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D2.8 – Project Management Report v4

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Abstract

This deliverable has been created in the context of the Work Package 2 (*Work Plan, coordination and document management*) of the H2020-funded project PIXEL (Grant No. 769355).

This is the fourth PIXEL project management reporting. The present document provides the Project Management Report (PMR) for the fifth period of 6 months of the project. This report includes all the activities and advances performed from M25 to M30 of PIXEL. WP3 and WP4 were already closed before this period. WP6 closed during this period. The rest of WPs (WP2, WP5, WP7, WP8, WP9) are still active.

The document provides an overview of the work done and the actions performed to achieve the goals proposed and included in the GA. The document includes use of resources section in addition to the technical and impact aspects.

The document is structured in three blocks, providing the description of the work performed by the members of the consortium during the corresponding period (M25-M30). First block analyses the actions taken to accomplish the specific objectives listed in the DoA. Second block describes with more detail the main results and achievements per WP. The third block provides an overview of the impact achieved so far, including the different actions at industrial, scientific, academic and communication levels.

A summary of this period can be seen as follows: (i) finish of PIXEL modules development and end of WP6, (ii) advance of the deployment of pilots, (iii) focusing on the exploitation and innovation of the PIXEL results (iv) preparation of the amendment to request an extension of the project and the addition of a new pilot related to the COVID-19 situation, (iv) clear advance on dissemination (despite the non-physical possibility of event attendant), especially highlighting the scientific dissemination publications.

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List of acronyms

Acronym	Explanation
AB	Advisory Board
CA	Consortium Agreement
COVID-19	Coronavirus pandemic 2019-2020 caused by virus SaRs-COV 2
CSA	Coordination and Support Action
DPO	Data Protection Officer
DX.Y	Deliverable nº Y from work package X
EC	European Commission
EU	European Union
GA	Grant Agreement
GDPR	Global Data Protection Regulation
HMI	Human-Machine Interface
ICT	Information and Communication Technologies
IM	Innovation Manager
IoT	Internet of Things
IPR	Intellectual Property Rights
KPI / eKPI	Key Performance Indicator / (Environmental) KPI
PEI	Port Environmental Index
PIXEL	Port IoT for Environmental Leverage
PMS	Port Management System
PMIS	Port Management Information System
PO	Project Officer
ToC	Table of Contents
DX.Y	Deliverable nº Y from work package X
WP	Work Package

1. About this document

The idea behind this deliverable is to provide to the EC the report of the project status. After 30 months of execution, all work packages have started, two have finished and several meetings have taken place. The scope of this document is to summarise the advances and results of the project within the period M25-M30.

1.1. Deliverable context

Table 1. Deliverable context

Keywords	Description
Objectives	This deliverable does not serve particularly to any goal of the listed in the Grant Agreement. Nevertheless, this document plays a crucial role on the accomplishment of all the PIXEL objectives, indeed. Keeping track of current tasks, having an overview of the status of the project and planning the next steps for the forthcoming reporting period are the needed mechanisms to ensure that PIXEL remains towards its goals.
Exploitable results	This deliverable does not generate any exploitable result.
Work plan	The Project Management Report involves, actually, the activity from all the tasks in the project, as every one of them has been analysed and reported. However, this deliveable is framed in the WP2 structure and, particularly, it is assigned to T2.1, T2,2, T2.3 and T2.4.
Milestones	N/A
Deliverables	Similarly to the work plan, the Project Management Report involves all deliverables that have been submitted so far and some to still be completed. But, as it is mentioned several times throughout the document, this deliverable is especially tied to D6.4, D6.5, the COVID-19 effects in the project and the discussion and confirmation of the second amendment to the Grant Agreement, as those have been the most relevant action points of M25-M30 period.
Risks	**Risk Nº2 –** This deliverable will allow all the Consortium, as well as the EC funder to ensure that the quality of work documentation and processes is being kept preventing any entity from misunderstand (or avoid) timing or responsibility due to lack of awareness.
	Risk Nº3 - Coordination mechanisms, keeping track of the advance of the project, identifying deviations and planning corrective actions will enhance the capacity and good execution pace of the project, and they are depicted in this document.

1.2. Methodology used for elaborating the report

Drawing from the template established through D2.5, this report aims to mean an update of the latter. While D2.5 was the first report, D2.6 covered M7-M12, the Project Technical Report for mid-term review covered the period M13-M19, D2.7 corresponded to the M19-M24 execution, the present document depicts the advances and use of resources in the M25-M30 period of and it includes a summary of the immediate previous advances, the actual evolution of tasks and the results produced by all work packages.

The methodology followed has been to: (i) summarise immediate previous advance, (ii) elaborate "progress reports" that have been translated by deliverable leader to the actual format, (iii) review of the tasks description by corresponding partners, (iv) closure of the document by Coordination..

2. Explanation of the work carried out by the beneficiaries and Overview of the progress

2.1. Objectives

The overarching goal of PIXEL is: "*to enable a multilateral collaboration, multimodal transport agents and cities to allow an optimal use of internal and external resources, sustainable economic growth and environmental impact mitigation in all ports, regardless their size or volume of operations. Thus, **PIXEL** aims at bringing the **Port of the Future** paradigm to the complete spectrum of ports, with special focus in the small and medium sized. To do this, **PIXEL** will leverage an IoT based communication infrastructure to voluntarily exchange data among ports and stakeholders ensuring a measurable benefit in this process. The main outcome of this technology will be **an efficient use of resources in ports**, as well as the sustainable development and growth of ports and surrounding cities/regions. **PIXEL** is a use-case driven action that focuses on the needs of the stakeholders in order to improve their performance by means of specific technology enablers and improved environmental and operational procedures*".

To ensure this, **PIXEL** provides (i) a set of models and predictive algorithms on the most prominent areas regarding the ports environmental impact: port and city environmental management, port energy demand, hinterland multimodal transport and port environmental pollution, including air, water and noise; (ii) a methodology and tools to calculate eKPIs and combine them in a Port Environmental Index, to enable proper quantification of the impact of Ports in cities and surrounding areas, correct assessment of mitigation measures, calculation of the return of investments in reduction of environmental impact and benchmarking with other similar ports; (iii) an open-source IoT-based technology enablers providing complete interoperability among existing port and city ICT systems and modern data-based systems to collect, aggregate and exploit data in a useful manner for port users, enabling more and better collaboration among the different stakeholders and unleashing the potential of Industry 4.0 management to ports and port-city relations and (iv) operational and visualization tools to observe, analyse and make decisions over the new available data.

All the efforts carried out during this reporting period (M25-M30) are in the line of accomplishing these global objectives. At this point, the consortium has delivered all planned deliverables, in few cases with short justified delays and with only two exceptions (D3.1 and D5.3) – which were properly informed - , ensuring maximum quality of work and alignment with GA's scope. Technical activity is advancing, the enabling platform was completed and is being successfully installed. Pilots deployments are ongoing and dissemination and communication activities have been performed to maximise impact.

2.1.1. Research and innovation objectives

To meet its goals, **PIXEL** focuses on a set **of specific research and innovation objectives,** which compose the structure and leitmotiv of the project. These objectives are listed below. A review of the advances performed during this fifth report to achieve each of them is also depicted in this sub-section.

It is worth to mention that the list below does not reflect the total amount of tasks undertaken to meet the objectives. For simplicity and readability, we have compiled in the following pages those which refer only to the fifth period of project management reporting: M25 to M30. For a full understanding of activities executed towards PIXEL goals the reader should come back to previous deliverables of WP2, in which the Consortium made the same exercise for periods M1-M6, M7-M12, M13-M18 and M19-M24.

Obj.1: Enable the IoT-based connection of port resources, transport agents and city sensor networks

The project proposes a novel ICT based communication infrastructure to enable the integration of data produced by devices, sensors and systems into a full-fledged operational data hub operated by all actors (internal and external) involved in port operations. Every data generated by every of those components involved in port activities will be properly collected and stored in a unified information hub and it will be seen transparently as homogeneous string from the application and monitoring point of view. PMS/PCS of stakeholders must be connected and feeding the system. IoT and sensor networks from different stakeholders

connected and interoperating. It provides methodology and tools for connecting isolated legacy systems such as SCADA/PLC based.

The results obtained related with this objective during the period M25-M30 of the project have been:

- DAL agents orchestrator developed and integrated
- A series of NGSI agents for ports (all the ports). Decision to complete this in the next WP.
- Article about PIXEL, its innovation and utility for Port-City interface in the AIVP website

Obj.2: Achieve an automatic aggregation, homogenization and semantic annotation of multi-source heterogeneous data from different internal and external actors

As part of the IT solution, the project will provide a methodology and tools for unifying the data coming from heterogeneous, multi-tenant sources. PIXEL will offer a comprehensible acquisition, processing and interchange of heterogeneous data coming from different sources present in a port-operations environment: sensors, isolated IoT components, legacy systems and documentation. A methodology and supporting tool will be released to support the data fusion, based on semantic annotation and mediation. As a consequence of this objective, PIXEL will achieve semantic-level interoperability among different actors, with capability to choose the ontological domain of the reports view.

The results obtained after M25-M30 that put PIXEL one step closer to accomplish this objective have been:

- FIWARE security modules completely customised and integrated in the development environment
- Huge advances in the pilots: agents integration, model integration, new visualizations.
- Platform PIXEL installed 100% in one port and more than 50% in the others.
- New sensors being installed and integrated for PIXEL

Obj.3: Develop an operational management dashboard to enable a quicker, more accurate and in-depth knowledge of port operations

It will support computing of indicators and multi-role views to enable better support to decision-making and optimisation of port/city specific needs. Platform will have an associated interface (HMI) with which responsible personnel of entities holding the pilots will be able to interact, measure and compare several operational data. As a result of achieving this objective, PIXEL will provide a dashboard validated by project members and independent stakeholders through a well-defined validation process.

The results obtained after M25-M30 that put PIXEL one step closer to accomplish this objective have been:

- Finalisation, dockerisation and integration of Operational Tools v2 (OTv2) Dashboard- global UI v2
- Documentation of all code (done through D6.4 and D6.5).

Obj.4: Model and simulate port-operations processes for automated optimisation

A structured, formalized, consistent and useful modelling will be undergone over port-operations processes to parameterize both the environmental impact caused by them and the process itself in pursuit of finding optimal resource consumption. PIXEL will leverage a set of standardized and inter-related specifications of port processes regarding energy demand, port and city environmental management, hinterland multimodal transport in ports, and generic environmental pollution affecting ports and surrounding areas. Developed models will be tested by comparing its validity against real conditions in four different ports, with different businesses interests (freight, passengers, short sea shipping), different size (small, medium, large) and schedule diversity (second and third years of execution of the action).

The actions taken to accomplish this objective during the period M25-M30 of the project have been:

- A new Pilot validation methodology
- Integration of PAS and Traffic models in ports of THPA and ASPM
- Preparation of the energy modelling scenario for GPMB (to be validated in the next reporting period)
- Global pilots advance for all defined user-stories

Obj.5: Develop predictive algorithms

In this project predictive algorithms will be developed devoted to selected port-operative process that will be modelled. Developed predictive algorithms that have the potential of significantly increase the efficiency in one or more of the following areas: energy demand, hinterland multimodal transport needs or anticipation of environmentally harmful actions. For verifying the achievement of this objective, the algorithms will be empirically tested and validated in the use-case scenarios. Additionally, it is planned an assessment of the increase in efficiency, confirming that is statistically significant.

The results obtained after M25-M30 that put PIXEL one step closer to accomplish this objective have been:

- The predictive algorithms were already completely developed by the previous reporting period.
- In M25-M30, these algorithms have been encapsulated and made ready for integration at port pilots.

Obj.6: Develop a methodology for quantifying, validating, interpreting and integrating all environmental impacts of port activities into a single metric called the Port Environmental Index (PEI).

The project will develop a Port Environmental Index (PEI) which will integrate all the relevant environmental aspects of port operations into a single metric framework. The index will enable ports to express their overall environmental impact as a single metric and use it for self-monitoring, appraisal of different mitigation measures as well as reporting issues (inter-port comparisons, benchmarking against best practices, etc.). The PEI will be validated through the use-cases and in a particular transversal trial where it be applied to each port to make proof of its scalability and portability, approved by the Stakeholders Policy Board and the method published in a relevant high-impact peer-reviewed journal.

The results obtained after M25-M30 that put PIXEL one step closer to accomplish this objective have been

- Final submission of deliverable D5.3
- Packaging of all T5.3 results to enhance and apply the calculation in task T7.5

Obj.7: Develop guidelines for mitigating possible environmental and health effects of port activities and develop evidence-based, standardized and cost-effective procedures for environmental monitoring in port areas

Based on all of the identified environmental and health impacts of port operations, the project will develop appropriate mitigation strategies. In addition, the temporal and spatial resolution of monitoring/sampling/measuring points and the integration, statistical analysis and visualization of the obtained data in a GIS environment will be addressed. Both forecasting and alerting of environmental-damaging situations will be enabled from a dashboard which will inform port (or any other body in charge) about environmental indicators and possible decisions to make. The PEI and the metrics that compose it will play a fundamental role in the achievement of this objective. As a consequence, there will be available mitigation suggestion in the operation tool of the PEI and there will exist geospatial representation of the environmental impact.

The results obtained after M25-M30 that put PIXEL one step closer to accomplish this objective have been

- Finalisation, dockerisation and integration of Dashboard and global UI v2
- Answers from ports (T5.4) and other involved agents to the survey issued in the last reporting period
- 5 new papers published in relevant journals, 3 of them related to the PEI methodology

2.2. Explanation of the carried work by WP

2.2.1. Work Package 1 – Ethics Requirements

Universitat Politècnica de Valencia (UPV) as Project Coordinator (PC) was assigned as the partner leader (and in fact the only participant) for this mandatory Ethics Work Package. WP1 is focused on complying with the Ethical requirements detected by the EC in the evaluation phase and creating the documentation and structures needed for this aim.

2.2.1.1. Summary of progress in previous periods

During the first 6 months of the project, the activity on WP1 was intensive, as every procedure, template and strategy for future actions was defined, according to the proposed deliverable submission plan for the work package.

First of all, UPV addressed the definition, identification, cataloguing and ethics compliance analysis of the **participation of Humans** in PIXEL. Secondly, the PIXEL Consortium undertook the definition, identification, cataloguing and ethics compliance analysis of the **protection of personal data** in PIXEL. In third place, deliverable D1.3 included the information to Ethically comply with safe and healthy procedures.

Additionally, PIXEL Ethics Mentor was appointed and his tasks clearly defined.

