WP3 T3.5
Title		Blockchain will avoid the number of data leakage.			
Assigned Partner		UPV / NTTD / IBM			
Description					
Blockchain ensures that data arrives only to authorized parties and gives full provenance in case of dispute.					
Execution Plan					
To fulfil this KPI, specific test cases considering the security measures deployed, will be defined to ensure that the risk of data leakage is minimized to maximum, considering that a cybersecurity risk cannot be mitigated totally. More on such risks will be described in D4.3 - Secure environment for data sharing and trading M20 that will define the methodology for sharing and trading data in the DataPortsPlatform. By M24, the plan is expected to include smart-contracts and governance rules development.					

Milestone # 1	M24	Initial measurement (Review that generated reports, when testing some cases, includes only information authorized for each third party)
Milestone # 2	M36	Final Measurement (Review that generated reports, when testing final cases, includes only information authorized for each third party)
Risk		Not available digital reporting
Evaluation		3
Results		
The execution process is like I.6.4.4. Access to the data is authorized through the blockchain, reinforced with 2 levels of access to the shared data sets (organizational-level access and public-level access) as specified in D4.4. Data providers can accept or deny data access requests, revoke permissions, grant read, write, or share access directly from the blockchain-based data governance component. This mechanism ensures that access to data is only possible between users or organizations with granted permissions. In turn, the traceability of all transactions makes it possible to audit all transactions (both permit management and data consultation) carried out in the blockchain network. In turn, data consumers can make data access requests and consult the list of available data, thus allowing a tool that increases the amount of information available for sharing among participants. Deliverable D.4.4 details 2 use cases (VGM and CPU) in which information is shared between the stakeholders involved in the process through the blockchain.		

ID	Type	Category	Source	Priority	Associated Tasks
I.6.4.4	Non-Functional	Security	Organizational Systems	MUST	WP4 T4.2, T4.3 / WP3 T3.5
Title		Blockchain will increase the amount of shared data among parties of the port business network			
Assigned Partner		UPV / NTTD / IBM			
Description					
Blockchain for shared data enables the share of data in a secured and trusted manner					
Execution Plan					
To fulfil this KPI, specific test cases considering the security measures deployed, will be defined to ensure that shared data among different parties is securely transmitted and processed, considering different milestones and therefore, platform status. Same as in I.6.4.3, the same execution process will be followed, and results will be reported on WP4 related deliverables.					
Milestone # 1	M24	Initial measurement (Review that generated reports, when testing some cases, includes secured information and therefore, the sharing of information is secured and trusted)			
Milestone # 2	M36	Final Measurement (Review that generated reports, when testing final cases, includes secured information and therefore, the sharing of information is secured and trusted)			
Risk		Not available digital reporting			
Evaluation		3			
Results					

All Blockchain related Impact KPIs followed the same execution approach, and their results are presented in WP4 deliverables, associated with pilot use cases. Access to the data is authorized through the blockchain, reinforced with 2 levels of access to the shared data sets (organizational-level access and public-level access) as specified in D4.4 Data providers can accept or deny data access requests, revoke permissions, grant read, write, or share access directly from the blockchain-based data governance component. This mechanism ensures that access to data is only possible between users or organizations with granted permissions. In turn, the traceability of all transactions makes it possible to audit all transactions (both permit management and data consultation) carried out in the blockchain network. In turn, data consumers can make data access requests and consult the list of available data, thus allowing a tool that increases the amount of information available for sharing among participants. Deliverable D.4.4 details 2 use cases (VGM and CPU) in which information is shared between the stakeholders involved in the process through the blockchain.

2.2.5 WP5 Impact KPIs

This category contains Impact KPIs related to the demonstration and the benefits of the proposed data-driven platform through Valencia and Thessaloniki port pilots and the global use case. A more analytical description of WP5 related KPIs can be found in D6.3 (M12) deliverable.

2.2.5.1 ThPA Pilot KPIs

The KPIs for ThPA S.A. were set at the beginning of the project, having in mind crucial milestones of its implementation. Their threshold (to the ones that applies) were set by the end of 2020, while the first evaluation took place in the end of 2021 and the final one at the end of 2022, year of project's completion.

ID	Type	Category	Source	Priority	Associated Tasks
I.6.5. T.1	Non-Functional	Compliance	End-Users	MUST	WP5 T5.3
Title		20% decrease in the CO2 emissions at the gates of the Thessaloniki port			
Assigned Partner		ThPA			
Description					
The data provisioning by internal and external data providers should be focused on improving the environmental footprint of the shipping ports in local communities. Data-driven AI-based services should provide solutions towards the compliance of reduction of environmental impact.					
Execution Plan					
Calculation method: For the calculation of CO2 emissions from trucks there are several models available considering various parameters. One of the main to be considered is the emissions when the truck is idle (loaded/empty). These references will be reviewed and the CO2 emissions of trucks at gates without DataPorts will be calculated and compared with new values using DataPorts. The model that was to be used is not properly functioning. The methodology for the calculation will be done combining the time spend at the gate and idling data (per type of truck/engine) through references/bibliography. Data will be used as a baseline, so as to be compared with final results.					
Milestone # 1	**M24**	Initial Measurement - The model to be used will be defined. The current values will be also available			
Milestone # 2	**M36**	Final Measurement - The final calculation will take place at the end of demonstration period. The values with DataPorts will be collected.			
Risk		The target value might be lower			
Evaluation		Removed			
Results					

ThPA considered this indicator could be achieved with the use of an outcome of an air pollution model that was to be set in place in 2021, as a deliverable of another EU funded project. However, it was soon realized that the model was not properly functioning and was decided not to be used. One of the main issues was that the relevant pollutants could only be correlated with the Terminal's operations and not Gate's operations specifically, which was the original case in DataPorts. The following figure presents an export of the model.

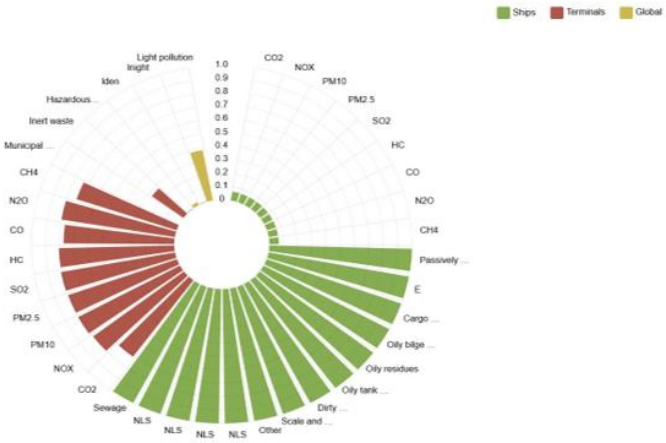


Figure 19 Export Model

Other ways were explored while the duration of the project, however it was decided that the complexity of an air pollution model that could corelate CO2 at the gate of the port with actual entries/exits of trucks and required accuracy could not be achieved. Ways to obtain the required results, such as subcontracting the task to a company with relevant expertise and equipment, to make actual measurements on a 24h basis, were rejected, as they incurred extra costs to the resources already allocated for the DataPorts project. Thus, this KPI was underscored since the previous evaluation as not obtainable.

ID	Type	Category	Source	Priority	Associated Tasks
I.6.5. T.2	Non-Functional	Compliance	End-Users	MUST	WP5 T5.3
Title		Updated: 15-20% decrease of trucks service time			
Assigned Partner		PRO / ThPA			
Description					
The DataPorts platform will support the optimization of Truck Appointment System (TAS) by better exploiting the available slots and reducing the waiting time to be served. Relevant information will be available to authorized and interested parties for better organization of their own resources.					
Execution Plan					
Calculation method: The availability of slots (per specific time periods) and the waiting time of the truck at gates will be collected by TAS. The corresponding values will be calculated without DataPorts (as is value) and compared with the new one using DataPorts. Current values are collected to be used as a baseline, to be compared with results.					
Milestone # 1	**M24**	Initial Measurement - The current values will be collected i.e., usability of gates (based on slots) and waiting times			
Milestone # 2	**M36**	Final Measurement- The final calculation will take place at the end of demonstration period. The values with DataPorts will be collected.			
Risk		The target value might be lower			

Evaluation	3

Results

Truck service time is recorded daily both for the Container Terminal Gate, as well as Gate 16, where trucks enter the port's premises. For the truck service time, the difference of the time of entry and exit of trucks from the Container Terminal Gate is used. The difference of the time of entry and exit of Gate 16 however, was not considered, since several cases were recorded, when the driver had not booked an appointment in advance (TAS), before entering the port premises. In fact, Gate 16 data proved that the time that the trucks enter the port and park in its premises, after extracting the actual time within the Terminal, reached - at cases - approximately 2 hours. On the other hand, data of the Container Terminal Gate, give a more accurate picture of operations, providing the truck's service time and turnaround. Comparing the average time that a truck is serviced in 2021 to 2022 monthly and using the overall average, the total improvement is 21%. DataPorts contributed by providing to Gate and Terminal employees access to unified data regarding a truck entry, thus reducing the time of control checks at the gate or unjustified entries that cause delays. The respective Gate employee, other than the booking of an appointment, can now reassure that the appointment corresponds to an approved entry by the Terminal.