Finally, D1.5 was completed containing a Data Management Plan for specific personal-protection subject data, differing from D2.2 through particularizing the plan for **specific Ethics-related raw data.**

During the next management reporting periods (M7-M12, M13-M18 and M19-M24), the activity on WP1 was diminished in terms of establishing procedures and documentation and was focused on continuous monitoring of ethical issues along the project execution. Having established the guidelines, the main tasks performed till M25-M20 were focused on

- Generic documentation of the project (day-to-day documents exchange, etc.)
- Forms and questionnaires needed to conduct our work
- Compliance with DMP and forwarding of new sources to register if applicable
- Ensure ethics compliance in the communication with external agents (other projects, CSA, IMO, AB, AIVP, IAPH, other entities) and in the dissemination
- PIXEL Ethics Mentor (see deliverable D1.4) supervised the main processes of information exchange and no remarkable issue has been detected by M30
- All interviews to external people have been stored anonymously
- No specific ethics concerns were raised about communication with Advisory Board.
- Formal permissions were provided for proceeding in susceptible dissemination actions

With regards to topics covered by D1.2, up to this moment no personal data has been processed when deploying the pilots. The PIXEL platform has been prepared to comply with anonymisation mechanisms as well as it has been provided with enough authentication and security techniques to ensure GDPR compliance.

After the AB was formed and formalised, all members were provided with the Participant Information Sheet and all of them completed and agreed with the Informed Consent for Protection of personal data issues.

2.2.1.2. Summary of results after previous periods

- Formalization of the procedure for ethics compliance about Humans participation in the project
- Creation of a template for Ethical issue identification by any partner
- Creation of a Participant Information Sheet for Humans that participate in the project, compiling their related information
- Creation of an Informed consent form for Humans that participate in the project. This sheet will be distributed to be signed by the external participants of PIXEL.

- Detailed strategy and procedure for personal data (subject to pass Ethics control) protection
- Creation of an Informed Consent procedure for personal data processing
- Creation of a Certificate of consent per personal data to be processed. This sheet will be distributed to be signed by the corresponding responsible
- Creation of a template specific for pilot trials to specify information about the data to be processed, framed into the context of Ethics compliance.
- Appointment of a Data Protection Officer from within the project Consortium
- Deliverables D1.1, D1.2, D1.3, D1.4 and D1.5.
- Confirmation of appropriateness of procedures established by D1.1, D1.2, D1.3, D1.4 and D1.5
- Finished execution of WP3 under holistic ethical observation and analysis of future actions
- Preparation of documentation and surveillance of contacts and surveys by WP5, WP8 and WP9.

2.2.1.3. Progress in M25-M30

During the management reporting period of interest (M25-M30), the activity on WP1 was diminished in terms of establishing procedures and documentation and was focused on continuous monitoring of ethical issues along the project execution. However, the extraordinary situation being lived due to the COVID-19 outbreak, its associated mobility restrictions and the new amendment request launched by the Consortium involved particular Ethics analysis.

Meanwhile, the assets that received a continuous ethical analysis (always following the guidelines depicted through D1.1, D1.2, D1.3, D1.4 and D1.5) were:

- Generic documentation of the project (day-to-day documents exchange, etc.)
- E-mail exchange, communication via other channels as Slack chat, communication in teleconferences.
- Analysis of the contents of the amendment #2 request launched by the Consortium from an Ethics perspective. The extension of the project requested will mean a prolongation in the Ethics surveillance and document preparation tasks. Both the EM and the associated team are prepared to face this eventuality.
- Analysis of the data to be used in the COVID-19 pilot with regards to Ethics compliance. According to the description of the new task T7.7 wrapping this activity, only workers density data will be additionally introduced in the platform. All technical partners and the stakeholder of the pilot (the Port of Monfalcone – ASPM) confirmed that no personal data will be dealt with. The Port Activity Scenario (PAS) model will be replicated and enhanced to incorporate measures related to the COVID-19 that the Port has installed. Specifically, work shifts may be affected by the analysis in case that the social distance may not be respected in any area of the terminal works at a specific timeframe depending of the density of workers (additive number) and the vessels to be operated in that period.
- Forms and questionnaires needed to conduct our work
- Surveys circulated (in the context of WP5, WP8 and WP9) to different external entities.
- Data about sensors, data sources, internal aspects of ports, data needed to complete the predictive algorithms, data needed to execute the models, data needed for PEI computation
    - Extensive communication with WP2 and the DMPs (for the D2.4 mainly).
- Communication with external agents (liaison with other projects, CSA, AB, IAPH, AIVP, conference organisers)
- A new member has been added to the Advisory Board, which has not raised any additional Ethical concern according to the EM. All the procedures were followed in the communication to bring a new member into the Board.
- Dissemination of PIXEL through all channels: website, social media, newsletter, pieces of news, scientific articles, presentation in (virtual) industrial events.

- Addition of ethical considerations to all material preparations (included in the plans for preparing, tracking and monitoring dissemination events).

Till this moment no specific ethical concern has been detected from the aforementioned list. All the exchanges of documentation have been done under optimal privacy conditions and the team does not consider any violation of privacy or personal data misuse have been produced.

PIXEL Ethics Mentor (see deliverable D1.4) supervised processes of information exchange, survey preparation, mailing list of the project through the website and was also aware about the data set to be collected in further stages of the project. No personal data issues have been detected.

According to D1.1, any interview and communication that has been done to external people (in WP5, WP8 and WP9 mainly) has been anonymised and only aggregated data has been used to create PIXEL documentation (e.g. D9.4 – social media interactions, events presented, etc.). For the results of the survey framed in task T5.4, the results are being discussed within project members mentioning the ports that have participated. This is being done under privacy respect and only anonymised results will be included in the reports to be generated.

No official meetings were conducted with the Advisory Board during the period of interest (whereas particular communication and consultations were actually performed), so no special concern about ethics has raised. However, data exchange with the AB has occurred always under optimal ethical awareness.

Pilot trials are at an intermediate phase of execution. However, up to the moment no Human information might have been processed. Special attention has been put to the collection of passengers' vessels data in the port of PPA. The information that is being collected in PIXEL does not include any personal information, as the only relevant data for the purpose of the project is to track the total of passengers in the different cruises. This will be properly reflected as well in the deliverable D2.4 in the next reporting period. The rest of data being integrated for the other pilot deployments do not entail the use of personal data.

With regards to topics covered by D1.2, the PIXEL Information Hub and PIXEL ICT infrastructure have been developed and are currently installed (WP6 and T7.1) and in deployment and use (WP7) phase. Regarding the platform, it is currently being installed in the port premises (virtual machines in own servers) where all data is being managed under a single-instance framework – meaning that all modules, handling information from different ports, are being run in different, mutually unreachable, computing locations. This means that no pilot port in PIXEL could ever have access to the data that is being collected and processed by in the other ports. However, there was also devised one multi-instance installation of PIXEL – in a test environment that was called "demo" and that inherits the structure used till now (see D2.7) – where different functionalities may act over data from different sources from different ports under the same computing space. This was specially analysed by the EM as it may involve some GDPR issues such as privacy of data. However, no personal data has been exchanged beyond the explicit mention of the code of the port from where the data is arriving – e.g. GRSPK, PMBOD. No specific complain was done by the partners on this regard. This has been corroborated.

Regarding D1.3, till the moment no risk assessment has been needed related to health and safety procedures in the project. If this happens in the future, the mechanisms established in deliverable D1.1 will be put in practice.

For future actions, several ethical concerns will be tracked and correspondent consent forms will be delivered for complying with PIXEL procedures:

- External experts to be contacted for "weighting and providing relevant inputs" about PEI's eKPIs. This will require a careful analysis from the ethical point of view and the proper forms and templates will be asked to be fulfilled. Eventual personal information will be anonymised and forgotten as well.
- Intervention of external agents (and people) to participate in PIXEL via the Proof of Concept (task T8.4) will also be analysed through the ethical perspective and the proper procedures will take place.
- Continuous work as in the points above.

2.2.1.4. Results after M25-M30

- Confirmation of appropriateness of procedures established by D1.1, D1.2, D1.3, D1.4 and D1.5
- Review of the contents of the amendment from the Ethic compliance perspective.

- Analysis of the Ethic implications of the project extension and the addition of the new task T7.7 for conducting a COVID-19 pilot.
- Analysis of possible GDPR and personal data concerns of the data to be handled in the new COVID-19 pilot.

2.2.1.5. Deviations

So far no deviations have been detected.

2.2.1.6. Corrective actions

No corrective actions are required

2.2.2. Work Package 2 – Work plan, coordination and document management

Universitat Politècnica de Valencia (UPV) as Project Coordinator (PC) has been leading work package 2 (WP2), and the five tasks in which the WP is divided. As a project coordinator, UPV has carried out the majority of the activities within the task. The management work from month M1 to month M30 of the project has been one of the most time-consuming and effort-spending items in the day-to-day work.

The first thing to emphasise about this reporting period in the whole project is that the plans were significantly affected by the current situation caused by **COVID-19**. This has led the PC (agreed by the rest of the partners) to request a 5-months project extension for PIXEL.

Additionally to the 3rd Technical Meeting (previous reporting period) - that was held under virtual fashion in the month of April - the 5th Plenary Meeting, that was supposed to take place in Monfalcone-Gorizia in the month of July, was also held virtually.

Additionally, the COVID-19 restrictions have been affecting the partners during this whole reporting period. Many of the risks COVID-19-related that were identified at the end of the last reporting period have been materialised. All ports have experienced difficulties to access to their premises, not being able to keep the sensors installation pace neither the expected time to be devoted by staff. Communication between technical partners remained fluent even though the finalisation of WP6 demanded extra time devotion at the expense of WP7-T7.1 integration and installation.

Apart from that, most remarkable actions in period M25-M30 have been: (i) to organise and prepare all the documentation to launch a new amendment (#2) to the Grant Agreement request, (ii) to organise project meetings and coordinate the whole technical deployment, (iii) to prepare the leaving of two members of the AB and the incorporation of one new member, (iv) to continuously assess project risks and (v) to oversight the data being integrated in the pilots for its Ethics and DMP-compliance analysis. The project consortium has generated two deliverables in this second period, associated with WP6 (2), whose quality control has been performed following the project handbook procedures.

2.2.2.1. Summary of progress in previous periods

Progress by task

Task2.1: Work plan, coordination and document management

The task manages project planning and coordination. By M24, all WPs had started while WP3 and WP4 were closed, all the activity had been executed as expected with minor delays and deviations that had been solved as they had been detected. Different management tools were deployed: (i) Onlyoffice for calendar, information repository and management procedures; (ii) JIRA for VOLERE methodology support and risk management; (iii) mailing lists and reporting; and software repository tools (GIT). For internal communication and adequate interaction between the partners, the project has already held (till M24) ten meetings (plenary and technical) during the period under review:

- Brussels (Belgium), 3-4 May, Kick-off meeting
- Bordeaux (France), 12-14 Nov 2018, Technical meeting
- Valencia (Spain), 11-12 Sept 2018, Plenary meeting
- Piraeus (Greece), 5-6 February 2019, Plenary meeting
- Valencia (Spain), 21-22 May 2019, Technical meeting collocated with Advisory Board meeting
- Ljubljana (Slovenia), 11-13 Sept 2019, Technical meeting
- Thessaloniki (Greece), 5-7 Nov 2019, Plenary meeting (not part of this reporting period)
- First Periodic Review (RP1) took place on February 22nd and 23rd in Brussels

- Code-camp for software development and Agile Integration alignment, in Valencia, on 2nd, 3rd, 4th and 5th February 2020
- Virtual, 31st March – 2nd April 2020, Plenary meeting (virtual, held via teleconferences)

The project has held biweekly teleconferences since the start of the project, using ISL tool provided by XLAB, additional telcos to handle specific issues have been also scheduled.

The PIXEL project has been interacting with the Port of the Future network and its associated projects (Corealis-RIA, PortForward-RIA, DocksTheFuture-CSA). Activity related with this network has been:

- Participation in monthly telcos.
- Participation in the DocksTheFuture Workshop in Porto, 29-30 October 2018
- Participation in the DocksTheFuture Mid-Term conference in Trieste, 3-4 Abril
- Participation with the PoF network in the European Maritime Days (Lisbon), 16-17 May 2019
- Participation by helping in the construction and testing the DSS tools created by DtF, April 2020

Quality control is a task performed in the framework of this task, as indicated in the project handbook. All project deliverables are reviewed project-internally by two persons, who have not contributed to the deliverable itself (as far as possible) in order to ensure that project deliverables are of the best possible quality and that they are consistent in its content (an internal planning and schedule has been organised for such reviews). In turn, the deliverable editor performed the reviewer's suggestions and requested – if needed – extensions within 2 weeks after internal review submissions. In addition, all deliverables have been read and commented on in parallel to those experts' reviews above by the technical manager and coordinator, too.

Additionally, during the previous period one activity that was conducted was to create and appoint specific task forces to address issues of the project execution. 1. Agile methodology (by sprints) for development and integration.PRO leads this task force; 2. Assignation of technical experts to different pilots in order to establish a parallel tracking and execution of the deployments (one port – one pilot – one technical partner assigned); 3. Impact assessment and alignment with GA team, formed by CERTH and UPV.

Task 2.2.: Administrative and financial management

Administrative and financial management of the project has advanced as expected:

- Distribution of prefinancing was executed during the first month of the project
- The first official periodic review took place during the last reporting period
    - Preparation of the Project Technical Report for the mid-term review (M21):
    - Preparation, correction and supervision of the Financial Statements of the partners for the mid-term justification
    - Preparation of the mid-term review session in Brussels
- Distribution of the interim payment was executed by the Coordinator during the last reporting period
- The project has generated one amendment. The main reasons were:
    - To redefine the participation with ORANGE and its three linked third parties: ORANGE Consulting (OrangeC), ORANGE applications for Business (OrangeB) and Association images & research, as from 1 September 2018.
    - To change the PMs assigned to some partners (MEDRI, IPEOPLE), according to their current management situation to best accomplish PIXEL objectives. A proper justification was provided.
- Fluent communication with the PO of the project has been held: Mr. Sergio Escriba (M1-M24); No change of PO has been experienced during this period.

- In order to fix some mistakes in delivery dates and responsibilities of some deliverables (e.g. D8.3), work has been carried out to be prepared to an eventual final Amendment in the next period.

Task 2.3: Advisory Board Management

The PIXEL Advisory Board (AB) is intended to be a valuable group of experts related to various fields of knowledge that are willing to contribute to the success of the project. The main purpose of this venture is to gain feedback on several matters of the project from an external expert viewpoint.

The Advisory Board of the project was appointed during the first year of the project, and it includes 6 members in total, as presented in Table 2.

Table 2. Advisory Board members

AB member	Organisation	Field of expertise
David Bolduc	Alliance Verte (Green Marine)	Environmental aspects in ports
Rafael Socorro	ACCIONA	Innovation, infrastructure, IoT
Lucija Kolar	Complementarium	Marine environment
Charalampos Platias	Greek Ministry of Maritime Affairs	EU policies, administration
José Manuel García	Port of Valencia	Ports, infrastructure, innovation
Francisco de los Santos	Autoridad Portuaria Bahía Algeciras	Ports, infrastructure, innovation

Agreed procedures were followed to establish this structure of members. Technical, industrial and academic criteria have been applied in order to contact particular people who could contribute significantly to PIXEL. Thus, specialists for the main application domains of PIXEL were included in the Advisory Board: environmental impact in ports, marine environment, small and medium ports, innovative technology and IoT, integration, smart cities, and other related services.