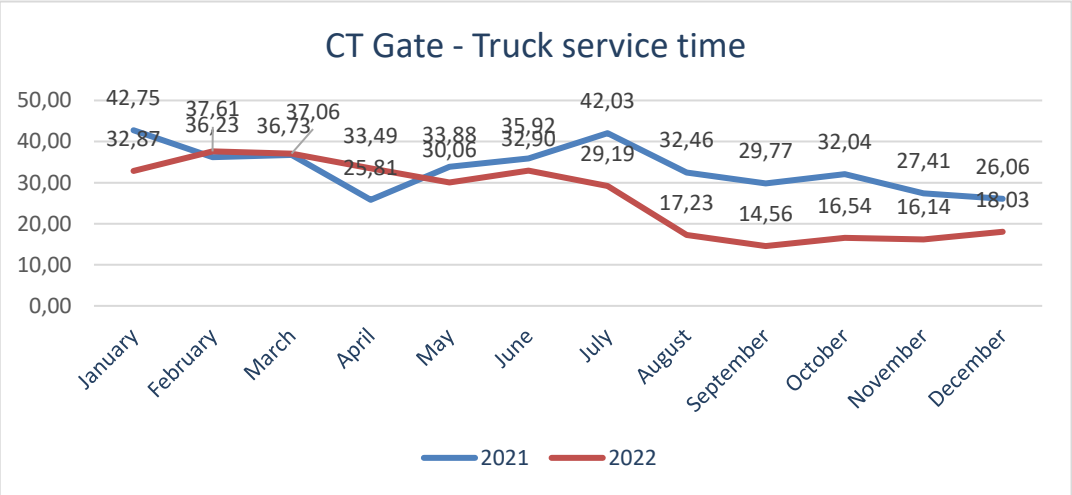


Figure 20 ThPA Truck Service Time

ID	Type	Category	Source	Priority	Associated Tasks
I.6.5. T.3	Non-Functional	Performance Efficiency	End-Users	MUST	WP5 - T5.3
Title		Improvements of the traffic conditions inside the port and in its area of influence			
Assigned Partner		PRO / ThPA			

Description

Mobility of the population (passengers, cars, trucks) might be proven to be a useful information for route optimization within the city near the port and more specifically, in areas closer to the shipping ports. If such data are combined with the passengers' embarkation and disembarkation, and the ships' schedules would potentially decrease inefficient traffic that might also lead to decrease of city pollution.

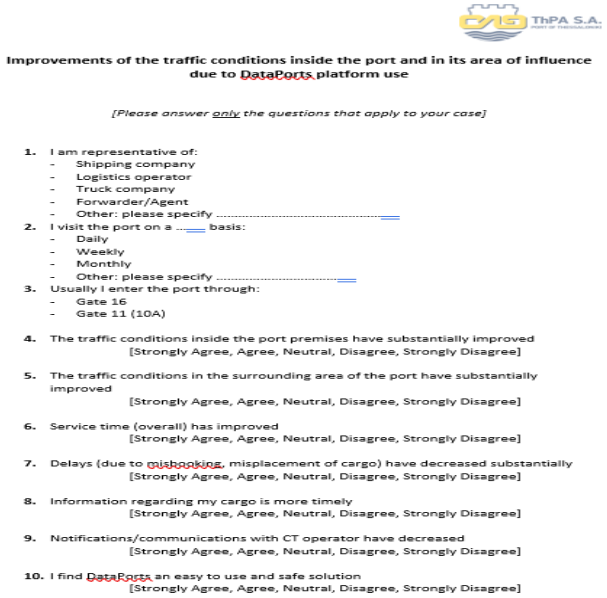
Execution Plan

Calculation method: A questionnaire will be developed and circulated to port community to evaluate the traffic conditions inside the port and its area of influence. This qualitative approach will support the evaluation of DataPorts intervention

Milestone # 1	M36	Final Stage Measurements - Completion of the questionnaire by 10 representatives of port community
Risk		No risk is expected

Evaluation	3
Results	

Structured questionnaires were discussed and compiled in the first year of the project; the relevant identification of stakeholders that would participate in the evaluation of the DataPorts results was done in collaboration with the ThPA General Commercial Division, which was involved in many disseminating activities regarding DataPorts, with local stakeholders, in the duration of the project. The questionnaire was distributed to 10 companies, for them to evaluate whether there are real improvements of the traffic conditions inside the port and in the surrounding area. In the same questionnaire, participating companies were asked to correlate the potential improvement of traffic conditions with the use of DataPorts, so aspects such as "timely information on the cargo", "decrease in communications with the terminal", "delays due to misplacements" and service time (overall) improvement" were investigated. The template is presented in the following figure.



ThPA S.A.

Improvements of the traffic conditions inside the port and in its area of influence due to DataPorts platform use

[Please answer only the questions that apply to your case]

1. I am representative of:
   - Shipping company
   - Logistics operator
   - Truck company
   - Forwarder/Agent
   - Other: please specify .....
2. I visit the port on a ..... basis:
   - Daily
   - Weekly
   - Monthly
   - Other: please specify .....
3. Usually I enter the port through:
   - Gate 16
   - Gate 11 (10A)
4. The traffic conditions inside the port premises have substantially improved
   [Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree]
5. The traffic conditions in the surrounding area of the port have substantially improved
   [Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree]
6. Service time (overall) has improved
   [Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree]
7. Delays (due to misbooking, misplacement of cargo) have decreased substantially
   [Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree]
8. Information regarding my cargo is more timely
   [Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree]
9. Notifications/communications with CT operator have decreased
   [Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree]
10. I find DataPorts an easy to use and safe solution
    [Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree]

Figure 21 ThPA Evaluation Survey

As presented in the following figures, 30% of the participants are Forwarders/Agents, 30% are shipping lines (local offices), while 30% are truck companies and 10% logistic operators. All participants visit the port daily and trucks entering through Gate 16.

Figure 22 Survey Participant Companies

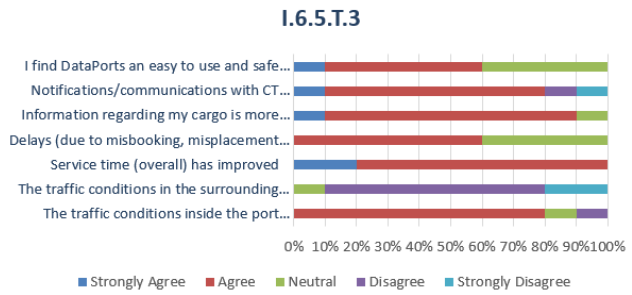


Figure 23 Survey Results

Most stakeholders, believe that procedure of importing/exporting containers has improved significantly, in terms of communication with the port and time loss, while the service time overall, has also improved. Thus, information about their cargo and relevant status, comes in a more time manner. More specifically, as presented in the following figure, 70% believes that communication with the Container Terminal's Documentation Department have decreased, while 80% believe that information on their cargo status is more time manner and service time overall has improved.

Moreover, while most participants agree that DataPorts solution is a user-friendly interface, they stated that the "*strongly agree"* answer can only be given after a reasonable time of use, resulting in 60% of participants in agreement, while a 40% feeling neutral. As for the traffic conditions in and around the port's premises, the majority (80%) was positive on the improvement inside the port, but not on the surrounding area, with a 70% supporting this statement. This is reasonable due to other external factors, such as the incomplete upgrade of the road linking the port (Gate 16) with the West entrance of Thessaloniki.

ID	Type	Category	Source	Priority	Associated Tasks
I.6.5.T.4	Non-Functional	Performance Efficiency	End-Users	MUST	WP5 - T5.3
Title		20% increase of operational effectiveness of ThPA community			
Assigned Partner		PRO / ThPA			
Description					
Mobility data approaching to port assistance, along with routing optimization, will improve cargo and container transport operations. This will result to a reduction of unnecessary container transfers, to more secured operations, and on the other hand will improve the efficiency of operations, increase the cost cutting and increase revenues. Monetization opportunities will be brought by emerging data-driven business models.					
Execution Plan					
Calculation method: A set of indicators will be defined to calculate the operational efficiency. The values will be calculated without and with DataPorts system. Indicators such as truck turnaround time or crane productivity, will be used as a baseline, to be compared with results.					
Milestone # 1	**M24**	Initial Measurement - Definition of indicators and availability of values			
Milestone # 2	**M36**	Final Measurement - The final calculation will take place at the end of demonstration period. The values with DataPorts will be collected.			
Risk		The target value might be lower			
Evaluation		2			
Results					

By monitoring the operational efficiency ratio, benchmarking ThPA S.A. performance can be monitored and measured. However, this Performance Indicator was correlated to an application which was decided earlier in the project, that will not be implemented. The lack of mobility data due to newly inserted GDPR restrictions, offered by OTE in the project and the availability of other open sources, whose datasets were incomplete, was the main reason. Furthermore, procedures that the truck companies have in place, such as the route that the driver must follow, which is decided and controlled by the company, leaves little room for route optimization. Finally, the implementation of the application prerequisites that the driver would have to be using OTE network and give the necessary consents. Under this context, such data couldn't be collected and used.

The following formulas of operational efficiency calculation could not be used in the framework of DataPorts, since they do not clearly depict the contribution of the DataPorts solution to a potential increase in efficiency, considering the daily tasks that the Container Terminal employees have.

Operational efficiency= (OPEX + COGS[9]) / Net sales

Operational efficiency rate= (operational expenses/total revenue) *100

For this reason, metrics such as Vessel waiting time at anchor and Truck Dwell Time were used. As presented in the following figures with the use of the DataPorts all indices started to improve, since mid-2022. Data extracted from the Terminal Operating System, proved that the average hours of a vessel in anchor (MoM) were substantially decreased, achieving a yearly average improvement of approximately **26%,** compared to 2021. Respectively, data extracted from the Truck Appointment System of ThPA, proved that the monthly average minutes of a truck dwelling in ThPA premises, have decreased achieving a yearly average improvement of approximately **12%,** compared to 2021.

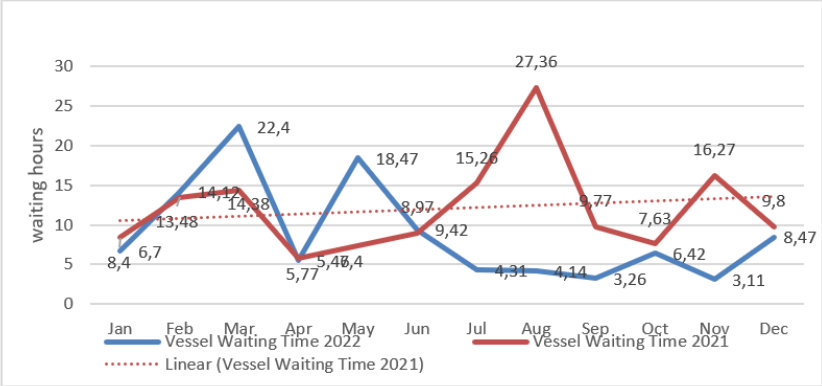


Figure 24 Vessel waiting time

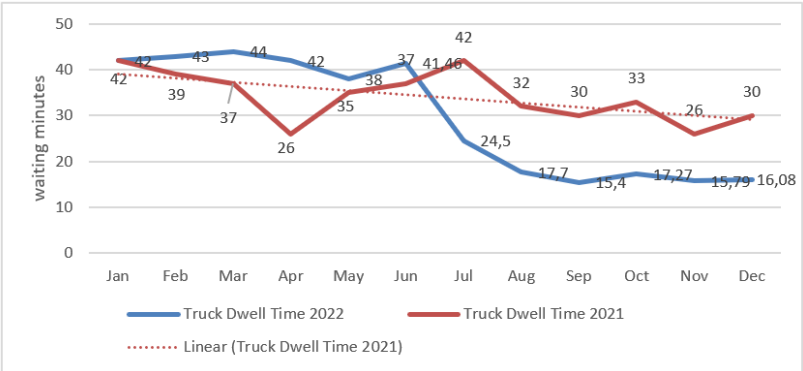


Figure 25 Truck dwell time

The time reduction of vessels at anchor and the reduction of truck dwell time, show an improved and smoother flow of operations. As a verification of the above, the productivity of cranes was also used. As presented in the following figure the Net Crane Rate average per month improved since mid-2022 with a yearly average improvement of 1%. (Subject to change due to external parameters)

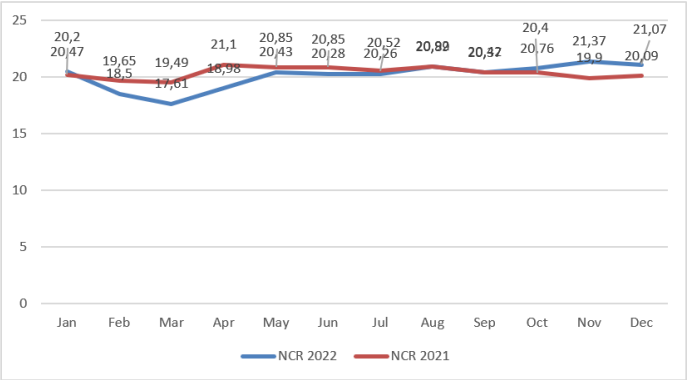


Figure 26 Net Crane Rate

It must be noted that 2020 is not presented in the above figures, having in mind that the DataPorts project was in its early implementation stages, and it was a year mainly affected by the global Covid impacts, thus not providing an accurate picture of regular operations.

In other words, by utilizing the unified information that DataPorts offers, there is a significant reduction in dwell time of trucks, which proves more efficient operations, since the trucks that are permitted to enter and remain in the Terminal are the ones that are "cleared" and approved by the Terminal employees. In addition, the predictions capabilities of the DataPorts platform can provide an insight on the expected traffic, regarding a specific vessel and amount of cargo to be picked-up or dropped, thus allowing for a better scheduling of operations (e.g., allocating more employees in a specific shift).

This reduction in time, also improves congestion within the Terminal and reduces unjustified actions due to miscommunications, meaning that the flow of trucks must follow the Yard Plan, Load List and Bay Plan (containers are loaded/unloaded in a specific order, in specified slots, depending on the actions to follow – specific slot on the vessel following a predetermined order based on destination, and specific area and slot in the Yard, based on the truck's destination and expected traffic). The vessel in anchor time and net crane rate improvement, verifies the increase in efficient operations.

2.2.5.2 VPF Pilot KPIs

All Valencia Port KPIs are directly related to the improvement of efficiency or reducing cost or incidents thanks to the data used shared on DataPorts. DataPorts platform and its components fully support these improvements. However, it is not possible to be measured during the 36 months of the project, since it will require additional budget, a production environment with agreements with seaports and shipping companies, using various assets and actual data. Hence their progress is on track with a disclaimer that they can be measured only in real environment.

ID	Type	Category	Source	Priority	Associated Tasks
I.6.5. V.4	Non-Functional	Functionality	End-Users	SHOULD	WP5 T5.2, T5.3, T5.4
Title		Improved knowledge of hazards of the freights during sea routes			
Assigned Partner		TRX / VPF			
Description					

[9] Cost of Goods Sold

A fully functional data platform will lead to an adoption by many users. It should offer a well governed data products and services, with an easy access and delivery mechanisms. Within the offered benefits lies their abilities to give end-users a cohesive view of data from multiple sources and make data available to those users with proper permissions. Data products and services through data platform should provide access to the right data at the right time, when are requested and at the requested accuracy. By being able to fulfil end-users' needs, it will increase the value of the data. Since data-driven platforms and the offering of data are relatively new services, advanced security and authentication tools and mechanisms must be applied and ensure the proper access and easily keep track of who can access data via the platform. Including datasets that were not easily accessed so far will create an increasing need for additional datasets and promote others to offers their data as well.
The Platform should allow increase of datasets not only by internal data owners/providers but also by external ones who are willing to be engaged in this data-driven ecosystem, offering, and receiving data, services, and eventually valuable information for their companies. The ability of data owners to provide datasets that are of actual need will increase the request for them as well as their volume and frequency. Freight-related data should ensure the safety of the transported freights and optimize their route.

Execution Plan

Smart containers can communicate periodically the GPS positions of the container enabling the stakeholders to compute the exact route of the container. In addition, using other sources of data such traffic and weather and when data science is applied, one can compute few alternatives and enhance route planning accordingly. Collaboration will be established with Asset Owners, and IoT devices will be placed in containers to collect data.
M18 - 24 devices planned to be installed in Valencia and 16 in Thessaloniki. The intent of the project was to work with Shippers (BCO or FF) to have these devices installed and containers shipped but no partner was found to manage these shipments and the evaluation.
M32 – Devices installed with the participation of Maersk Sealand (Asset Owner) instead.

Milestone # 1	**M12-M18**	Equip containers with IoT devices – Moved to M24
Milestone # 2	**M24**	Engage with pilot's assets owner to agree on route planning benefits evaluation
Milestone # 3	**M36**	IoT providers and Asset owners will share evaluation of benefits regarding route planning to stakeholders
Risk		Ability to find an asset owner willing to share data with the ports and cargo owners. Risk not to have enough relevant data points to compute the KPI.
Evaluation		2

Results

Given that the intent to prove the impact with the shipper was not realized, it is difficult to evaluate this item. However, a total of 40 devices have been installed in this pilot with various routes from Valencia and Thessaloniki. We had more than 20 000 data points for container positions. Below, are specific examples of a trip from Valencia and a trip from Thessaloniki to Valencia.