Generically, AB members are expected to provide technical, ethical and legal guidance, input and feedback on the PIXEL industrial and technological roadmap, advise on links with relevant interest groups outside PIXEL, facilitate information about trends on technology and business models in the field and encourage interactions with other projects and initiatives.

The main format of collaboration among AB members and the PIXEL consortium has been set as by attending to meetings or workshops and interaction through e-mails with different bodies of the project. The initial planning for AB-PIXEL Consortium meetings was set as the following:

- **Virtual meetings**: Teleconference calls will be properly scheduled to keep track of advances and to get feedback and other contribution from AB members. Planned dates for these meetings were:
  - AB Welcome and Kick-Off collaboration – February 2019 (done)
  - 4th PIXEL Plenary Meeting – November 2019 (done)
  - 3rd PIXEL Technical Meeting – March 2020 (not done by M18)
  - 3rd PIXEL Workshop – November 2020 (not yet done)
  - 6th Plenary Meeting – March 2021 (not yet done)
- **Face-to-face meetings:** PIXEL plans to have two physical meetings with the Advisory Board, coinciding with Plenary/Technical Meetings of the project. Planned dates for these meetings are:
  - 2nd PIXEL Technical Meeting - May 2019 (done with attendance of 4 AB members)
  - ?? PIXEL Plenary Meeting – to be decided – due to COVID-19 effects.

Whenever an AB Meeting is envisioned, the agenda of the associated PIXEL Meeting will dedicate a single slot for this purpose. So applied for the face-to-face meeting in Valencia (May 2019). Every detail was announced and confirmed with enough advance (following article 6.2.2 of the Consortium Agreement). Travel expenses (except from non-EU countries) associated to attendance of these meetings are covered by the Project Coordinator (as it is indicated in the Grant Agreement).

During the M19-M24 period, the most relevant actions in this task were:

- Replace/maintaining two AB members because of change of company/position: Jose Manuel García left his position within the Port of Valencia to join one of the most important logistic companies in Europe: TIBA logistics. Due to the relevance of this company, and the willingness of Jose Manuel, this AB member was still considered relevant and was maintained in the AB of PIXEL. The same applies for Rafael Socorro, who changed his position (was promoted) within ACCIONA. He declared to have less time devoted to innovation and research but still enough to be useful and interested in PIXEL.
- Providing feedback of PIXEL by fulfilling the questionnaire that PIXEL members prepared in 2019

Task 2.4: Risk management and Quality Assurance

The Risk management strategy is considered an important issue in PIXEL, even if there is no specific deliverable dedicated for that. It refers to an ongoing activity of monitoring and assessing the work that is being carried out during the project, detecting and anticipating risks, and select the best strategy to manage each of them.

The criteria to classify and prioritize the risks follows the principles recommended by the Project Management Body Of Knowledge (PMBOK®) of the Project Management Institute (PMI). Frequent risk management telcos (twice a month, collocated with the plenary WP2 telcos) have been held in order to have tight control of the execution of the project. Additionally, WP leaders were encouraged to early detect the risks in their respective WPs and raise them in WP2 telcos. An informal work log has been maintained and the list of (foreseen and unforeseen) risks has been continuously updated in the EU Portal (SyGMa). Currently there were 22 foreseen risks and 10 unforeseen risks.

Risk management has been mainly led by PC and WP leaders, however the different members of the PMC have participated in risk management during the first 18 months of the project. During the different Advisory Board meetings (face-to-face, virtual) discussions about risks have been held.

This task, same as the others in work package 2, will last for the whole period of the project. Thus, some actions were undertaken during its first 24 months.

Particularly, the period M19-M24 was one of the most active one with regards to risk observation, assessment, mitigation and foreseeing for the future. A lot of work was carried out in the risks' task (T2.4), but the most remarkable effects will be associated to the actions following COVID-19.

Additionally, the identification of risks was slightly enhanced in M19-M24 through the analysis of the first tasks of the project (documentation procedures, communication strategy, etc). Furthermore, some mitigation actions that were previously designed have been implemented. For instance, several efforts have been done to maintain the work plan without major deviations, both in duration and in number of partners involved.

Task 2.5: Data and ethical management, planning and assessment

PIXEL advance the following from M1 to M24 on T2.5:

- Identification of data subject to protection
- Elaboration of Data Management Plan (D2.2 and D1.5)
- Data Protection Officer appointed in PIXEL has been working with the participants of task T2.5 to supervise and create the needed documentation to enhance data protection strategies.
- Forwarded information about data management plan and data protection to WP3 (requirements) and WP6 (data processing).
- Establishment of a template to describe the data sources of all types to be included within the DMP observance.
- Elaboration of the second version of the Data Management Plan (D2.3), following the FAIR data management principles, describing (following the established template) the different data sources of interest and identifying next data sources.
- Identification of the next round of data to be included in DMP further versions. This is a continuous work that draws from the observation (by UPV, PRO and other relevant partners) of: (i) day-to-day advances of the project, (ii) technical scope and the different data sources that are being incorporated to the platform at each moment, (iv) the requirements, (v) the available data sets from the ports being

integrated and used to generate and run the different technological tools of PIXEL, (vi) the market and state-of-the-art study and (vii) the global procedures on material generation in the project.

- Collection of details of the different (already known) data sets, advancing on its characterisation in order to fulfil the template for all identified data.

2.2.2.2. Summary of results after previous periods

Main results associated with the execution of the WP is the adequate coordination of the activities organised in WP that required an intercommunication between them. Main achievements:

- Execution of the different administrative and financial activities as required by the project.
- Deployment of the different collaborative tools in order to manage the execution of the project.
- Submission of the deliverables in due date, delays have always been justified and agreed with the PO after analysing the corresponding rationale, e.g. delay of 15 days of D4.1, delay of 2 months of D5.3
- Quality control of the deliverables and results of the project.
- Application of a risk management mechanism.
- Detection and analysis of risks in the project due to the COVID-19 outbreak and associated restrictions.
- Identification, analysis and prospect of data privacy and protection for the different activities of the project. Formulation in deliverables D2.2 and D2.3.
- Establishment of the AB and start of the interaction with it obtaining advice and guidance for the project.
- Deliverables submitted successfully:
  - Deliverable *D2.1 – Project management and quality handbook*
  - Deliverable *D2.2 – Data Management Plan v1*
  - Deliverable *D2.3 – Data Management Plan v2*
  - Deliverable *D2.5 – Project Management Report v1*
  - Deliverable *D2.6 – Project Management Report v2*
  - Periodic Project Report (PPR) for the First official Periodic Review covering the execution of M1-M18 of the project
  - Deliverable *D2.7 – Project Management Report v3*

2.2.2.3. Progress in M25-M30

Progress by task

Task2.1: Work plan, coordination and document management

The right functioning of a project often relies on a balanced coordination, taking into account the text of the proposal that has been funded and the daily activities that occur within it. In this regard, UPV is the Coordinator and UPV and, as WP2 leader, is the main executor of this task for PIXEL. Supported by other partners, if requested, UPV holds the responsibility of aligning the technical and social scope of PIXEL (according to the GA) with the day-to-day execution of the several tasks that take place simultaneously. At the same time, all the "logistic" of the project: enabling internal communication tools, being the interface for every request, etc. is covered within task T2.1

This task has been continuously performed during the whole reporting period. Regarding common tasks of coordination, a lot of activities have been undertaken, such as organising plenary telcos, creating and maintaining specific mailing lists, supervising the whole work execution, uploading documentation (deliverables) to the EC, ensuring a good communication among the partners, communicating with the Project Officer after proper requests and keeping track of the work plan, ensuring the proper pace of work looking for the sake of the project and having one meeting in which all partners reunited

Meetings

Like the previous period, as this period was also significantly affected by the situation caused by COVID-19, Instead of a face-to-face plenary meeting, a virtual meeting was held. The Virtual Plenary Meeting was held on 7th and 8th of July. **The 5th Plenary Meeting**, that was supposed to take place in Monfalcone-Gorizia in the month of July, was forced to be celebrated virtually. It took place via ISL teleconferences. The Project Coordinator prepared the meeting clearly indicating the partners that were explicitly needed in each session. The agenda was simplified to 1,5 days, maximising the benefits of simultaneous teleconferences taking place. It consisted of clearly organised sessions, encompassing most of work packages, some of them dealt with in parallel, with the special accent being on WP6 (as it was finished in the period shortly preceding the meeting), WP7, WP8 and WP9.

The issues discussed were useful to ensure a proper advance of the project. However, all the Consortium acknowledged the difficulties to carry out PIXEL works on a 100% remote fashion.

Reporting and documentation

With regards to the documentation, from M25 to M30 the common documentation repository was kept populated by all partners, while being created and maintained by UPV. Instructions for uploading, naming, placing and modifying the various document in the private server have also been followed by partners. Currently, more than 8 GB of original PIXEL documentation is already managed.

Periodic reports have been requested to all work package leaders. This method, that has been performed through several ways, is the approach selected to check the advance of the project. Altogether with bi-weekly telcos in which all partners participate. Biweekly management telcos are organised in alternative Thursdays, in order to solve any management issues, and every two telcos perform risk management activities.

Work plan

Regarding the work plan, the period M25-M30 has been intensive, especially due to the COVID-19 outbreak consequences: both difficulties and opportunities. Additionally, various WP leaders approached the PC with diverse requests/concerns about the project plan at different points, specially about cross-WP interactions, interdependencies and shared works that should be spotted under a clear task for the next months.

Project extension

The pandemic COVID-19 has affected greatly the capacity of PIXEL partners to normally conduct the scheduled activities in the work plan. After having analysed with the partners one by one the issues experienced to normally conduct research and management activities in PIXEL, these were the conclusions:

- Majority of partners are facing situations like having the staff working from home needing to take care of children (i.e. authorised by companies and national governments), deal with connectivity issues or not having at full disposal of material elements to conduct effective actions, for example ports have restriction access to many areas of their premises even for authorised people, the port of Monfalcone has even stopped all non-basic activities.
- Several activities are very limited as they require travelling and/or face-to-face interactions Dissemination activities (and the whole WP9) are hugely affected as all forthcoming events are being cancelled (among them, some of the most important for the project in its lifetime).
- Communication with external entities (e.g. Advisory Board, equipment providers) is more difficult and slower than usual, some of the providers have stopped activity till the end of the crisis (e.g. sensor vendors).
- Administrative issues in all entities are hampering to put PIXEL at the priority at certain procedures such as contracting or resources consumption. For example, telecom operators and public entities are redirecting workforce to network management due to increase in requirements to telework or public bodies cannot continue with contracting procedures.

Therefore,

a) as a complete lockdown has been maintained in Europe till May/June 2020, and while certain restrictions on mobility and on-the-field work still applied by August 2020 (M28) and beyond, and
b) drawing from the communication issued by the EC (through the FAQs section - https://ec.europa.eu/info/funding-

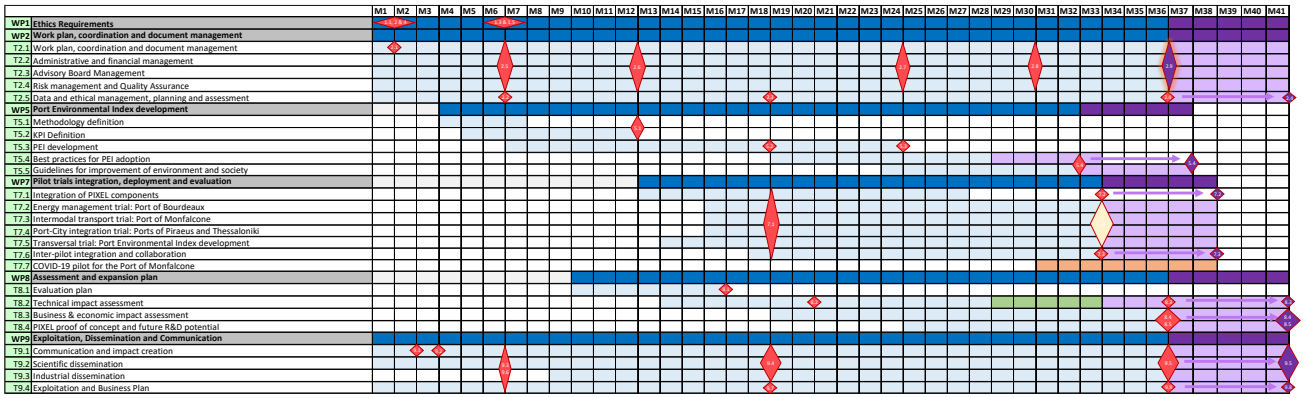
tenders/opportunities/portal/screen/support/faq/13117;grantAndTendertype=1;categories=;programme=H2020;actions=;keyword=COVID-19%20outbreak;period=2014-2020), any extension request of less than 6 months may be issued and should be granted if well-enough justified.

Then, the Consortium **decided to request for an extension of 5 months to the total length of PIXEL project**. This way, the project will end on its month M41, corresponding to 30th September 2021. Additionally to this request, the Coordinator kindly asked the Project Officer to accept some delays that were foreseen for the deliverables D4.4, D5.3, D2.7, D6.4, D6.5 and D7.2, that were being worked during the outbreak crisis.

This request was included (properly justified) in the amendment #2 that has been launched during this reporting period and is currently (31-October-2020) being analysed by the Project Officer and the EC Agency.

In case of being accepted, the Gantt diagram of the project will be as follows:

Table 3. New Gantt diagram in case of project extension and COVID-19 pilot acceptance



COVID-19 pilot: addition of a new task: T7.7.

According to the communication issued by the EC (through the FAQ - https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/support/faq/13119;grantAndTendertype=1;categories=;programme=H2020;actions=;keyword=COVID-19%20outbreak;period=2014-2020), a re-orientation of some project work could be accepted as long as it will be addressed to tackle the coronavirus crisis.

At this point, PIXEL analysed altogether with the Project Officer the possibility to introduce a new pilot in the project addressed to help maritime ports to improve prevention and management of pandemic situation.

Drawing from the previous, although not additionally funded, some PIXEL partners **decided to re-direct some of the current tasks of PIXEL to create a new pilot** addressed to help ports coping with COVID-19 restrictions. The idea was to leverage as maximum as possible what has been already developed in PIXEL.

Several options were slightly described and analysed during the months of May and June, and after a poll and communication exchange, 7 partners agreed on executing a pilot. This pilot will be deployed used the Port of Monfalcone data and contribution and will be focused on the PAS model results (already available developed in PIXEL). The plan is to begin the development of this pilot in October 2020. As per the work plan, this pilot is requested to be organised under a new task in the WP7 (T7.7) to be named *COVID-19 pilot for the Port of Monfalcone* and to be led by UPV.

The Consortium devised a task structure for this pilot, including the associated shift of resources that will be needed. The task structure and the PM shifts have been communicated to the EC via the amendment #2 launched during this reporting period. In case of being accepted, the consequences in the work plan (creation of task T7.7) can be observed in Table 4.