Figure 27 Thessaloniki to Valencia Trip

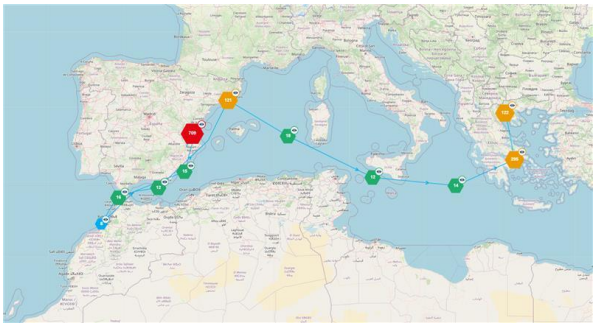


Figure 28 Valencia to Thessaloniki Trip

These sensors were not included in the pilot but shocks detection and temperature sensing in Traxens trackers will allow customers with fragile cargos to better plan routes according to operations quality or seasonal changes.

ID	Type	Category	Source	Priority	Associated Tasks
I.6.5. V.7	Non-Functional	Performance Efficiency	End-Users	SHOULD	WP5 T5.2, T5.3, T5.4

Title		Reduction of transport and logistic costs per box and per kilo
Assigned Partner		TRX / VPF
Description		
Similar as I.6.5. V.6		
Execution Plan		
Smart containers support enhanced decision-making by stakeholders by providing a common base to achieve near real-time shared visibility across the entire door-to-door trip execution. M18 - 24 devices planned to be installed in Valencia and 16 in Thessaloniki. The intent of the project was to work with Shippers (BCO or FF) to have these devices installed and containers shipped but no partner was found to manage these shipments and the evaluation. M32 – Devices installed with the participation of Maersk Sealand (Asset Owner) instead.		
Milestone # 1	M18	Equip containers with IoT devices – Moved to M24
Milestone # 2	M24	Engage with pilot's assets owner to agree on cost benefits evaluation
Milestone # 3	M36	Asset owners will conduct a case study on the impact of smart container on their lead-time and D&D bills as two main measurements able to reduce the cost for a given item
Risk		Ability to find an asset owner willing to share data with the ports and cargo owners.
Evaluation		2
Results		
Given that the intent to prove the impact with the shipper and the asset owner was not realized, it is very difficult to evaluate this item. Tracking done without IoT (tracking the milestones or the vehicles only, like Project44 "https://www.project44.com/" and FourKites "https://www.fourkites.com/") already provides improvements for transport and logistic costs at the container level. The real time location of containers provided by IoT trackers allows to go further by optimizing the idle time in specific zones and identify the contingency points.		

ID	Type	Category	Source	Priority	Associated Tasks
I.6.5. V.8	Non-Functional	Performance Efficiency	End-Users	SHOULD	WP5 / T5.2, T5.3, T5.4

Title		Reduction of theft and intrusion risk in high-value containers
Assigned Partner		TRX / VPF
Description		
Similar as I.6.5. V.6		
Execution Plan		
Smart containers enable to delineate the responsibilities of each actor of the supply chain.		
M18 - 24 devices planned to be installed in Valencia and 16 in Thessaloniki. The intent of the project was to work with Shippers (BCO or FF) to have these devices installed and containers shipped but no partner was found to manage these shipments and the evaluation. M32 – Devices installed with the participation of Maersk Sealand (Asset Owner) instead.		
Milestone # 1	M18	Equip containers with IoT devices – Moved to M24
Milestone # 2	M24	Engage with pilot's assets owner to agree on cost benefits evaluation
Milestone # 3	M36	Asset Owner will measure the number of intrusions in average of smart containers versus regular containers
Risk		Ability to find an asset owner willing to share data with the ports and cargo owners. Risk not to have enough relevant data points to compute the KPI.
Evaluation		2
Results		

Given that the intent to prove the impact with the shipper and the asset owner was not realized, it is very difficult to evaluate this item.
Given their limited security, shipping containers are subject to unexpected opening which can impact the operations of Shippers and Carriers. Container cargo theft is down but the overall value of goods stolen is up. Illicit cargo smuggling seems to be increasing as customs seizures are larger and more frequent.
Violence due to container cargo theft or illicit goods smuggling impacts the safety of port and vessel personnel and warrants automated and anonymous measures to avoid also endangering logistics teams.
Along with advanced contextualization algorithms, knowledge of customs practices and locations (geozones) characteristics, the sensors array in Traxens devices allows to raise exception events showing suspicious or unexpected door openings that could point to theft or smuggling. Then, Traxens application allows automated notification and collaboration to reach resolution of the incident through authorities' quick intervention and provide extra proof to help investigating. Below can be seen an example of Traxens intrusion tracking app.

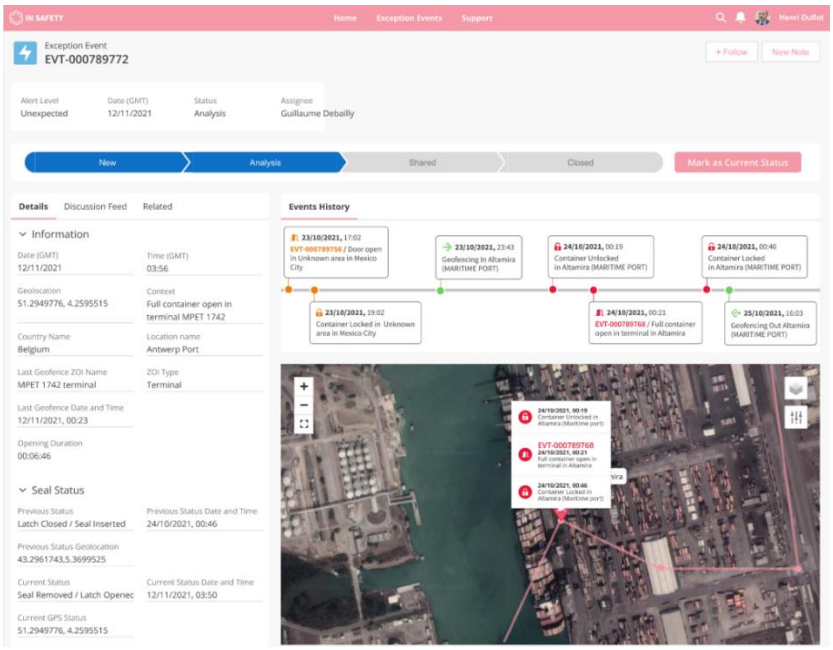


Figure 29 Traxens Application

Based on the limited sample of 24 devices in Valencia and 16 in Thessaloniki, we did not identify any intrusion (smuggling or theft) during the pilot. However, the relevant KPI is probably not the average number of intrusions in smart containers versus containers not equipped with devices but rather the thefts or rip-offs identified by Traxens devices on its whole fleet. We have observed that more than 0,2% of all container trips tracked by Traxens have had a proven smuggling event detected by the solution. Then, it is understandable that future smart containers growth relies strongly on this door opening feature events.

ID	Type	Category	Source	Priority	Associated Tasks
I.6.5. V.9	Non-Functional	Performance Efficiency	End-Users	SHOULD	WP5 / T5.2, T5.3, T5.4
Title		Improvement of berthing/un-berthing smart container operations			
Assigned Partner		TRX / VPF			
Description					
The objective is to improve container tracking operations.					
Execution Plan					

Enable terminal operators to verify the exact location of each container in their yard in real time, advice of mishandling or equipment failures, and assist in locating dangerous goods to enhance safety. M18 - 24 devices planned to be installed in Valencia and 16 in Thessaloniki. The intent of the project was to work with Shippers (BCO or FF) to have these devices installed and containers shipped but no partner was found to manage these shipments and the evaluation. M32 – Devices installed with the participation of Maersk Sealand (Asset Owner) instead.		
Milestone # 1	M18	Equip containers with IoT devices – Moved to M24
Milestone # 2	M24	Engage with terminal crew to agree on operations improvement evaluation.
Milestone # 3	M36	Inland and sea terminal operators share the impact of the smart container data availability
Risk		Ability to find an asset owner willing to share data with the ports. Risk not to have enough relevant data points to compute the KPI. The use case may not happen straight away for actual production use due to the devices data being owned by Asset Owner (most often Shipping Lines). Hence, specific contracts will have to be discussed with, obviously, a cost for the port. The value can be weighted by the port by M36.
Evaluation		2
Results		
The real-time availability of data will eventually increase the container operations. Although in the pilot we are using real data, it is only for demonstration and evaluation purposes on a limited sample of devices, so we have not been able to measure which could be the real increase. We have been able to evaluate that, in ports with a low level of automation and digitization, we would need to have almost all containers equipped with tracking devices to allow quicker vessel loading process. In this case, pilot participants feel we could improve on current performance, but it requires a sizeable deployment of devices on containers going through the ports. We could imagine installing devices when containers enter the port and remove them at gate out or vessel loading but, in addition to the operational hassle, such temporary devices not requiring the container doors to be open do not exist in Traxens portfolio. In selected ports with a high level of automation and digitization, container tracking through reach-stackers and crane OCR can already allow most of the benefits of what smart containers could bring to loading operations improvement.		