The pilot has started (planning, initial works expecting the proposal to be accepted) by 1st October 2020 (M30).

Spotting shared responsibilities

During this period, some key tasks in WP5 and WP6 have finalised. During their execution, some activities were needed to be carried out that were not (initially) specifically written as part of the GA. However, those are

mandatory for the proper conduction of the pilots, their demonstration and evaluation. Therefore, once those tasks were formally over according to the work plan, the WP leaders asked the PC and TC to find a formula to frame those works to be kept carried out. Those activities can be considered "transversal", that will be taking place while the pilots will be running:

- Development of NGSI agents. This activity has been conducted in task T6.2 despite not being its main purpose. Once the DAL module and the DAL orchestrator module are ready to be integrated, T6.2 can be considered finalised. However, the development of NGSI agents is mandatory to allow the pilots in WP7 to run. Therefore, it was decided to frame this activity distributed in different WP7 tasks. A detail of this distribution can be found at section 2.2.7.6.
- Fine-tuning, software results and testing and validation of the PEI inner calculations. Whereas the process of conversion from raw data into eKPIs for PEI computation was defined in the deliverable D5.3, its technological materialisation depends of: (i) each port, (ii) each data source in each case, (iii) other configuration data. This was not possible to be framed within WP5 because of: (i) not originally contemplated in its scope, (ii) the duration of the WP does not allow to carry out this task and (iii) skills of the WP5 team are not oriented to piloting and software integration. The key idea in this activity (see deliverable D5.3) is to embed those data conversions into NGSI agents -various per port- and store the information properly. Additionally, the different processed cannot be validated until they have been tested with the real data of the ports during certain time, which must be conducted in the piloting phase. **Therefore, this activity is framed within task T7.5.**

Supervision procedures

Coordination methods established and used by the Coordinator are being followed by WP leaders partners to manage internally the advance of particular WPs. For instance, bi-weekly/monthly periodic telcos and a monitoring sheet with pending issues and most urgent tasks to be done.

A new supervision procedure has been devised and installed during M25-M30 period. The Project Coordinator and the Technical Coordinator reunited repeatedly to outline a plan for pilot monitoring and validation. This was driven by the need of aligning: (i) technical coordination of WP7, (ii) global technical coordination, (iii) integrating results from WP6, (iv) assessing risks of potential delays in pilots, (v) avoiding additional cascading effects for WP8 and (vi) adjusting to potential new deadlines due to the project extension.

A brief summary of this new supervision procedure can be found at section 2.2.7

Task 2.2.: Administrative and financial management

In task T2.2 the administrative issues generated and specially those related with the EC have been addressed. In the following paragraphs there are some details about the main activities in T2.2 during M25-M30 period:

- **Interim mid-term payment procedure** execution (and solving of issues): As soon as the mid-term payment from the EC was received by the Project Coordinator (UPV) – at the end of M23 – the mechanisms were started in order to proceed with the payment to the partners. Several issues were experienced as there were various internal agreements made during the period that need analysis of the amounts to be forwarded. By month M25-M26, the procedure was finalised and UPV proceed with the procedure. Some weeks after, it was confirmed that all partners received their corresponding amounts. UPV kept, during all the process, a transparent communication to all the partners about the status.
- **Amendment:** Partners discussed different options and items to be included in the request, such as a project extension -duration decided in a PCC session- and the creation of a new task in WP7. The PC centralised the requests and proceed to the submission to the EC. The need of this amendment was already discussed with the Project Officer several months ago. The items that were finally included in the amendment were:
    - Changes requested by partners, including modifying structure of key personnel in Section 4, change of names and logos of partners or budget distribution.

- Internal agreements taken place between partners with implications on PMs and budget.
- Correction of some typos in the GA: in deliverable names, in task duration, in partners'participation, in the main text, etc.
- Duration of tasks and deliverables in WP7 and WP8 to keep consistence.
- Request the introduction of a new task (T7.7) to conduct the COVID-19 pilot.
- Request a 5-months project extension

The status of these requests is currently "under revision" by the EC. Some of the points above may be accepted and other may be rejected. Additionally, it is foreseen that some of the requested changes will be put on hold to be justified in the next official reporting period.

Besides this, in the context of T2.2 several internal reporting actions have been conducted. Both technical and financial reporting was request to all partners to keep track of a proper use of resources since the very first stages of the project. As it is commented in the last section of this deliverable, no relevant deviations in the resources consumption should be mentioned up to now.

Task 2.3: Advisory Board Management

The PIXEL Advisory Board (AB) is intended to be a valuable group of experts related to various fields of knowledge that are willing to contribute to the success of the project. The main purpose of this venture is to gain feedback on several matters of the project from an external expert viewpoint.

This period (M25-M30) has been characterised for its focus on internal management, issues related to COVID-19 and little dissemination opportunities. Considering the previous, it was foreseeable that M25-M30 should be very active with regards to the Advisory Board Management and associated actions with the members. Additionally, the crisis is affecting all the companies in Europe and the AB members were not as available as in the past. Besides, WP2 team decided to maintain the strategy of not harassing the AB members on expected feedbacks from them during this period.

However, a continuous monitoring has been kept from the Coordination team by fostering a periodic communication with the members of the Advisory Board. Furthermore, several actions can be remarked. The following have been performed, mainly, by the leader of the task:

- Confirming the withdrawal of one AB member: David Bolduc. This was caused by his need of time devotion to internal operation in Green Marine and consultancy works. Mr. Bolduc properly informed (by May 2020) the Project Coordinator about this decision.
- Incorporation of a **new member to the Advisory Board** to replace the vacancy. Certain criteria were considered:
  - PIXEL would benefit from some contribution by policy-oriented entities
  - The new member should already be familiarised with PIXEL findings and objectives
  - The new member should show an interest in PIXEL
  - The new member should
  - One of the most attractive traits of PIXEL is the target to small and medium ports and the port-city integration flavour of several pilots. A port-city orientation should be boosted towards the end of the project

  Drawing from the previous, the person selected was **José Sánchez, from AIVP**[1]. Dr. José M P Sánchez is international project manager in AIVP (International Association Cities and Ports). He is responsible for the development of the AIVP Agenda 2030, co-managing the Port Center Network and the Expert's Network, and coordinating content on port city community and environmental affairs. In 2019, he completed his PhD in Hamburg's Hafencity University focused on sustainable port-city relationships. In his research career he received different grants to pursue his investigation from organizations such as the Übersee-Club from Hamburg or the Cusanuswerk

[1] http://www.aivp.org/en

Studientstiftung. José M P Sánchez is also an architect since 2011, when he finished his Master at Lisbon's Technical University, earning the Top 20 Master students' award. Previously, Jose Sánchez has worked as an architect in renowned practices, and as independent consultant, lecturer and researcher. He is also the author of the blog theportandthecity.wordpress.com, where he shares his views on port cities.

- Plans for the next period:
  - The main format of collaboration among AB members and the PIXEL consortium will be by attending to meetings or workshops (now, only virtually) and interaction through e-mails.
  - Virtual presence of the members of the AB as soon as vis-à-vis meetings will be able to be conducted in Europe. There were plans to hold a physical meeting with the Advisory Board members during this reporting period, but the COVID-19 mobility restrictions prevented this from happening.
  - Organisation of a workshop to show to the AB members the current status of PIXEL tools, models, visualization, etc. Huge advances have been done so the feedback to be received afterwards will be very useful to fine-tune PIXEL assets.

Task 2.4: Risk management and Quality Assurance

This task, same as the others in work package 2, will last for the whole period of the project. Thus, some actions were undertaken during the period M25-M30 of the project.

Particularly, this period was one of the most active one with regards to risk observation, assessment and (especially) mitigation. A lot of work was carried out in the risks' task (T2.4), but the most remarkable effects were associated with:

a) the actions following COVID-19.
b) the different delays taking place at various points of the project, producing cascading effects
c) compliance with the work plan

During months M23-M24 (outbreak of the epidemic), different risks for current and forthcoming activities were identified. The most intensive activity in T2.4 has been to track and assess those risks and observe whether they have been materialised or not. Additionally, for those materialised, a series of mitigation actions have been put in place. A report on this activity can be found at section 4.

Additionally, a whole new set of risk have also been identified during M25-M30 period. Those risks have been analysed using the consolidated procedures agreed for PIXEL. Due to the current point of execution of the project, the most relevant risks identified are associated to WP7 and WP8 , regarding the deployment of PIXEL in real ports and the impact that the different functionalities will have both for the ports and the society.

All risks have been duly registered and formalised by their introduction on the "Continuous Reporting" tool in the online area of Sygma (Funding and Tenders' portal private space).

Regarding quality assurance, the process defined back in the first period for the quality review has been followed in all those deliverables that have been elaborated in M25-M30. Particularly, despite of being due to the previous reporting period, deliverables D4.4 and D5.3 have passed through the quality assurance process (Internal Review plus Innovation Review, meeting certain timing). Deliverable D2.8 of WP2 (this document) has followed the usual review circuit as well. These have been actions for both quality and risk mitigation.

Task 2.5: Data and ethical management, planning and assessment

The activities have been the following, which mostly coincide with the last reporting period (continuous activities):

- Identification of the next round of data to be included in DMP further versions. This is a continuous work that draws from the observation (by UPV, PRO and other relevant partners) of: (i) day-to-day advances of the project, (ii) technical scope and the different data sources that are being incorporated to the platform at each moment, (iv) the requirements, (v) the available data sets from the ports being

integrated and used to generate and run the different technological tools of PIXEL, (vi) the market and state-of-the-art study and (vii) the global procedures on material generation in the project.

- Collection of details of the different (already known) data sets, advancing on its characterisation in order to fulfil the template for all identified data. Specifically, details are being fulfilled of the next sets:
  - Raw data from own sensors
  - Observational data from own web services
  - Observational data from external services
  - Results generated from model and PEI calculation
  - Guidelines and recommendations related with the PEI adoption
  - Historical data collection and processing for model training
  - Data predicted generated after execution of predictive algorithms
  - Pictures of PIXEL members presenting at events:
  - Pilot deployments in the four ports participating in PIXEL
  - New COVID-19 pilot

Table 4. WP2 Partner contribution summary table

Partner	Contribution

P01 UPV	• Coordination of the project.
	• Administrative tasks
	• Leading management (WP2) and taking care of the coordination of the project, with definition of all procedures, setting up of the repository and other necessary day-to-day resources
	• Writing of D2.8
	• Advisory Board management:
	  ○ Arrangement of meetings and other agreements
	  ○ Arrangement of the incorporation of a new member in the Advisory Board to replace the outgoing members.
	• Organisation and lead of PCC sessions regarding project extension and COVID-19 pilot
	• Act as the intermediary for all communications between the beneficiaries and the EC
	• Implement quality procedures for the project
	• Administration of project resources including budget-related issues
	• Financial management including distribution of payments to the beneficiaries
	• Facilitate communication within the consortium on administrative matters
	• Consolidate project's deliverables and reports and maintain Quality Assurance including submission to the EC
	• Leading the 5th Plenary Meeting (virtual) in July.
	• Organisation of different sessions for technical advance the virtual meeting in July.
	• Create, update and maintain the control and official documents, thus keeping track of the WP activity
	• Organisation of bi-weekly Plenary Telcos
	• Lead the risk identification and mitigation process
	• Lead the documentation preparation for amendment #2, including:
	  ○ Preparation of COVID-19 pilot description
	  ○ Preparation of 5-month project extension justification

	• Taking the lead, describing and starting the new task T7.7
P02 PRO	• Supporting Coordination in its majority of tasks from their position of Technical Coordinator • Supporting Coordination specially in Risk detection, mitigation and taking actions • Organisation of different sessions for technical advance in the virtual meeting in July 2020. • Assistance to the preparation of PCC telcos. • Usual actions corresponding to a WP leader (WP7) • Devise of a specific methodology to track and validate the pilot results in coordination with the Project Coordination partner (UPV) • Oversight of proper technical advance of the project, acting as a technical leader in several occasions in different work packages • Collaborate in the documentation preparation for amendment #2, including: o Preparation of COVID-19 pilot description o Preparation of 5-month project extension justification
P03 XLAB	• Collaborate in the documentation preparation for amendment #2, including: o Preparation of 5-month project extension justification o Other relevant aspects
P04 INSIEL	• Collaborate in the documentation preparation for amendment #2, including: o Preparation of COVID-19 pilot description o Preparation of 5-month project extension justification
P05 CATIE	• Attendance to all Plenary Telcos. • Attendance to PCC telcos. • As WP leader contributes to risk management and quality assurance. • Collaborate in the documentation preparation for amendment #2, including: o Preparation of COVID-19 pilot description o Preparation of 5-month project extension justification
P06 ORANGE	• Advisory board member and global follow-up (Task 2.3 and 2.4) • Supporting Coordination specially in Risk detection, mitigation and taking actions • Usual actions corresponding to a WP leader (WP6) • Coordination of the administrative finalisation of WP6 • Collaborate in the documentation preparation for amendment #2, including: o Preparation of 5-month project extension justification
P08 MEDRI	• Supporting Coordination specially in Risk detection, mitigation and taking actions • Usual actions corresponding to a WP leader (WP5) • Administrative and financial management: contribution in administrative issues, including the active contribution on the preparation of the amendment #2 with regards to budget rebalance. • Performance of a budget rebalance request including a reallocation of person/months, contracts and documents for two new staff members and the needed adjustments to deal with the 5-months project extension.
P09 SDAG	• Collaborate in the documentation preparation for amendment #2, including: o Preparation of COVID-19 pilot description

	○ Preparation of 5-month project extension justification
P12 ASPM	• Collaborate in the documentation preparation for amendment #2, including: ○ Preparation of COVID-19 pilot description ○ Preparation of 5-month project extension justification
P14 PEOPLE	• Collaborate in the documentation preparation for amendment #2, including: ○ Preparation of COVID-19 pilot description ○ Preparation of 5-month project extension justification
P15 CERTH	• Supporting Coordination specially in Risk detection, mitigation and taking actions • Usual actions corresponding to a WP leader (WP8) • Collaborate in the documentation preparation for amendment #2, including: ○ Preparation of COVID-19 pilot description ○ Preparation of 5-month project extension justification

2.2.2.4. Results after M25-M30

Main results associated with the execution of the WP is the adequate coordination of the activities organised in WP that required an intercommunication between them. Main achievements of the period M19-M24 have been:

- Description of the new task T7.7, establishment of a workplan and introduction in the global timeplan
- Discussion, preparation and formalisation of list of topics to be included in the amendment #2 and official request to the EC.
- Preparation of justification and formal request to obtain a 5-monhts extension of the project.
- Inclusion of a new member in the Advisory Board in substitution of two leaving members.
- Submission of the report deliverable (D2.8) reflecting the reality of the project at this moment.
- Quality control of the deliverables and results of the project.
- Request of amendment #2 prepared and launched
- Deliverables in this WP successfully submitted:
  - *D2.8 - Project Management Report v4*

2.2.2.5. Deviations

No significant deviations have been produced in the execution of the work package.

According to the observed in the previous reporting deliverable (D2.7), the COVID-19 outbreak is having effects in PIXEL. Apart from the outlined in the Task T2.4 description, two aspects were included in the amendment #2 request that may be considered a deviation:

- Project extension of 5 months
- Addition of one task in WP7 (T7.7), that has driven some partners to adjust their personnel efforts allocation.

2.2.2.6. Corrective actions

1. Amendment has been launched (currently in discussion with the Project Officer) to correct and formalise the previous.
2. See in task T2.4 that several mitigation measures have been put in place to cope with some risks (due to COVID-19) that have been materialised in this reporting period.
3. A more thorough analysis of the resources spent by the partners has been performed by the Project Coordination partner. Results and conclusions from that analysis can be seen in Section 6.1.

2.2.3.Work Package 3 – Requirements and Use Cases

Having lasted from month M1 till M12 of the project, the project team considered the tasks duly conducted and the inputs needed for further work properly provided.

WP3 has been in charge of gathering and defining the set of technical requirements for the development of PIXEL solution and for each of its core components and use-cases scenarios. For this purpose, the specific objectives have been to analyse the market of current port, environment and operational data integration, related technological enablers and to describe thoroughly scenarios for the use cases that will take place via four pilots, involving all the relevant actors, goals and processes. The specific objectives of the WP were: (i) to provide a state of the art and market analysis in the areas targeted in the project, especially on environmental factors and impact in multi-modal transport models in present-day ports, (ii) to identify and analyse ports, agents, stakeholders and different actors involved in each use-case addressed in the project: Monfalcone, Bordeaux and Piraeus-Thessaloniki, (iii) to adequately formulate, gather and analyse requirements from targeted pilots, and other involved actors to characterise PIXEL, (iv) to track requirements through different stages of the process, (v) to identify and design suitable business models for the PIXEL solution, (vi) to establish knowledge sources, representation, management, and potential to each tool and outcome, (vii) to analyse legal and regulatory requirements that will be relevant to PIXEL pilot deployments and (viii) to propose PIXEL architecture and accompanying specifications via requirements specification.

During the second management reporting period (M7-M12) the work package was finished according to the expectations and involving all needed partners and agents to meet the objectives. However, the execution has not been free of hindrances and barriers that have been overcome.

Initially, the deliverable D3.1 was catalogued as a shortcoming from the Consortium after its first internal draft delivery. Issues arose with regards to this deliverable were centred on the lack of coordination, alignment and managerial disagreements between the deliverable leader (IPEOPLE) and Project Coordination. For this reason, the consortium decided (via a binding PCC session celebrated according to procedures set in GA and CA) to revert the situation taking some measures that ended up, among other actions, on the partner IPEOPLE changing its assigned team to PIXEL. After this PCC session, a new ToC and first approach for D3.1 was proposed by the Consortium and partners such as PRO, XLAB and UPV assisted the newly appointed team of IPEOPLE in order to overcome the situation. This redounded on a delay on deliverable submission but with a clear consciousness of quality and with proper production of this important asset of the project. To sum up, the process of writing D3.1 was altered by certain internal reasons but the Consortium was able to revert the situation and to culminate the work without affecting further tasks nor diminishing the scope of objectives of the work package.

Regarding the analysis of use-cases and scenarios, the Consortium made an outstanding effort to create deliverable D3.4. After submission of deliverable D3.3, partners realised that several challenging tasks were to be done in order to meet the expectations and to provide a solid and useful manual of scenarios and use-cases. Particularly, following the workplan set from D3.3 to complete D3.4 guided partners to create the document, besides including other documentation for more clear input to WP4 and WP6: use-case diagrams, user stories, scenarios definition, available/needed data, environmental and modelling questionnaire and clear expected outcomes.

Finally, the main action of requirements gathering and wrapping was performed. Following the Volere methodology and the particularised procedure established at the beginning of the project (detailed in deliverable D3.2), different partners were assigned to conduct: (i) requirements creation, (ii) stakeholder validation, (iii) technical validation and (iv) final set of requirements definition. This process has been strongly enriched by the action of most of partners making an effort to align the requirements with their own responsibilities in other WPs. For instance, technical partners specialized on tasks from WP6 have reviewed the JIRA platform and provided view and contributions to align all current contents and mapping objectives to particular requirements. On the other hand, for accomplishing a full coherent delivery of D3.2, the task leader (INSIEL) decided to set specific sub-teams to be in charge of ensuring consistency of requirements related to use-cases, guaranteeing that the same essential information is covered by the main documents describing their purpose: D3.3, D3.4, D4.1 and D3.2.

With regards to the period M25-M30, the WP3 did not execute any task per se, with the exception of a continuous monitoring of legal issues (T3.2) and the surveillance of stakeholders market linked to the exploitation activity in T9.4.

The RoI discussion, that involved the re-submission of D3.1 in the period M19-M24 in task T3.1, has now been completely translated to the task T9.4.

There is nothing to report about WP3 during this reporting period.

The Consortium considers that **this WP has not suffered any negative impact** neither collateral effect because of the COVID-19 outbreak, as all the activities were finalised before the epidemic crisis.

2.2.3.1. Summary of progress in previous periods

WP3 activity started at the very beginning of the project. All ports were very soon encouraged to analyse their own scenarios, their goals and expectations (after the text submitted in the proposal) and to start gathering as most information as possible to enrich the input to be provided to the other technical work packages.

In the first 6 months of the project, all the tasks within WP3 started and provided tangible results to the project. Here below the main achievements of each one of them in the previous period (M1-M6) is described:

Progress by task

Task 3.1: Market study with stakeholders

This task consisted of:

- Analysis about the previous and current research Projects (FP7 & H2020) that have similar focus and objectives with PIXEL
- Analysis of 16 ports for the identification of the most important trends that affect the Port Operations, namely in the area of port efficiency and connected logistics
- Creation of a Market Analysis out of the two latter activities
- Struggles with finalizing D3.1 due to difficulties in obtaining the necessary data from the various sources that were decided to be used to elaborate the deliverable
- Desk research
- In-depth interviews with market experts
- Interviews with PIXEL stakeholders and use-case pilots host partners, users' surveys and Workshops
- Market studies & reports analysis

Despite of task T3.1 finalising on month M6 of the project, the Consortium felt necessary to continue some associated work. Analysing the market, PIXEL's position and the current status of the art with regards to ports' realm must be a continuum to achieve project aims. Market studies & reports analysis, Desk research and future Innovation potential of PIXEL on ports' market will be further assessed through task T9.4. Results on these activities will be delivered within its associated documents

Task 3.2: Regulation, Policies and Recommendations

This task has been executed since month M1 and concluded in M9. According to the team the activity has concluded by continuing the work expected from GA and D3.3.

This task consisted of:

- Elaboration of a questionnaire distributed among the partners to gather the proper
- Rough identification of regulations applying to the use-cases and provision of information for deliverable D3.3
- Set of a roadmap of actions to perform with regards to legal regulation on ports affecting PIXEL

- All partners made an extensive effort of identifying and reporting their corresponding regulations in the areas of: Environment (waste, pollution), transportation legislation, safety and security legislation, GDPR, ISO certification and Quality control policies relevant to the project activities in the port pilot areas
- Description of the main European directives, legislation framework in specific port operation relevant areas
- Elaboration of a a comprehensive and detailed list of related compliances each port needs to cope with (according to its specific use case) and a definition of international and national regulatory bodies to be following to.

Task 3.3: Use cases and scenarios definition for port environmental issues

This task was continuously performed during the period M1-M12, and it was finished in M12. The main activities undertaken in the past reporting period were:

- To define the structure of the first deliverable (D3.3 - "use cases and scenarios manual v1").
- Work from ports within PIXEL to describe their use-case following the template and to explain their current situation
- Final version of the first deliverable (D3.3)
- After the submission of D3.3 in month M6, during the first part of this second period (M7-M9) the Consortium focused on build over it to create the next iterative version: D3.4 – Use cases and scenarios manual v2.
- Continuous discussion between ports and technical partners of PIXEL to analyse the objectives and final achievements and how to be reached, always having the Description of Action as a reference.
- To provide a final detailed description of the use-cases that form part of the project, the data that will be used, the user-stories to be followed and the different actors intervening.
- All use-cases were divided in different user-stories that were listed (using unique identifiers) that will serve to track down each objective/function required by the port during the whole project.
- To provide a complete set of input parameters to WP4, WP5, WP6 and WP8 about what needs to be developed to meet use-cases objectives.
- To provide a baseline to generate final requirements in T3.4 for covering “functional requirements” set.

Task 3.4: Requirements specification

This task was continuously performed since M1 and finalised in M12. The main activities undertaken in the past reporting period were:

- Identification of the methodology to apply to collect and manage requirements (VOLERE)
- Customization of the methodology to PIXEL nature and creation of a template for inserting requirements
- Selection and customization of a prioritization methodology (MosCoW)
- Creation of a template (and introduction of the template in the JIRA flow) to introduce the requirements.
- Design of a workflow to manage and monitor the status of the requirements, with the possibility to create some macro categories of the requirements status.
- All requirements (functional and non-functional) were identified by pilot and technical partners, with the support of all project partners, that will guide the next technical stages of PIXEL
- Performance of an iterative process to improve both quality and soundness of collected requirements.
- Prioritization of all the requirements collected (more than 100) using the MosCoW methodology.
- Legal compliance and issues have been considered as part of T3.2 in order to identify and describe related non-functional requirements. In particular impact of GDPR on proposed use-cases has been evaluated
- Writing of deliverable T3.2.

2.2.3.1. Summary of results after previous periods

The main results that we have obtained in the context of WP3 are the following:

- First approach to the use-cases manual
- Template for the creation of a requirement and design the process of creation, refinement and approval of a requirement. Selection of JIRA for creating and managing requirements
- Training video for PIXEL partners so that everybody is able to insert/correct/accept the requirements; depending on the stage of the requirements process that they must act.
- Market Analysis document created (part of D3.1)
- Full definition of set of functional and non-functional requirements of PIXEL.
- Full analysis of market and of environmental aspects for ports addressed by current initiatives, as well as existing business models and status of the port business.
- Final description of use-case and scenarios, providing a useful baseline and guidance for forthcoming technical development both for WP4, WP5 and WP6.
- Deliverables submitted successfully:
  - Deliverable *D3.3 – Use cases and scenarios manual v1*
  - Deliverable *D3.1 – Stakeholders and market analysis*
  - Deliverable *D3.4 – Use cases and scenarios manual v2*
  - Deliverable *D3.2 – PIXEL Requirements Analysis*

2.2.4.Work Package 4 – Modelling, process analysis and predictive algorithms

WP4 started on month M4 and has finished by the end of the last management reporting period (M24). The first three tasks (T4.1, T4.2 and T4.3) were finished by M18 and all management and execution details were provided in the Periodic Technical Report submitted before the mid-term review that took place on January 2020 (M21). During the last reporting period, the task T4.4 was finished successfully and the associated deliverable (D4.4) was submitted to the EC by April 2020.

WP4 goal has been to provide several Modelling and Predicting Tools to PIXEL. Actually, WP4 has developed models, data analysis and algorithms in order to manage port efficiently and adapted to the environmental stakes. To do this WP4 has considered the environmental impacts identified in WP5 as necessary to the Port Environmental Index in order to provide metrics. Then in WP6 (especially in T6.4 Pixel Operational Tools) those models, data analysis and algorithms have been implemented to be used via the Operational Tools. Currently, all models and predictive algorithms developed are being integrated in real deployments in WP7.

Together those operational modelling (WP4) and operational (WP6) tools constitute a decision support tool providing a useful and transversal knowledge for cargo operational management. It will allow operators to evaluate the environmental impact of any activity scenario, and to compare them for an optimal choice regarding environment.

The Consortium considers that **this WP has not suffered any negative impact** neither collateral effect because of the COVID-19 outbreak, as all the activities were finalised before the epidemic crisis.

2.2.4.1. Summary of progress in previous periods

Progress by task

T4.1 – Port and City Environmental Management Models

First objective of this task was to develop the interoperability between the models that would be developed in the other tasks of the work package, namely the energy demand and production models, pollution and transport demand models. The model that was developed in this task (PAS – Port Activity Scenario) acts as a central hub between the other tasks models that will allow the exchange of information between them.

This task had three distinct but interdependent goals:

1. Estimation of the data that other models will require in order to operate.
2. Development of the model (PAS) that will estimate / produce data needed by other models in the WP
3. Preliminary estimation of data availability for modelling the PAS.

The task started in month 4 and officially ended in month 18. The related deliverables of this task (Deliverable D4.1 – PIXEL models v1 and D4.2 – PIXEL models v2) were delivered on time.

Different relevant activities that were carried out as well in months M1-M18 were:

- Code has been developed that allow to build in an automatized way the list of all port activities that happen during a certain period of time
- PAS model was fully developed and settled as ready to be integrated in PIXEL Operational Tools.
- WP4 team considered that this task was fully achieved and completed by M18.

After its formal finalisation, some work was exerted related to this task. During the Thessaloniki plenary meeting (in M19) it was decided that the interoperability provided by PAS can assist to the direct calculation of the Port Environmental Index (PEI – developed in WP5) both for real operating conditions of the ports as well as for the use of what-if scenarios.

Additionally, a video of the functioning of the PAS was created. It is available in the PIXEL Youtube channel

T4.2 – Energy Demand Models

This task focused on modelling the port's energy demand and production to provide information about the energy use. Three main axes have been investigated in this task: 1) quantify the energy consumption corresponding to a specific port activities scenario, 2) how to predict the local photovoltaic electricity production for a given period and 3) how to estimate the resulting electricity net balance between electricity consumption and production in the port area. This task has closely interacted with a) task 4.1 in order to have a common definition and modelling approach for port activities and b) task 4.5 in order to development predictive algorithm for energy production with a photovoltaic (PV) system.

The following activities were conducted to achieve those objectives:

- To develop a model of the energy demand due to the port activities a deep investigation based on the GPMB use-case took place to understand the best approach to use.
- A first data analysis work based on 7 years of data (vessels calls) have was done to understand the structure of energy demand.
- The energy demand has been modelled according to a fixed scenario using the port activity scenario**.**
- Definition of all the input data models, designed and developed the algorithm to transform vessels calls, supply chain specification and the list of port activities in time series of energy consumption.
- Development of code to use the PAS outputs as an input of the energy demand model.
- Energy demand model was fully developed and settled as ready to be integrated in the PIXEL Operational Tools.

Although the task was closed in M18, some work continued in order to fine tune the Energy-demand model for the preparation of a live demo to be shown in the mid-term review. GPMB presented it to the reviewer and the Project Officer in Brussels from the perspective of what a port will obtain (impact, use) by using the tool.