ID	Type	Category	Source	Priority	Associated Tasks
I.6.5. V.10	Non-Functional	Performance Efficiency	End-Users	SHOULD	WP5 / T5.2, T5.3, T5.4
Title		Improvement of the last-mile operations in logistics			
Assigned Partner		TRX / VPF			
Description					
Proposed new AI-enhanced digital services, should be used to optimize the shipping port resource management and optimize the operations. Best practices may be used to other ports, especially to those that are operated by the same Port Authority. An effort should be given to on-board data collected form logistic companies related to the port. An attempt towards that, should be given to influence through the offered benefits and attract additional end-users that will enrich the operational productivity and the performance efficiency of the shipping ports and the offered services.					
Execution Plan					
Smart containers can communicate periodically the GPS positions of the container enabling the stakeholders to compute a better ETA which allows a better last mileage planning.					
M18 - 24 devices planned to be installed in Valencia and 16 in Thessaloniki. The intent of the project was to work with Shippers (BCO or FF) to have these devices installed and containers shipped but no partner was found to manage these shipments and the evaluation. M32 – Devices installed with the participation of Maersk Sealand (Asset Owner) instead.					
Milestone # 1	M18	Equip containers with IoT devices – Moved to M24			
Milestone # 2	M24	Engage with pilot's assets owner to agree on route planning benefits evaluation			

Milestone # 3	M36	Asset's owner will share evaluation of benefits regarding last mile operations
Risk		Ability to find an asset owner willing to share data with the ports.
Evaluation		2
Results		
Given that the intent to prove the impact with the shipper and the asset owner (was not relevant as it was not responsible for last mile logistics due to merchant haulage) was not realized, it is very difficult to evaluate this item. Tracking done without IoT (tracking the vehicles only, like Project44 and FourKites) already provides improvements for last mile operations. The real time location of containers provided by IoT trackers allows to go further by reducing blind spots and making it easier to provide the same service globally.		

ID	Type	Category	Source	Priority	Associated Tasks
I.6.5. V.12	Non-Functional	Performance Efficiency	End-Users	SHOULD	WP5 / T5.2, T5.3, T5.4
Title		Increase in landside operations efficiency (boxes/hour) concerning smart containers			
Assigned Partner		TRX/VPF			
Description					
Proposed new AI-enhanced digital services, should be used to optimize the shipping port resource management and optimize the operations. Best practices may be used to other ports, especially to those that are operated by the same Port Authority. An effort should be given to on-board data collected form logistic companies related to the port. An attempt towards that, should be given to influence through the offered benefits and attract additional end-users that will enrich the operational productivity and the performance efficiency of the shipping ports and the offered services.					
Execution Plan					
Smart containers support enhanced decision-making by stakeholders by providing a common base to achieve near real-time shared visibility across the entire door-to-door trip execution. M18 - 24 devices planned to be installed in Valencia and 16 in Thessaloniki. The intent of the project was to work with Shippers (BCO or FF) to have these devices installed and containers shipped but no partner was found to manage these shipments and the evaluation. M32 – Devices installed with the participation of Maersk Sealand (Asset Owner) instead.					
Milestone # 1	M18	Equip containers with IoT devices – Moved to M24			
Milestone # 2	M24	Sign a contract with Asset owners that are willing to use the data to optimize their landside operations			
Milestone # 3	M36	Asset owners will measure landside operations efficiency (boxes/hour) concerning smart containers versus regular containers			
Risk		Ability to find an asset owner willing to share data with the ports. Risk not to have enough relevant data points to compute the KPI. The use case may not happen straight away for actual production use due to the devices data being owned by Asset Owner (most often Shipping Lines). Hence, specific contracts will have to be discussed with, obviously, a cost for the port. The value can be weighted by the port by M39.			
Evaluation		3			
Results					

The real-time availability of data will eventually increase the container operations. Although in the pilot we are using real data, it is only for demonstration and evaluation purposes on a limited sample of devices, so we have not been able to measure which could be the real increase. We have been able to evaluate that, in ports with a low level of automation and digitization, we would need to have almost all containers equipped with tracking devices to allow quicker vessel loading process. In this case, pilot participants feel we could improve on current performance, but it requires a sizeable deployment of devices on containers going through the ports. We could imagine installing devices when containers enter the port and remove them at gate out or vessel loading but, in addition to the operational hassle, such temporary devices not requiring the container doors to be open do not exist in Traxens portfolio. In selected ports with a high level of automation and digitization, container tracking through reach-stackers and crane OCR can already allow most of the benefits of what smart containers could bring to loading operations improvement.

2.2.5.3 Global Use Case KPIs

ID	Type	Category	Source	Priority	Associated Tasks
I.6.5.G.6	Non-Functional	Usability	End-Users	MUST	WP5 T5.2, T5.3, T5.4 / WP7
Title		Increase products from Posidonia Port Solutions products integrated in DataPorts.			
Assigned Partner		PRO			
Description					
As a result of the port management system integration and so the increase of available data sources, more data would be provided to the platform that may have other stakeholders besides of the Port Authorities.					
Execution Plan					
The Posidonia data sources will be integrated in the DataPorts platform through the implementation of agents and the modification of the Posidonia products to share the data. M18 Milestone has been removed because there was no real value identified. A new M24 milestone has been set instead, and the M36 has been changed according to the new description, that now remarks that this KPI is about the number of Posidonia products integrated in DataPorts. The Posidonia data sources will be integrated in the DataPorts platform through the implementation of agents and the modification of the Posidonia products in order to share the data.					
Milestone # 1	**M24**	One product (Posidonia Operations) is integrated with the DataPorts platform through the implementation of an agent.			
Milestone # 2	**M36**	Three products (Posidonia Operations, Management and PCS) are integrated with the DataPorts platform through the implementation of agents.			
Risk		The willingness of 3rd parties to share data			
Evaluation		3			
Results					

The integration of Posidonia products into the DataPorts project is done by means of the development and deployment of agents in the DAC (Data Access Component) which map Posidonia products as data sources. In M24, Posidonia Operations was deployed at both Valencia and Thessaloniki Ports. In M36, the corresponding agents have deployed to the data access as shown in the following screenshot:

Figure 30 Posidonia Operations deployed at Valencia and Thessaloniki

There are 4 instances of applications integrated in total:

- Posidonia Operations in three different port authorities: “operations_thpa” for the ThPA, “operations_vpf” for the VPA, and “operations_bpa” for the Balearic Port Authority.
- Posidonia Management (api_listener_jwt_mng) for the Balearic Port Authority
- Posidonia PCS (api_listener_jwt_pcs) for the Balearic Port Authority

- Another application has been integrated with DataPorts as a data consumer. Posidonia Notifications receives and processes messages through a subscription to the data sources, using the DataPorts data model to identify the meaning of the information received.

ID	Type	Category	Source	Priority	Associated Tasks
I.6.5. G.7	Non-Functional	Usability	End-Users	MUST	WP5 T5.2, T5.3, T5.4 / WP3
Title		Improve the integration of the Posidonia products for other deployments			
Assigned Partner		PRO			
Description					
The integration of the DataPorts platform with Posidonia port management system implies that future data sources may be integrated with other products applying similar processes or mechanisms such as builder agents.					
Execution Plan					
An automated mechanism as is an agent will be developed, to set up a process by which Posidonia management system will be integrated with DataPorts platform. This will define a template for future integrations. M18 deadline is postponed to M24 since the platform data access component is released on M18 and the agents need the provided SDK to be developed. There is a dependency with the I.6.5.G.6 KPI. Once the agent for Posidonia Operations is developed, a template will be created and included in the Data Access component wizard. On late Q1 of 2022 the template will be update along with the new agent version. The objective remains to remark the use of the templates provided by the platform for making easier the integration of the products. So, the first integration will need additional time, but once the template of the agent is included in the platform`s SDK future integrations will be easier for other Posidonia products.					
Milestone # 1	**M18**	Removed: Build an agent for a Posidonia product using a provided template. Measure the cost in terms of time and effort.			

Milestone # 2	**M24**	A template for the creation of agents for Posidonia Operation is included in the SDK of the Data Access Component
Milestone # 3	**M36**	Templates for Posidonia Operations, Management and PCS are included in the SDK of the Data Access Component.
Risk		The willingness of third parties to share data
Evaluation		3

Results

Initially, only VPF and ThPA were included as participating port authorities in the DataPorts project. Later, a third port authority from the Balearic Islands in Spain was also invited to participate. The integration of the 3 Posidonia products deployed at Balearic Port Authority allowed us to create three agent templates that can be reused to integrate further instances of Posidonia Operations, Management and PCS from different port authorities. As a result, 3 new templates are available: Posidonia Management, Posidonia Operations and Posidonia PCS. The 3 of them are of type "publish/subscribe". These agent templates are shown in the following screenshot from the DAC's interface:

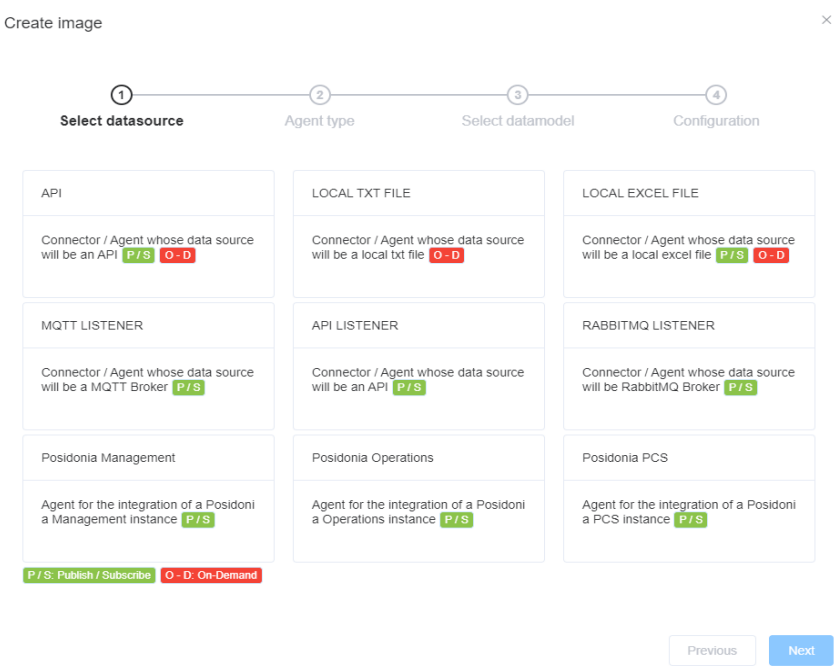


Figure 31 DAC's interface - Agents' Template

- The Posidonia available templates provide the following advantages:Posidonia Management: this template integrates a running Posidonia Management instance. The template performs the data model mapping and already provides 270 lines of code. Development of a new agent only requires filling the Orion's URL in the wizard and the agent is ready to be packaged and deployed.
- Posidonia Operations: similarly, this template is used to integrate a running instance of Posidonia Operations, providing the same URL connection details. The template already provides the mapping in 485 lines of code.
- Posidonia PCS: lastly, this agent integrates a running instance of Posidonia PCS. This template contains 285 lines of code.

Based on the experience gained during the project, the template will allow creating an agent in less than 1 hour, while the creation of the agent from scratch, on average, takes 1 week.

ID	Type	Category	Source	Priority	Associated Tasks
I.6.5. G.8	Non-Functional	Scalability	End-Users	MUST	WP5 T5.2, T5.3, T5.4 / WP3
Title		Number of Posidonia Port Solutions products integrated in the pilots			
Assigned Partner		PRO			

Description		
The Posidonia port management system integration process aims to increase the available data sources not only for the platform but also for both pilot ports.		
Execution Plan		
Build the agents for the Posidonia data sources and integrate them with the DataPorts platform. Deploy one Posidonia product in each of the pilots. Posidonia products will be deployed in the pilot ecosystems. M18 deadline is postponed to M24. Due to licenses and resources limitations of the pilot ports, Posidonia Operations will be deployed on cloud for both. We are now working on the requirements and the configuration of the environment. Ports will have access to the application as an external service. Instances of Posidonia Operations are being integrated on cloud for both ports. Cooperation of ports has been requested to configure the AIS station and the cartography. The Milestone is expected to be achieved in Q1 of 2022. M36 is about the number of sources integrated. There is a close collaboration with the ports to get all the data needed from them. VPF has sent some maps info and access to AIS won't be a problem.		
Milestone # 1	**M18**	Removed: Define the deployment process in the pilot ecosystems
Milestone # 2	**M24**	One product (Posidonia Operations) is deployed, set up and available for the ports of Valencia and Thessaloniki
Milestone # 3	**M36**	Posidonia Operations data is integrated in the pilot scenarios of Valencia and Thessaloniki and used for the achievement of their own KPIs.
Risk		The willingness of third parties to share data
Evaluation		3
Results		
Posidonia software was currently working in the 3 ports (VPA, ThPA and BPA) that have participated in any of the pilots. The work done within the DataPorts project has been aimed at integrating the information provided by such solutions via the Data Access Component (DAC) by developing different agents (as already justified in I.6.5.G.6). There are 3 instances of Posidonia applications integrated in total: • Posidonia Operations in the three port authorities • Posidonia Management for the Balearic Port Authority • Posidonia PCS for the Balearic Port Authority		

ID	Type	Category	Source	Priority	Associated Tasks
I.6.5. G.10	Non-Functional	Performance Efficiency	End-Users	SHOULD	WP5 T5.2, T5.3, T5.4 / WP3
Title		Data fusion of the same asset from different sources			
Assigned Partner		PRO			
Description					
The integration of the platform with all the available data sources implies that more data is available for the Port Authorities and other organizations. This data may be about entities that are already shared from other data sources. All data of the same entity from different sources should be unified and shared as a unique object.					
Execution Plan					
First the data must be shared with the platform, transformed into the common ontology. Then the DAV component will merge this data when data for the same entity is shared from different data sources or processes. Since the platform Data Access Component is released on M18 the agents need the SDK to be developed. There is a dependency with I.6.5.G.6 KPI and the data model definition. Currently the agent is under development and the ontology is being defined, but the final version will be released in M27. This milestone will be achieved probably on late Q1 of 2023. We are going to share real time events that will be forwarded, so it is great that a vessel name is always “vessel_name” no matter the source. Currently it is not planned to merge data in the DAV component. The execution of M36 milestone can’t start before the agent is built.					

Milestone # 2	**M24– M30**	Data is transformed and shared into the platform from the data access and interoperability layers.
Milestone # 3	**M36**	Shared data for the same entities, provided from different data sources, are joined by the DAV component creating a single entity with all the data.
Risk		The willingness of third parties to share data
Evaluation		Removed
Results		

The DAV is implemented with a generic dataset application in mind. This means that any kind of dataset can enter DAV and be pre-processed, filtered & cleaned. With that as a fact, if two same datasets from different sources were to enter DAV, they would be cleaned and stored within it. However, they would not be fused in the same database collection. Such an operation would require additional implementation steps that would extend DAV's functionality, but it is not available now. This functionality would be part of a future "DAV 2.0".

As a conclusion, the functionality linked to this KPI was prioritized as a "should" using the MoSCoW[10] methodology, meaning that such functionality is identified as something that is not a core functionality for the DAV's correct operation, but a functionality which can provide added value if implemented. Therefore, this KPI cannot be assessed since the underlying functionality is not yet present in the DAV.

ID	Type	Category	Source	Priority	Associated Tasks
I.6.5. G.11	Non-Functional	Usability	End-Users	MUST	WP5 T5.2, T5.3, T5.4 / WP7
Title		Engage final clients in DataPorts and Posidonia Port Solutions products			
Assigned Partner		PRO			
Description					

The integration and deployment of the platform within the pilot ports means having new ways both to share and to consume data. This means that new stakeholders may be interested in the integration with the platform. The pilot must engage final clients (VPF and ThPA) to not only include new data from providers (PRO, TRX) into the platform but to use this data in at least one-use case.

Execution Plan

DataPorts will be integrated in the Port of Baleares, current users of the Posidonia Port Solution. The execution plan is changed. DataPorts will be integrated in the Port of Baleares. A current user of the Posidonia Port Solution. The new final client to engage that is using Posidonia and is not one of the pilots is Baleares. Some tasks have started for the integration in the Port of Baleares, like the analysis of the new functionalities and tools, and the data available. For Q2 or Q3 of 2022 the final list of functionalities and improvements will be ready. Finally, the Posidonia Operations application is going to be provided as a cloud service but should be the same for the ports as we need to configure the application to run customized for them. The important here is to use the data in the port scenarios, so it is ok.

Milestone # 2	**M30**	New functionalities and improvement of some process are defined for the usage of DataPorts in the Port of Baleares.
Milestone # 3	**M36**	The integration of the Posidonia products and DataPorts has been finished, also the developments needed to achieve the results defined in the KPIs.
Risk		The willingness of third parties to share data
Evaluation		3
Results		

[10] https://en.wikipedia.org/wiki/MoSCoW_method

The Balearic Port Authority was invited to participate in the project and the three Posidonia instances (Management, Operations and PCS) have been integrated through agents deployed in the DAC. Additionally, a fourth product, Posidonia Notifications has been integrated to notify events related to different processes happening in all areas of the port. The following picture shows a screenshot of this product, in which we can see that 65 different events have been mapped from the DAC. These events are generated from data fed from Operations, Management and PCS.