T4.3 – Hinterland multimodal transport Models

The work in this task was focused on modelling the cargo traffic generated by a port and assessing its impact on the hinterland. The model developed in this task has been built based on the reality of the Port of Monfalcone and its hinterland of the Friuli Venezia Giulia Region. In particular, the objective was to implement a new tool enabling both forecast and management of congestions involving port and hinterland areas, supporting the cooperation and the interoperability between regional actors (in this case ASPM and SDAG) and boosting the use of the railway to reduce the environmental impact. To reach this goal, the context was analysed: the output of such work is represented by a model composed of 2 sub-models to meet the pilot needs:

- The multimodal transport has been modelled for the transportation of slabs to the hinterland, since Monfalcone port is the arriving point by ships of the slabs to be distributed to the industrial districts. So, the model creation considered all characteristic of the slabs transport, the infrastructures and the main destinations of the slabs in order to estimate the traffic generated by the slabs and the environmental impact of the different transport solutions.
- The second sub-model is focused on the congestion events of the Monfalcone port due to different reasons, such as port operational activities, type of cargo arriving, weather conditions, day of the week (trucks cannot circulate during the weekend), etc. A model was created to estimate when the congestion can happen within the port of Monfalcone in order to trigger the traffic incoming towards SDAG.

Code was developed for these two models. The provided results help to understand if a different traffic management has a positive impact on congestions and are useful for an effective decision support tool to optimize the re-routing of trucks. These models have been fully developed and were considered ready to be integrated in PIXEL Operational Tools.

WP4 team considered that this task was fully achieved and completed by M18. However, during M19-M24 the T4.3 collaborated with next work packages by the development of the NGSI agents and the adapters of the model to be able to be executed by the Operational Tools were works carried out during the M19-M24 period. This included the dockerization of the model.

T4.4 – Environmental Pollution Models

Main goals of the Task 4.4 were the creation of noise and air dispersion models that could be used by pilot ports to assess their contribution to the environmental pollution levels. In order to successfully finish those tasks, two different approaches were used. For noise modelling, a commercial software Predictor-LimA Software Suite, developed by Brüel & Kjær, was used. As for air pollution, it was decided to use the American Meteorological Society (AMS) and the United States Environmental Protection Agency (EPA) Regulatory Model – AERMOD.

Both pollution models were developed using the Port of Thessaloniki as an example.

Regarding noise pollution, the following activities were carried out:

- Setting up the software environment for running the model
- Using data provided by THPA to be inserted in Predictor-LimA.
- Selection of adequate calculation method. Decision was to use different methods for railway (CNOSSOS-EU method) and road (ISO 9613.1/2 Road method) and import those results into a method used for the calculation of industrial noise.
- The final noise map was presented to other partners during the Technical Workshop in Ljubljana.

And for the air pollution modelling:

- Selection of procedure to be followed: result: to write scripts which essentially are "shells" for the open source pollution modelling software AERMOD.
- The port of Thessaloniki provided information about possible source locations, port activates and total energy consumption for some of the piers
- Missing data was provided form other models such as the Port Activity Scenario
- Preparation of the model to be Dockerized and converted to a service in WP7 to be integrated in the different pilots on the ports.

WP4 team considered that this task was fully achieved and completed by M18.

However, during the review a formal request was issued from the EC to proceed with a simplified model for water and soil pollution, during M19 to M24, partners of task T4.4 have worked in order to develop, 2D and steady-state models using classical methodology.

In order to model water pollution, TELEMAC-2D was selected and it was slightly applied to anticipate potential water pollution and allow port environmental agent to test different solutions that can mitigate the impact. Regarding the soil pollution in the port context, the SISYPHE module of TELEMAC-2D was used to have a better understanding of how solid pollutants particles coming from port activities and discharged into water evolve in time and space.

What the WP4 team worked on, as it was documented via the re-submission of deliverable D4.2 was:

- Describe the models (TELEMAC2D and its couple with SISYPHE)
- Description on how to use the model in case a port would wish to implement it to have a long-term evaluation of the water and soil pollution on their premises.
- Requirements for the integration of those models (data, system and training requirements).

The request made by the EC in order to fulfil with these modelling has been considered covered by the WP4 expert team.

T4.5 – Predictive Algorithms

Task 4.5 aims at the identification and development of predictive algorithms in ports to support achievement of PIXEL objectives and will relate to all the tasks in WP4, where is the need for predictive algorithms.

First part of Task 4.5 (taking place in the period M7-M18) was thus dedicated to the identification of predictive tasks, according to the PIXEL Requirements analysis, Use cases and scenarios manual, as well as the needs of PIXEL Models and developments in bigger ports. All the technical details were provided via deliverable D4.3.

During the period M19-M24, this task was the main focus of the WP4, as it is the only one remaining active. This task advanced and finalised the different predictive algorithms that were identified and explored during the period M7-M18. Different sub-tasks were identified based on the existing documentation regarding requirements and use-cases as well as based on the review of the state-of-the-art in the literature, existing trends and examples from the maritime industry, our AI expertise and available internal and external data.

The algorithms identified and developed were:

- **Predicting vessel calls data from FAL forms and other sources:** GPMB's FAL forms data via API were extensive explored and analysed during M7-M18. During M19-M24, ETD prediction module was upgraded with AIS data, integrated into PIXEL architecture and demo frontend prepared for showcasing results at midterm review. This demo was shown during the review in M21 (January 2020).
- **Use of AIS data:** During M7-M18, openly available historical AIS data sources were identified, as well as an effort was made to contribute to the open-source initiative AISHub. Exploratory data analysis took place to analyse AIS data around GPMB, PPA, ASPM and beyond. Methods were developed for congestion analysis around the ports and for anchorage area detection and delineation were further developed for other ports. The developments and the associated code have been protected by XLAB (owner of the algorithms) but were part of the task done in this regard.
- **Use of satellite imagery:** Satellite imagery (ESA Copernicus Sentinel-2) was combined with AIS data in order to develop an automatic construction of large-scale ship detection dataset. In M19-M24, the developed ship detection methods were used for maritime traffic analysis, by monitoring certain areas of interest in the port.
- **Analysis and prediction of road traffic conditions with connection to port operations:**. Exploratory data analysis for ASPM, PPA and THPA (M7-M18) was followed by the development of data pre-processing, processing and modelling of a short-term traffic prediction algorithm with the same methodology in the 3 cases, resulting in a set of Python scripts and Jupyter Notebooks that have been uploaded to the GitHub account of the project.
- **Prediction of renewable energy production (predict a PV installation future production):** Work was performed in M7-M18 for data analysis and transformation (resampling, seasonality, …) of the production of a potential PV system in GPMB. Later, algorithms were developed: Algorithms have been developed to predict the PV needed for the provision of energy knowing previous data on production and previous weather condition. This code has also been uploaded to the GitHub account of the project.

Additionally, during the last months of its execution, WP4 worked closely with three others WP:

- WP5: a lot of discussion between WP4 and WP5 leader in order to establish link between what will be done in WP4 (emissions quantification and supply chain modelling) and the impact on the PEI.
- WP6: and WP7 works has been done to have a full set of model's requirements definition. The definition of data models was part of the discussions between WP4 and WP6 teams. Additionally, the development of agents was a matter of discussion here. Besides, the Operational Tools required to the different model owners to specify: (i) data model inputs, (ii) outputs of each model and (iii) the specification and/or development of the different adapters to allow integration of the models in PIXEL (to be deployed in WP7).

2.2.4.2. Summary of results after previous periods

The main results obtained in this work package WP4 are the following:

- Models have been developed and were set ready for integration within the PIXEL platform (WP6) and use/test in real condition (WP7)

- Port Activity Scenario Model: Modelling of the supply chain and port's activities and enable to build activity scenarios that are used to identify energy sources, emissions of pollutants and estimate the flow of cargoes entering or leaving the port.
  - Definition and development of the model of the Port Activities Scenario.
  - Definition of the data models to be used in the Port Activities Scenario.
  - Definition of the flexibility and transferability of the model: definition of the restrictions of the model of the Port Activities Scenario and of the restrictions' correlation with the data availability.
  - Definition of the system and training requirements of the model of the Port Activities Scenario.
- Energy Demand Model: Enable quantification of energy consumption associated to cargo transition.
  - Definition and development of the energy demand model. Definition of data models to be used.
  - Test of the model with GPMB
  - Definition of the system and training requirements of the model
- Hinterland multimodal model: Provide an effective decision support tool to optimize the re-routing of trucks.
  - Definition and development of the transport model: two sub models have been developed.
  - Definition of the system and training requirements of the model
- Air and noise dispersion models: Simulate the air and noise pollutant dispersion caused by various activities and operations inside the port.
  - Adaptation of AERMOD interface to use the model in PIXEL
  - Use of a noise model based on Thessaloniki data
  - Definition of the system and training requirements of the model
- Water and soil pollution models:
  - Water and soil pollution modelling identification.
  - Water and oil pollution modelling description of integration, use, data needed and technological requirements for a port wishing to implement them.
  - Water pollution modelling utilisation for the THPA port case (using bathymetry data).

- Predictive algorithms have been fully identified, described, **developed and published in GitHub**. The following results have been already obtained:
  - ETA using vessel calls (protected)
  - AIS data (protected)
  - Traffic prediction algorithms for PPA, THPA and ASPM
  - PV installation prediction
- The work done in WP4 has been presented in 4 research conferences (8th International Conference on Maritime Technology, Maritime Transport Conference, OCEANS 2019 conference)
- Three deliverables have been submitted successfully:
  - Deliverable *D4.1 – PIXEL Models v1*
  - Deliverable *D4.2 – PIXEL Models v2*
  - Deliverable *D4.3 – Predictive Algorithms v1*
  - Re-submission of *D4.1 – PIXEL Models*
  - Re-submission of *D4.2 – PIXEL Models v2*
  - Deliverable *D4.4 – Predictive Algorithms v2*

2.2.4.3. Work in M25-M30

There was no real activity of WP4 to report on this reporting period (M25-M30) as it was officially finalised in M24. However, there have been some remnant cross-WP collaborations that have taken place during this period:

- The members of WP4 have continued to be ensuring the usability of their results. They have been asked about functionalities and technical nuances of WP4 models in order to reach the project goals.
- In WP6, the finalisation of the Operational Tools and the Dashboard needed a continuous interaction with WP4 model owners to establish the interface mechanisms (GetInfo.json and Instance.json) and the visualisation of the results out of each model (Dashboard widgets). The data models to store the information into the Information Hub also needed to be agreed upon between T6.3 participants and WP3 model owners.
- For the deployment of the pilots (T7.1), it has been needed a punctual exchange of information to understand and fine-tune the transition between standalone execution of the models (WP4) and an integrated seamless flow in the PIXEL framework in the port (WP7). It is expected that this information exchange will last till the end of the WP7.

Additionally, some WP4 works (concretely those from T4.1) have been presented in the OR62 research maritime conference: https://pixel-ports.eu/?tribe_events=the-operational-research-society-sustainable-maritime-operations-stream

2.2.4.1. Deviations

Finally, the deliverable D4.4 was finalised during the first weeks of the current reporting period. This slight deviation (6 weeks) was justified. This was one of the forecasted the effects of the COVID-19 outbreak. According to the Consortium, this little deviation has not caused any further consequence on the advance of the project.

2.2.5. Work Package 5 – Port Environmental Index Development

The Port Environmental Index (PEI) is a quantitative composite indicator of the overall environmental performance of a port. The main idea behind PEI is to devise a comprehensive, standardized and transparent methodology to be used as an integrator of all the significant environmental aspects of ports and the related impacts into a single metric.

WP5 is one of the most important work packages of the project, as it embeds the core of the environmental impact assessment action. The outcome of this WP will be a single metric for measuring the environmental impact of a port. The main result that the WP will bring to the project will be the PEI itself, accompanied by a set of guidelines on how to use and interpret it.

The beginning of the reporting was mainly related to finalising the deliverable D5.3. The delivery of this document, which was originally due to M24, needed to be postponed because of the COVID-19 outbreak and its effects. By the end of M26 (June 2020), the deliverable was successfully submitted. That has brought task T5.3 to its end and the team has been focused on the creation of the adoption guidelines for the index and on the translation of its final form into real deployments, ensuring proper execution of T7.5 PEI transversal trial.

Apart from that, the period M25-M30 WP5 has been focused on:

- Continuous intensive work on the translation of the procedures for obtaining eKPIs from raw data from ports to the T7.5 team for the NGSI agents preparation.
- Alternative data sources and data origins to be provided by ports.
- Selection of representative ports (and seek for potential contacts) to gain insight of current adoption practices in the ports of environmental measuring tools
- Preparation and issue of a survey for the TEN-T ports to advance towards task T5.4 objectives.
- Fine-tuning of the calculation methods of the eKPIs, which main workload has been reallocated to be conducted under task T7.5. These activities will be reported there (see section 2.2.7).

The contributions to the WP9 consisted of the publication of two scientific papers (one on noise pollution and one on air pollution) at the beginning of the period that have already been published (see section 3.1.2). Additionally, a short communication was submitted to a high-impact journal about the PEI that was also published during the period. Besides, one article about the use of AIS data to calculate the ship index is being prepared at the moment of this reporting document; it is expected to be finished and submitted within the first two months of the next period.

A relevant thing to remark about this reporting period is that the plans were significantly affected at the end of the period by the critical situation caused by COVID-19 (from M23 on). As it was stated in the last reporting document (D2.7), the forecast was to have a number of tasks and activities of WP5 delayed by the COVID-19.

This has led to an extension request of all the currently active tasks in WP5 (T5.4 and T5.5). The extension of the two tasks will also mean the re-scheduling of the due date of deliverable D5.4, which was planned for the month M32, and that will be expected by M37 (May-2021). The WP itself will be extended 5 months, till 31st of May 2021.

2.2.5.1. Summary of progress in previous periods

Progress by task

Task 5.1: Methodology definition

This task consisted of:

- a general description of the workflow to be used and methodological approach for obtaining the PEI;
- literature review of the current methodological approaches for the identification of environmental aspects of port operations;

- analysis of the existing approaches for addressing and defining the significant environmental aspects of port operations;
- conclusion on best approach for setting system boundaries: build three different indexes: an environmental index for the ships, a separate one for terminals and a third one for the port authorities;
- discussion on different methodological approaches related to different types of cargo;
- discussion on different methodological approaches to select the indicators (environmental key performance indicators eKPI) for PEI construction and weighing.
- Choice of the methodology and depiction of full explanation via deliverable D5.1 (M12).

This task was considered concluded in M7.

Task 5.2: KPI Definition

This task had a timeframe of 8 months, starting in M5 and ending in M12. Under this task (and first of all) all the possible environmental Key Performance Indicators (eKPIs) have been identified. The methodology for defining and making a selection of the eKPIs was based on a literature review including a compilation of information and synthesis according to the factors needed for the PIXEL project's realization. The first step was a broad list of the eKPIs published in D5.1 "Environmental aspects and mapping to pilots".

The main criteria that have been used for selecting the eKPIs were the following:

- **Significant**: be significant according to the stakes defined by the impacts that they represent.
- **Representative:** differentiate the effects of port activities from any other "outside" effect: the aim is not to monitor the quality of the environment that is related to all the activities present (not only port).
- **Measurable**: be measured in real time, and treated thanks to IoT systems or to use data produced by the ports if they are already existing;
- **Quantitative:** respond to monitoring protocols leading to pertinent and exploitable data as part of the PEI calculation process.
- Be useful in PIXEL uses-case application: **usefulness.**

In the deliverable D5.2, no definitive conclusion on the exact eKPIs to be included for each port has been reached due the fact that the list has been further refined in T5.3.

This task was considered concluded in M12. However, different fine-tuning of the eKPIs were continuously tackled till M24 in order to align them with technological implementation of the PEI. Therefore, the final iteration of the definitive set of eKPIs that used for calculating the PEI was delivered through D5.3, which was submitted in June 2020 (8 weeks after its deadline, with the proper acceptance of the delay justification).

Task 5.3: PEI development

This task had a duration of 15 months, starting in M7 and ending in M24. This task included a further narrowing and analysis of the eKPIs to be used in the PEI calculation based on the different IoT data sources that have been identified in this task.

Particularly, the PEI data requirements and ways of retrieving them were assessed in M7-M18 and the different statistical approaches for data imputation, normalization, weighing and aggregation were also analysed.

In D5.2 "PEI Definition and Algorithms v1" under broad categories a reduced set of eKPIs compared to the D5.1 Environmental aspects and mapping to pilots was considered. The set of eKPIs reported in the deliverable D5.2 is the second iteration of the eKPIs specified in D5.1 while the final iteration was pending to be delivered in D5.3 at the end of M24.

Finally, the different ways of visualising the PEI in the PIXEL platform were also assessed in M7-M18 period such as line –charts presentations, trend diagrams presentations and other types of representation (circumflex charts, etc.). In addition, some advanced PEI features for PEI visualizations were also described.

The task T5.3, which was supposed to be finalised by M24 (end of this management reporting period) was the more intensively tackled by the WP5 team during M19-M24 period. The results were properly introduced in the

deliverable D5.3. In the last reporting period it was made clear that this deliverable would be formally submitted by M26, due to the deviations indicated below.

The main actions conducted in the most intensive period of the task were:

- Creation of a waste inventory
- Short summary and recommendations on the PEI calculation methods were provided and a pseudocode for the calculation
- Indicators for all the sub-indices, together with relevant measurement units and calculation methods
- Work on how to link the PAS output with the estimation of the emissions in the atmosphere due do the port activity (link between PAS and PEI) and how to use AIS module within PIXEL to generate inputs for the PEI.
- Determining methods for estimating eKPIs from directs measurements or proxy data
- Discovery of suitable IoT sensors for feeding certain data needed in PEI
- Data analysis for PEI within the mathematical toolbox choice.
- Development of a running version of PEI calculation in Java
- Start of integration of PEI visualization into the global PIXEL dashboard

Task 5.4: Best practices for PEI adoption

This task started in M19. A summary of the actions taken till the beginning of this reporting period is:.

- Methodological approach for the task and the PEI adoption needs
- Analysis of the results of the TEN-T ports Environmental Sustainability reports' content
- TEN-T ports' questionnaire design
- Initial work on envisioning metrics for assessing port environmental performance by ports
- Tentative structure of the adoption and practices and implementation problems
- Initial identification of the benchmarking possibilities and strategies
- Questionnaire for online interviews and identification of contact persons with ports and related agents in order to gain information about PEI adoption and other planned feedbacks

Task 5.5: Guidelines for improvement of environment and society

This task started in month M23, then only had 2 months of execution before the beginning of the current reporting period. Due to the COVID-19 outbreak (M23), no much advance was able to take place till this moment, with the following activities standing:

- Analysis of the relation of T5.5 with other tasks within WP5 and interaction and dependencies on other tasks of the project.
- Plan of action.
- Inclusion of T5.5 contribution to the deliverable D5.4 in the ToC has been created. Specifically, the ToC of deliverable D5.4 has been split in two, in order to document advances from both tasks (T5.4 and T5.5) under separated spaces while keeping a common storytelling and line of thought

2.2.5.2. Summary of results after previous periods

The main results that we have obtained in the first 6 months of the project in the context of WP5 are the following:

- The general methodological framework for PEI development and computation has been devised.
- The significant environmental aspects of port operations have been identified and mapped to the PIXEL pilot ports.
- The eKPIs of environmental aspects of port operation have been assessed and proposed.

- The IoT data sources for eKPIs retrieval and computation have been analysed and solutions have been proposed.
- The statistical toolbox for PEI computation has been addressed and several statistical methods for data imputation, normalization, weighing and aggregation have been put forward.
- Different approaches for assessing uncertainty and sensitivity analyses related to the PEI algorithm have been proposed.
- Different ways of PEI visualization in the PIXEL dashboard has been proposed including advanced features for data analysis and visualization.
- Port waste inventories have been considered and analysed.
- A final list of eKPIs has been agreed upon.
- Development of code and generation of a usable program in Java for current PEI calculation
- Establishing a list of persons to contact of external ports and agents for T5.4 purposes
- Different dissemination results were created, including scientific papers, presentations at relevant conferences and posters.
    - 2 papers (Environmental monitoring and assessment, TRA2020 respectively) and has been presented in 2 research conferences (Recent scientific achievements of the Teaching institute of public health, GreenerSites Final Conference)
    - Two poster presentations in the Eighth International Conference on Marine Technology
    - Two scientific papers (one on noise pollution and one on air pollution) were finished in this period and are planned for submission early in the next reporting period

- Deliverables submitted successfully
    - Deliverable *D5.1 – Environmental Aspects and Mapping to Pilots*
    - Deliverable *D5.2 – PEI Definition and Algorithms v2*.
    - *(pending to M26)* - Deliverable *D5.3 – PEI Definition and Algorithms v3.*

2.2.5.3. Progress in M25-M30

Progress per task

Task 5.3: PEI development

The task T5.3 had its original end on M24 (last month of the previous reporting period). However, due to certain justified delays, some pending activities were pending. Specifically, the completion of D5.3 and the finalisation of all calculation details for the index were tackled during months M25 and M26.

By the end of M26 (30th June 2020), the deliverable D5.3 was submitted successfully. WP5 partners to deliver the work request by the WP leader.

According to what is explained in task T2.1 (see), the committed specifications from task T5.3 for T7.5 were decided to be moved directly to task T7.5. This way, the task T5.3 can be considered finalised in M26 (thus, no need for extension request) and this effort can be channelled and reported via the "continuation" task in WP7.

In particular, the activities that will be tackled in T7.5 as a continuation of the work done in T5.3 are:

- Full integration of PEI visualization into the global PIXEL dashboard
- Development of all NGSI agents to convert raw data into eKPIs
- Application of all the calculations designed to real scenarios (one pilot per port in PIXEL)
- Test and validation of the algorithms designed
- Test and validation through time – with real data- of the mathematical methods selected

Task 5.4: Best practices for PEI adoption

Period M25-M30 constituted the central phase of the execution of this task. During these months, the previously designed questionnaire and actions were put into practice. CERTH led the team towards successful reach of external ports/port agents to provide useful feedback. The idea is to interpret all participations to the surveys and extract conclusions to settle the best practices the PEI should comply with. This will allow WP5 team to meet the objectives of this task.

A summary of the tasks undertaken during this period in T5.4 are:

- Creation of the questionnaire for T-TEN ports.
- Import of the questionnaire to a specialised web platform for conducting the survey,
- Web research for appropriate contacts in the TEN-T ports for the survey,
- Joint search for direct contacts in the target ports of the questionnaire. All T5.4 partners participated in this activity that had the goal of maximizing the response rate of the survey. Subsequently, all partners sent an email with the survey to their contacts following the format specified by CERTH.
- Completion of sending the first batch of emails to the TEN-T ports for which a contact email was found and additional search for contacts in the remaining TEN-T ports.
- Elaboration of a draft report presenting the results of reviewing the content of the Environmental Sustainability Reports of the TEN-T.
- Sending of reminder emails and search for more appropriate contacts to the ports already approached,
- Preparation of the survey results analysis tool (in progress).

Task 5.5: Guidelines for improvement of environment and society

The period M25-M30 has been strongly affected by the COVID-19. External entities have been difficult to reach. At the same time, priorities of partners have been oriented to cope with the pandemic outbreak. This has slowed down the work pace in T5.5, which is a very cross-task-dependent activity.

The outcome in T5.5 is supposed to be drawing from the results of T5.3 and T5.4. Whereas some recommendations of the usage of T5.3 product (PEI software and functionality) was devised during this period, no useful conclusions have been extracted from the work in T5.4 yet. The guidelines for "deploying and using the PEI by a port staff member" were completed. Those guidelines were included within the last part of deliverable D5.3 (section 5.5).

The main work of this task will be carried out during the next reporting period.

Table 5. WP5 Partner contribution summary table

Partner	Contribution
P01 UPV	• Contribution to the finalisation of deliverable D5.3, in particular to the sections 1, 2, 4 and 5. • Design of the technological spot of all PEI calculations within PIXEL. • Development of the associated visualization of the Ship index and the whole PEI • Supervising the data acquisition options for the ports to run the PEI • Participate in the task and deliverable 5.4 (Best practices for PEI adoption) • Deliver the packaged software of T5.3. • Propose, design and plan the "transition to T7.5" to allow transferring WP5 findings into runnable pilots in WP7.
P02 PRO	• Contribution to the finalisation of deliverable D5.3 • Help on the data acquisition finalisation for all four ports

	• Smoothing the transition from T5.3 towards T7.5 • Helping prepare the PEI software packaging for integration in PIXEL framework

P05 CATIE	• At the beginning of this reporting period, CATIE provides inputs for the deliverable D5.3 on the statistical toolbox section, perform a first data analysis for PEI and give guidelines about how to implement PEI based on mathematical analysis.
	• Participation on the PEI software implementation, specifically in;:
	  ○ Mathematical methods (normalisation, weighting, aggregation) to be used in the final calculation of the PEI.
	  ○ Introduction of emission factors in the PAS output.
	  ○ Use of the PAS results by the PEI model.

P06 ORANGE	• Participate in the task and deliverable 5.4 (Best practices for PEI adoption)

P07 CREO	• Making a point on all the different data sources that can be useful for the extraction eKPIs values. Documenting it via deliverable D5.3.
	• Determining methods for estimating eKPIs from directs measurements or proxy data.
	• Inputs in the deliverable D5.3 for chapter 4 - Methods for estimating eKPIs from data sources for final submission.
	• In the context of task T5.4:
	  ○ Help for creation of the questionnaire for T-TEN ports.
	  ○ Search for direct contacts in the ports targeted for the questionnaire.
	  ○ Share the D5.4 Questionnaire survey link with direct port contacts.
	  ○ Remind and help to increase the participation to the survey.

P08 MEDRI	• Organisation of WP5 meetings (virtual)
	• Usual tasks of WP coordinator (organisation of work, coordination, supervision)
	• Regarding the task T5.3:
	  ○ The PEI methodology was completed and tested on the Ship index.
	  ○ The eKPIs, statistical and technical toolboxes were finalised.
	  ○ The deliverable 5.3 was completed and submitted on June 30th on the approved delay of 2 months.
	  ○ The PEI methodology was expanded to the Port Authorities and Terminals (in addition to the ships, as in the previous period).
	  ○ A methodology was provided for the calculation of emissions resulting from gas and electricity consumption (to be continued in Task 7.5).
	• Formal conclusion of task T5.3 and proposition (including a plan) for the application (and continuation) of the works through task T7.5

P12 ASPM	• ASPM contributed to D5.3 development collecting data from port system/community and investigating in data sources availability. • ASPM continued analysing data coming from ships due arrival forms, trying to find specific information useful for the PEI development such as wastes and emissions data. • ASPM evaluated and ordered a noise and light sensor capable to send port environmental data useful for the PEI pilot • Finally, ASPM received the noise and light sensor capable to send port environmental data useful for the PEI pilot and defined its installation activity in the port of Monfalcone premises.
P14 IPEOPLE	• Reviewing D5.3 - PEI Definition and Algorithms v2

P15 CERTH	• CERTH is the leader of tasks T5.4 and T5.5. CERTH has performed the usual activites associated to task leadership.
	• Work on deliverable D5.4:
	  ○ Draft report presenting the results of reviewing the content of the Environmental Sustainability Reports of the TEN-T ports.
	  ○ Completion of sending first batch of survey emails to TEN-T ports for which a contact email was found. Additional search for contacts for the remaining TEN-T ports. Future: reminder emails and search for more appropriate contacts to the ports already approached, communicating of the research through direct contacts to ports and organisations by CERTH and other PIXEL partners.
	  ○ Preparation of the survey results analysis tool (in progress).

2.2.5.4. Results after M25-M30

The main results that obtained in this period of the project (M25-M30) in the context of WP5 are the following:

- Final submission of deliverable D5.3
- Answers from ports and other involved agents to the survey issued in the last reporting period
- Packaging of all T5.3 results to enhance and apply the calculation in task T7.5
- The creation of the results analysis tool is at an advanced stage. This will be used to analyse the results of the surveys in T5.4.

2.2.5.5. Deviations

The deliverable D5.3 originally had the deadline in M24, which was moved to M26 due to the situation with COVID-19. All the work was done as planned, and the deliverable was submitted before the end of June. This slight deviation was properly justified and it was accepted as this delay was forecasted by the task T2.2.

Task T5.4 should have been lasted till M28. However, due to COVID-19 effects and cross-WP dependencies, the task has not finished yet. Actually, there still are some pending activities to be carried out.

Despite the difficulties experienced in the data gathering exercise (see last reporting document – D2.7), the T5.3 team was able to establish the mechanisms for all 4 ports in PIXEL to let a feasible implementation and deployment of task T7.5. These mechanisms have been provided in this reporting period (M25-M30) via the deliverable D5.3 in its final version.

On another note, the COVID-19 associated delays, altogether with the focus on completing deliverable D5.3, left the T5.3 team in a difficult situation. While the work needed to complete a robust D5.3 was properly exerted, the team committed to provide additional specifications that would let the task T7.5 (application of PEI to pilots) to run seamlessly. These specifications consist of a detailed documentation of how to make particular calculations from data to eKPI particularised for the four PIXEL ports. These pieces of information, including specific conversion tables and mathematic formulae to use, will help write the software code of the NGSI agents that are responsibility of the task T7.5.

2.2.5.6. Corrective actions

The committed specifications from task T5.3 for T7.5 were decided to be moved directly to task T7.5. This way, the task T5.3 can be considered finalised in M26 (thus, no need for extension request) and this effort can be channelled and reported via the “continuation” task in WP7. It is worth to mention that, as it was explained in D2.7, the testing and validation of the PEI algorithm after ports’ data had already been moved to the T7.5 before.

As it has been explained before, some of the risks foreseen in the last reporting have been materialised due to the COVID-19 effects. Apart from the late delivery of D5.3, the two remaining tasks of the WP have been seriously hindered from being properly completed. This led the WP5 team to included in the amendment #2 a request of extending the WP5 activities still alive:

- End of WP5: M32->M37
- End of T5.4: M28->M33
- End of T5.5: M32->M37
- Due date of D5.4: M32->M37

2.2.6.Work Package 6 – Enabling ICT infrastructure framework

Work package 6 must provide as outcome the ICT enabling infrastructure for PIXEL solution. This means that every piece coming from previous activities will be put together under the umbrella of IoT technology. Because of that, the work in this work package has been intensive and conclusive during this reporting period of the project.