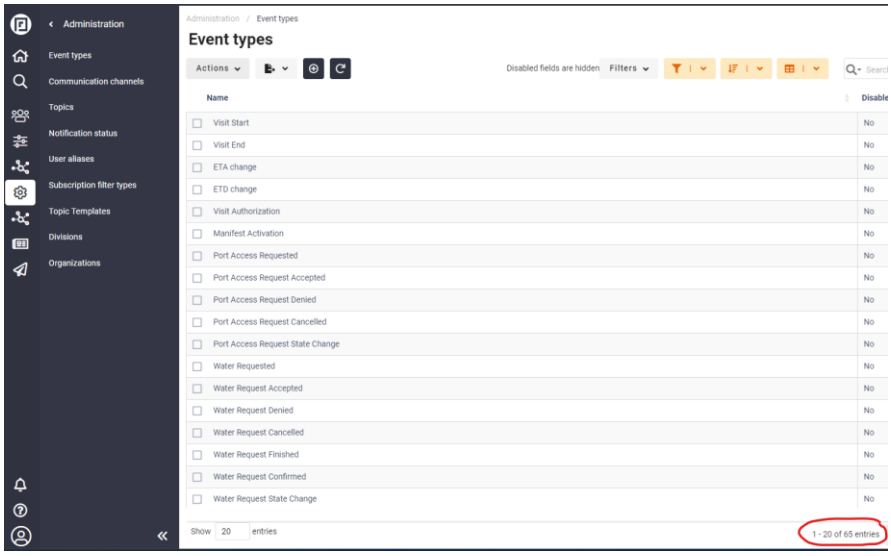


Figure 32 Operations, Management and PCS Events

The following screenshot show the different kinds of notifications channels that are currently available for configuration in this application:

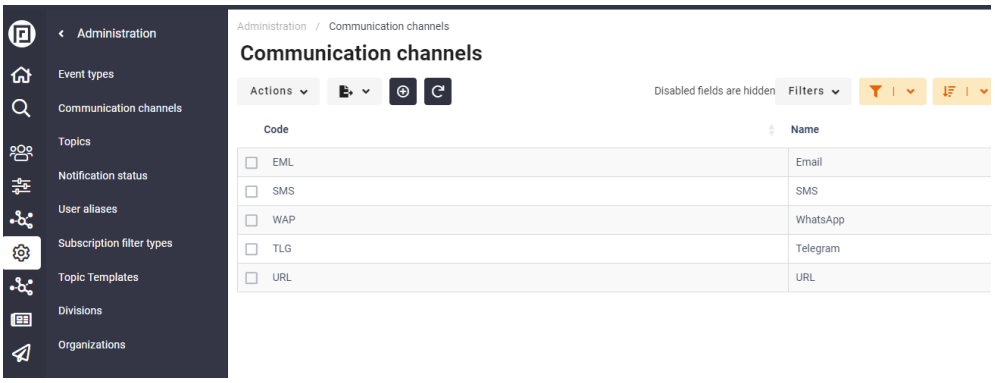


Figure 33 Notification Channels

With this new application, different users from either the PA or service providers can receive live information on events generated during daily routines in the port area.

ID	Type	Category	Source	Priority	Associated Tasks
I.6.5.G.13	Non-Functional	Performance Efficiency	End-Users	MUST	WP5 T5.2, T5.3, T5.4
Title		Reduce integration effort for BCOs and Freight Forwarders using DataPorts and wanting a Smart container solution			
Assigned Partner		TRX			
Description					
New KPI added according to revised use case. As Traxens will be integrated in the DataPorts platform, BCOs and Freight Forwarders can benefit from a lower effort to use the Smart container service.					

Execution Plan		
As planned in the pilot development, Smart Containers data should be integrated in DataPorts platform and available on demand. Beyond technical development and conduct of the pilot for M36, the marginal gain for a customer already having an integration with DataPorts can be defined as the workload to integrate data directly from Traxens platform, which may not be relevant for small users of smart container service (who can also use TRX platform standard user experience without integration workload).		
Milestone # 1	**M36**	Data is shared from integrated Traxens products and available to be consumed under the defined access rules
Risk		Actual customer interest in raw data instead of Traxens platform UX
Evaluation		2
Results		
Businesses that operate as either BCOs (Beneficial Cargo Owners) or Freight Forwarders can potentially experience significant reductions in integration effort when utilizing the Smart container solution, particularly if they are already connected to DataPorts at any given port. This is because a connection with DataPorts provides them with direct access to all relevant data and information, eliminating the need for additional steps or processes to retrieve this information. The Smart container service is designed to streamline and optimize the flow of data and information related to the shipping and transportation of goods, making it easier for BCOs and Freight Forwarders to manage their operations and make informed decisions. By subscribing to this service, these businesses will have access to real-time data and insights into the status and whereabouts of their shipments, enabling them to make informed decisions and respond to any potential issues or challenges that may arise. In summary, the combination of DataPorts and the Smart container solution can significantly reduce the integration effort required by BCOs and Freight Forwarders, thereby allowing them to focus on their core business activities and make the most of their investment in these technologies. By leveraging the power of data and automation, these businesses can gain a competitive advantage and drive greater efficiency and productivity across their operations.		

ID	Type	Category	Source	Priority	Associated Tasks
I.6.5.G.14 NEW KPI	Non-Functional	Performance Efficiency	End-Users	MUST	WP5 T5.2, T5.3, T5.4
Title		Increase the reuse of Smart containers after their first trip with destination VPF or ThPA			
Assigned Partner		TRX			
Description					
New KPI added according to revised use case. DataPorts will provide a way to commercialize further Smart containers data that had as destination VPF or ThPA and sitting still in container depot.					
Execution Plan					
Having the option for Smart Containers as a turnkey solution for shippers integrated into DataPorts will allow extra sales through DataPorts. The deployment of pilot devices will allow to gather more data points than existing Traxens incidental moves in ThPA and VPF ports and evaluate the potential gains. The evaluation of those gains is proposed in M24 update of D7.1 and will be updated in M36 to consider actual figures. As mentioned for earlier KPIs, deployment of pilot IoT devices is hindered by the lack of availability of containers owned by an actor willing to share data with the ports as origin and destination. M32 – 24 devices deployed in Valencia and 16 devices deployed in Thessaloniki.					
Milestone # 1	**M36**	Data is shared from integrated TRX products and available to be consumed under the defined access rules			
Risk		Ability to manage Smart container stocks from all asset owners in depot. Ability to find an asset owner willing to share data with the ports. Risk not to have enough relevant data points to compute the KPI.			
Evaluation		1			
Results					

Given the limited time running the pilot, there has been only one opportunity for reuse of a smart container that travelled from Thessaloniki to Valencia (the others not having come back to either port). A container of the pilot travelling from Thessaloniki to Valencia and being ready for reuse. Until now, this container has not left for another trip yet.

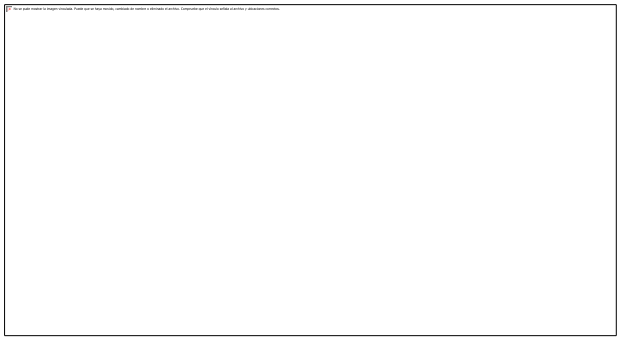


Figure 34 Smart container travelled from Thessaloniki to Valencia

2.3 KPI ADJUSTMENTS

From the course of actions of Dataports, and the analysis of the impact requirements, it was deemed necessary to change the Impact KPIs described in DoA, to be more realistic and feasible. For this reason, new KPIs were proposed which are in line with the objectives of the project. On months M18 and M24, as was reported in D6.3 and D6.8, Impact KPIs were redefined or were deemed necessary to be removed because they would not be measurable within the duration of the project. In addition, during the execution of the project as depicted in Figure 35, KPIs continue to be modified addressing the needs of the pilots and the partners involved.

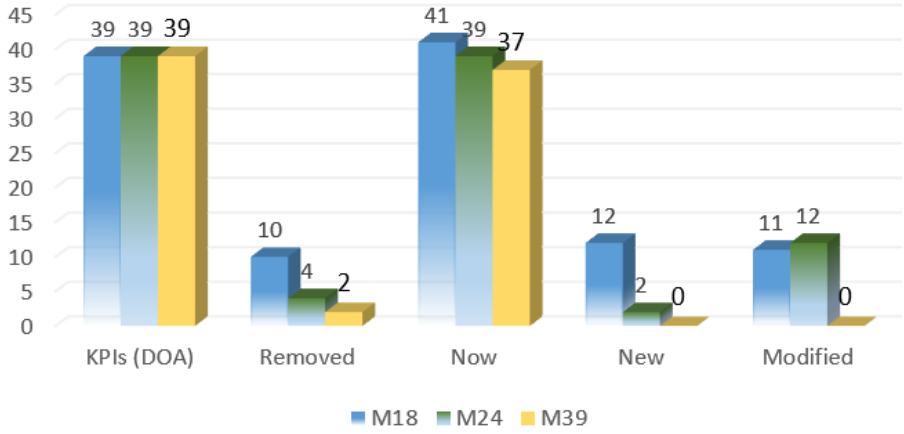


Figure 35 KPI Current Status (Adjustments)

Initial KPIs' allocation over time can be seen in Figure 36, as well as the changes in several KPIs caused due to difficulties in communication with Asset Owners and the IoT equipment installation delays.

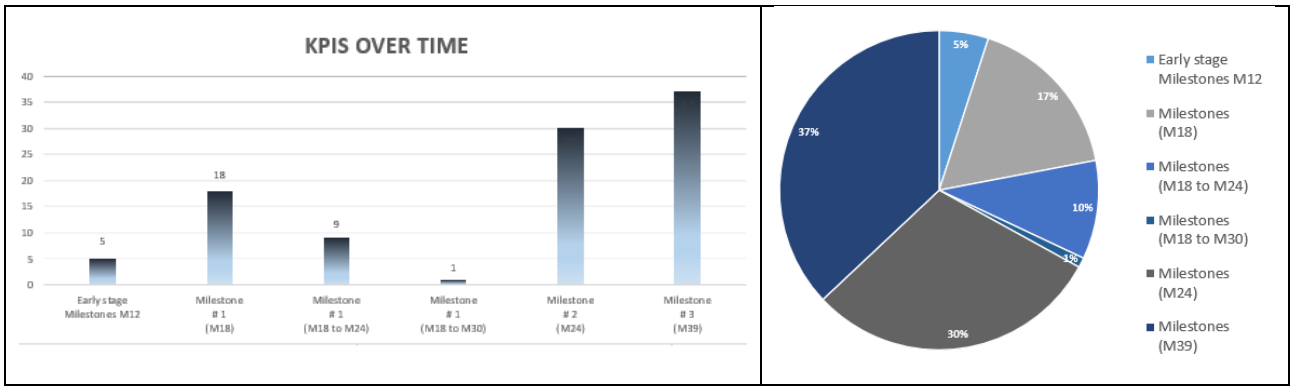


Figure 36 Impact KPIs allocation over time

2.4 RISKS (CHALLENGES)

Among the risks related to the Impact KPIs should be considered the difficulties on measurements according to the proposed execution plans. Such difficulties may be internal, that are related to the implementation of DataPorts platform components as well as, those that are related to other external phenomena, non-related to the project. For each Impact KPI, there is a risk indicator as presented on each Impact KPI's table on section 2.2. This indicator affects the progress and the fulfilment of each KPI, and it was changed accordingly to follow the evaluation value.

The risks were initially described at a very introductory level, however as their execution was progressing and challenges have become obstacles, each KPI in such position is addressing its challenges accordingly. Since the execution time planned was not enough due to delays of engaging third parties such as, Business Cargo Owners, or delays due to platform's integration forced DataPorts to move related milestones, or act accordingly. Moreover, milestones had to be re-defined to be more realistic and of a benefit to DataPorts partners. These challenges were reported in the previous sections above, at each Impact KPI.

Moreover, due to the existing covid-19 pandemic, several actions that were planned to be taken were forced either to be delayed, use other approaches, or cancelled. Such cases have affected the pilots' execution and therefore the KPIs' fulfilment. Hence, actions have been taken accordingly.

3 OUTREACH ACTIVITIES

Reporting on outreach activities is presented in D6.11 since it contains more detailed information on collaboration with other initiatives, collaboration with projects and communication with third parties.

4 CONCLUSIONS

The Impact KPIs have an important role regarding the adoption of DataPorts platform by the seaports' community. Achieving a high success percentage, Impact KPIs have shown that DataPorts project is on the right track and capable to transform the seaports of the future into a smart and cognitive point of reference. Most of the Impact KPIs reported in previous sections were focused on increasing the data and service availability and follow the main categories in terms of social, economic, environment, and innovation impact.

This document reports the results of the execution of the Impact KPIs of DataPorts without omitting any challenges that came in front, but also the way that they were overcome. The main objective was to provide a clear view of each KPI, with a timetable to practically report their progress and conduct the evaluation.

Finally, Impact KPI reporting, allowed DataPorts partners to accurately measure the value of platform's components and align the KPIs with business objectives.

5 REFERENCES AND ACRONYMS

5.1 REFERENCES

[1] European Commission Report on Open Data: https://ec.europa.eu/digital-single-market/en/open-data
[2] https://www.fiware.org/
[3] https://www.eclipse.org/
[4] https://projects.eclipse.org/projects/technology.bridgeiot/developer
[5] https://www.ai4eu.eu/
[6] https://www.ammitec.org/
[7] http://www.thesexpress.gr/
[8] http://www.intercontainer.es
[9] http://www.sealandmaersk.com)
[10] https://seu.portsdebalears.gob.es

5.2 ACRONYMS

Acronyms List	
AI	Artificial Intelligence
AIS	Automatic Identification System
API	Application Programming Interface
BC	Blockchain
BCO	Beneficial Cargo Owner
CP	Consortium Plenary
CPU	Container Pick-up
D&D	Detention and Demurrage
DAV	Data Abstraction & Virtualisation
DoA	Description of Action
EU	European Union
FF	Freight Forwarder
FTP	File Transfer Protocol
GA	Grant Agreement
GDPR	General Data Protection Regulation
GHG	Greenhouse Emissions
GPS	Global Positioning System
IoT	Internet of Things
KPI	Key Performance Indicator
KRI	Key Risk Indicator
ML	Machine Learning
MoSCoW	Must have, Should have, Could have, and Won't have

Acronyms List	
MQTT	Message Queuing Telemetry Transport Protocol
PA	Port Authority
PC	Project Coordinator
PCS	Port Community System
PMB	Project Management Board
PPR	Project Periodic Report
QM	Quality Management
ROI	Return Of Investment
RM	Risk Management
SDK	Software Development Kit
SME	Small Medium Enterprise
SMS	Short Message Service
TAS	Truck Appointment System
TM	Technical Manager
UX	User Experience
VDC	Virtual Data Container
WP	Work Package
WPL	Work Packages Leaders

Table 2 Acronyms

6 ANNEX A: ADDITIONAL FIGURES

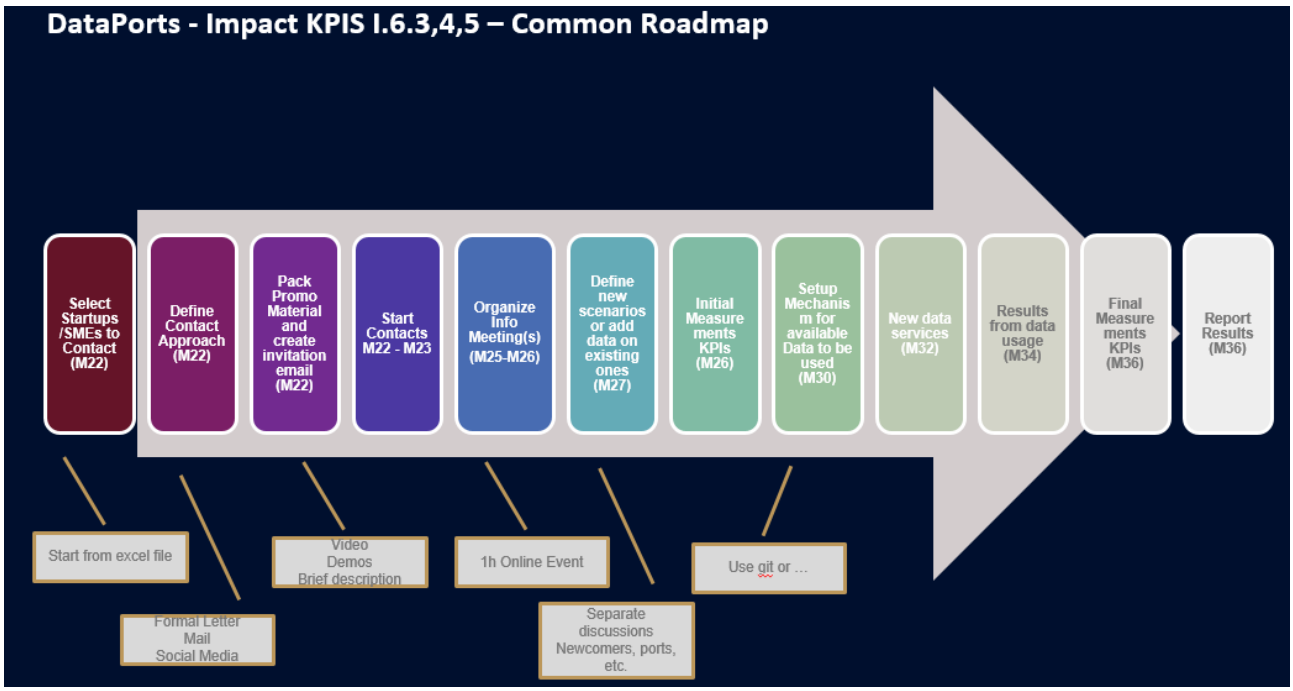


Figure 37 Impact KPIs I.6.3, I.6.4 and I.6.5 Roadmap

Data and Services in Shipping and Maritime Startups & SMEs		
BoatsAdvisor	iContainers	Procureship
Bunkering at Sea (B@s)	Intelligent Cargo Systems	Propulsion Analytics
Container xChange	Kontainers	Radiantfleet
Cseanav	MareFind	SaMMY
DA Pilot	Marine Traffic	Ship Reality
Deep Sea Technologies	Mestor	ShipChain
Ferryhopper	METIS	Signal Ocean
Flexport	Nautilus Labs	Space Horizon
Freightos	Nereus Digital	Syndeseas
Harbor lab	Octopi	Transmetrics
Haven	Openichnos	Vesselbot
Hopwave	PEOPLE Tech	We4Sea
Bespot	Xeneta	Telesto Technologies

Table 3 Startups & SMEs to contact