Particularly, this WP was planned last a total of 22 months; having started on M4 and finishing on M26. In this regard, this work package has been only executed during the first two months of this reporting period (M25 and M26). The activity has been well balanced between documentation and software development with the intention to meet the WP objectives in time and manner. In this period tasks only T6.4, T6.5 and T6.6. have been executed. Task T6.1 finished in M18 while T6.2 and T6.3 finished just before this reporting period (M24).

The two months of execution of this WP in the period have been focused on: (i) fine-tuning and finalising all the modules framed in the collaboration needed for WP7, (ii) closing any pending issues on inter-module communication, (iii) development and dockerised delivery of the new version of PIXEL Operational Tools (OT v2), (iv) development and dockerised delivery of the new version of PIXEL Dashboard (v) making documentation efforts for the code of the different modules, completing the ReadTheDocs page: https://pixel-ports.readthedocs.io/en/latest/, (vi) depict all advances and content into deliverables D6.4 and D6.5

For WP6 management, joint WP6/WP7 bi-weekly telcos "Agile development and integration" have been conducted to ensure proper finalisation of the WP6 and the transition to the WP7, closing all pending issues of the technological modules arisen during the integration phase.

Despite of considering WP6 closed since M26, these joint telcos are planned to keep going till the end of WP7 (deployment of the pilots). In that regard, the WP6 team (mostly the same than WP7) will be collaborating in WP7, re-visiting some functionalities of the modules and fine-tuning them if needed. It is also expected to receive further requests for changed during the end-to-end integration of all modules and functionalities. For example, during the execution of the Traffic prediction module, one Dashboard widget must be deployed; this may require some WP6 partners to ensure the proper compliance of all the structure and data flow.

As it was forecasted in the last reporting period (D2.7), the COVID-19 epidemic has affected (though slightly) the actual execution of WP6. Technical teams have diminished the coding pace that was installed during M19-M24 but specially ports are highly affected by the outbreak. Some activities were stopped, which has hampered the development of NGSI agents associated to the four ports.

Similar to what has happened in WP5, the WP6 team (and the whole Consortium) considers that the WP6 was formally finalised in M26 with the proper submission of deliverables D6.4 and D6.5. However, certain NGSI agents are left pending to be developed. This work has been translated into WP7which also involves the agents development and integration as one of the main enablers to run the pilots.

2.2.6.1. Summary of progress in previous periods

Progress by task

Task 6.1: PIXEL information system design and architecture

The work in T6.1 started in August 2018 (M4), and finished in M18, performing the following activities:

- Initialization of architecture definition plan, development tools and guidelines for conceiving the PIXEL ICT.
- Conduction of several meetings to initialize a working framework for the whole work package
- Definition of the WP execution plan, internal milestones and the methodology to be followed. Every sub-task has its corresponding plan and first approach to the technologies to be used.
- Establishment of the RA (Reference Architecture) for PIXEL, contemplating all technical constraints and needs of all the tasks comprised in WP6.

- Clarification of the technological choices for implementing each one of the modules after analysing the requirements set through deliverable D3.2 and D3.4.
    - A thorough definition of each one of the modules (including state of the art), architecture diagrams, explanation and examples of the architecture and different technological choices made can be consulted in D6.1 and D6.2.
- Clear establishment of the relation between modules and tasks in order to clearly delimitate the responsibilities within the work package and create a collaborative framework for development.
- Creation and writing of the deliverable D6.1
- Refinement of all modules explanation (and more detail provided) altogether with an architecture fine-tuning via deliverable D6.2.
- Creation and writing of D6.2.
- Specific check on requirements.

This task was considered finished and closed by month M18.

Task 6.2: PIXEL Data Acquisition

This task oversees developing the "connection layer between raw data and PIXEL framework". It has been being executed since month M7, and the activities performed till M24 were the following:

- Definition of the main components that form part of the module and validation with all partners.
- Provision of a standard way to import data into the PIXEL Information Hub in order to allow an easy use of any kind of data source available on each port. It has been decomposed in various components: (i) context broker, (ii) persistent data hub, (iii) short term history, (iv) agent.
- The partners were involved on both integrating different DAL components and developing agents tackling diverse types of data sources. With this aim, one technical partner was assigned to select, for the first software milestone, various data sources from one pilot site and develop the agent.
- Work on the northbound connection: DAL with the Information Hub.
- A work on the input and output formats for energy model has been made in collaboration with WP4
- A Docker-based development environment for FIWARE was created and a GIT repository in Orange GITLAB instance was initiated.
- A NIFI solution (Apache NIFI) was deployed in order to quickly implement NGSI agents for prototyping.
- Several NGSI agents were developed and integrated, specially focused on the GPMB use-case in order to have a working demo ready for the mid-term review. More information about this can be found in the deliverable D6.3.
- Generation (development) of a generic python framework (library) for the development of NGSI agents. This also constituted a contribution to open-source initiatives by ORANGE.
- Fine-tuning of the module architecture, specially focused on the models' execution part.
- Creation of a task force for the Data Models definition (lead by ORANGE) that proposed and validated various Data Models to be used in PIXEL
- Provide an NGSI Agent Python library and documentation to help other partners to developed NGSI Agent (*pyngsi*).
- Deploy DAL on the demo platform in order to put in place the mid-term review live demonstrator.
- Develop the DAL Orchestrator to propose an API to deploy new NGSI Agent
- Start of development of various NGSI agents, specially those related to GPMB, ASPM and THPA pilots. As it is justified in the deviations, this activity has its continuation in the WP7.

This task was considered close in M24. The development of NGSI agents has a continuation under the WP7 tasks. While the purpose of developing agents in T6.2 was merely to validate the component and corroborate its interfaces, the development of on-purpose agents to run the pilots has been allocated to specific tasks in WP7. Check 2.2.6.5 section for more details.

Task 6.3: PIXEL Information Hub

This task oversees developing the "data storage and persistence layer of PIXEL". It has been being executed since month M7, and the activities performed till M24 were the following

- Review of existing solutions and selection of suitable technologies, and started testing subcomponents.
- Proposition of the final system composition
- Analyse the relation with other modules in PIXEL ICT infrastructure and establishment of interaction diagrams (depicted in deliverable D6.1)
- Establishment of the internal architecture of the IH module.
- Testing DAL integration with existing data sources
- OT integration first phase as agreed at the plenary in Greece.
- Preparation of M18 review demonstrators
- Alignment of data structures
- Review of OT integration patterns
- Development of methods for storage of complex data structures
- Development, fine-tuning and finishing of the necessary custom models and integration of the already-existing solutions to have the framework of the IH as a whole:
    - OpenJDK
    - Elasticsearch
    - PIXEL DataCollector (southbounds connection)
    - PIXEL Archiving System Core
    - API for the northbound collection (info to be retrieved by the models executed via the Operational Tools)

This task is considered finished by M24, at the end of the previous reporting period.

Task 6.4: PIXEL Operational Tools

This task is in charge of developing the framework for executing models, retrieving data from the IH and preparing the results to be shown in the Dashboard. It has been being executed since month M9, and the activities performed till M24 were the following:

- Establishment of a work plan, including a timeline schedule to commit all requirements on time.
- Designing an overall schema of components that will compose the complete module: (i) Event Processing, (ii) Database, (iii) Model and PA Engine, (iv) API gateway, (v) publication submodule, and (vi) user interface.
- Definition of subcomponents clearly: with their relations with other components, interaction with other modules of PIXEL architecture, their technological function and flow of actions and use.
- Analysis and discussion about the interfacing with other parts of the PIXEL platform.
- Selection of technologies for implementing all sub-components
- Setting up of a test environment for developing the tools
- Development and integration of components. This activity is still ongoing as task T6.4 lasts for M26. In fact, it requires models (which were even released in M18) and predictive algorithms (not even finished according to the project time plan) to be ready to start integrating them. Before that, work has been done with testing models.
- Design and implementation of a user interface. This is a work tightly related with the PIXEL Dashboard (task T6.5). Code has been implemented from scratch with similar technology as the dashboard to facilitate the integration (VUE, JavaScript).

- Development of the new version of the Operational Tools software (OTv2)
- Specification of the files to be used for (i) identification and creation of a model in the OT (GetInfo.json) and for (ii) the instantiation of a model (running the model; Instance.json).
- Development of the connectors with models module in order to put in communication the model developed within WP4 and the OT.
- Specification and materialisation of the southbound interaction in order to let the models retrieve data from the IH and the northbound interaction in order to let the Dashboard access to the results of the models so that can be visually represented.
- Support dockerization of WP4 results - models.
- Running of the Operational Tools with all needed connectors in the "development environment" in FILABS.
- Integration of the component with the rest of modules of the platform

Task 6.5: PIXEL Integrated Dashboard and Notification

This task is in charge of developing the Visualization and Human-Machine interface of PIXEL. It has been being executed since month M9, and the activities performed till M24 were the following:

- Designing an overall schema of components that will compose the total module: (i) PIXEL Information Hub UI, (ii) PIXEL Operational Tools UI, (iii) Maps (GIS), (iv) Notifications and (v) Charts and Dashboard.
- Analysis and discussion about the interfacing with other parts of the PIXEL platform.
- Selection of technologies for implementing all six sub-components
- Setting of test environment for developing the tools
- Development and integration of components, mainly the following:
    - Dynamic creation of visualizations
    - Alerts module
    - Map engine to spot data sources
    - Overall navigation
    - Integration of other PIXEL modules, specially the Operational Tools
- Creation of the visualizations needed for the working demo in the mid-term review
- Development of an automatic report generation tool to support the generation of valuable information in ports for official reports
- Creation of the configurable widget framework and its application to the demo environment.

Task 6.6: PIXEL Security and Privacy

This task is in charge of developing the authentication and global security. It has been being executed since month M7, and the activities performed till M24 were the following:

- Definition of the main guidelines for IoT security and the mechanisms to be used.
- State of the art study and contribution to deliverable D6.1.
- Analysis and choice of security components for the PIXEL ICT infrastructure
- Installations FIWARE tools on the FILABS development environment to check size, usability and customisation needs
- Start of the customisation of the existing FIWARE enablers for PIXEL security
- Start of integration of the security with other PIXEL modules
- Installations FIWARE tools on the FILABS development environment to check size, usability and customisation needs

- Customisation of the existing FIWARE enablers for PIXEL security (whole WP6 duration)
- To fine-tune the scope of security that is included in the different releases of the platform.
- API Gateway solution was analysed, tested and included in the FILABS "development environment".

2.2.6.1. Summary of results after previous periods

During the first 18 months of the project (91% of the activity of the work package), the results obtained can be listed as the following:

- Definition of the WP execution plan, internal milestones and the methodology to be followed.
- Definition of every sub-task of the corresponding plan and first approach to the technologies to be used.
- State of the art and technology selection.
- Links with WP3, WP4, and WP5 regarding requirements.
- Finalized first and second (final) version of the architecture.
- Full list of components for each module closed.
- Development environment is setup and running
- DAL agents orchestrator developed and integrated
- Operational Tools v2 (OTv2)
- Dashboard and global UI v2
- Information Hub connected and integrated in the "development environment"
- Northbound and southbound APIs completed and tested between all modules
- A series of NGSI agents for ports (specially for GPMB)
- An NGSI Agent Python library and documentation to help other partners to developed NGSI Agent
- FIWARE security modules completely customised and integrated in the development environment
- PIXEL platform developed for an initial release
- The following deliverables were submitted successfully:
    - Deliverable *D6.1 – PIXEL Information system architecture and design v1*
    - Deliverable *D6.3 – PIXEL data acquisition, information hub and data representation v1*
    - Deliverable *D6.2 – PIXEL Information system architecture and design v2*

2.2.6.2. Progress in M25-M30

Progress by task

Task 6.4: PIXEL Data Acquisition

This task was considered close in M24. The development of NGSI agents has a continuation under the WP7 tasks. While the purpose of developing agents in T6.2 was merely to validate the component and corroborate its interfaces, the development of on-purpose agents to run the pilots has been allocated to specific tasks in WP7. Check 2.2.6.5 section for more details. This continuation has been being executed during the M25-M30 period.

Task 6.4: PIXEL Operational Tools

During the period M25-M26, the Operational Tools were exhaustively worked, being continuously presented and informed to the Consortium via specialized telcos and plenary and technical meetings. The task is almost finalised, for what the team has required to conduct the following activities:

- Development of the new version of the Operational Tools software (OTv2)
- Integration of other PIXEL modules, specially the Operational Tools. The newest version of the Operational Tools has been integrated in the UI of the platform.

- Deployment of the implemented version of OT v2 in FILABs

The task T6.4 finalised in M26, during this reporting tool. According to the partners, this task must be considered close after the submission of D6.4 and D6.5.

Task 6.5: PIXEL Integrated Dashboard and Notification

The main focus of the T6.5 during the last 2 months of its execution has been to develop, integrate and continuously run in the "development environment" of the second (and definitive) version of the Dashboard/global UI wrapper and the inclusion over it of several requested features. In particular:

- Fine-tuning and delivering the second version of the component,
- Documentation of the second version of the Dashboard module via D6.4 and D6.5
- Development of an automatic report generation tool to support the generation of valuable information in ports for official reports
- Development of various widgets to cover functionalities that will be used in the pilots in the different tasks of WP7. Similarly to T6.2 and WP5, PAS supply chain configurations, PEI visualization, different models visualization and representation. This will be an on-going task even after the finalisation of WP6, as new visualization needs may arise within WP7 (pilots) and changes over the current versions are likely to be requested by technical partners or ports during the deployment
- Development of the Alerts and Notifications functionality using ElastAlert
- Creating and materialising the links with T6.6 by embedding the user profiling and authentication via the Dashboard

The task T6.5 finalised in M26, during this reporting tool. According to the partners, this task must be considered close after the submission of D6.4 and D6.5

Task 6.6: PIXEL Security and Privacy

The security in PIXEL has been reinforced during M25-M30 thanks to the work mainly promoted by ORANGE. The different activities overseen have been the following:

- Trace an end-to-end coverage of the security, ensuring that for already integrated framework (in GPMB), the security modules are usable, useful and used.
- Integration of the security with the new versions of other PIXEL modules (OT v2, Dashboard v2, different NGSI agents developed), including the corresponding login screens and UI associations. This is an on-going task that will need to be maintained even after the finalisation of the task. This will have a huge importance in the pilots (includes considerations of WP1 – ethics).
- Analyse the different connection between PIXEL components to provide the better security solution to guarantee a smooth transition to WP7 tasks, including integration and pilots execution.
- The task T6.5 finalised in M26, during this reporting tool. According to the partners, this task must be considered close after the submission of D6.4 and D6.5

The task T6.5 finalised in M26, during this reporting tool. According to the partners, this task must be considered close after the submission of D6.4 and D6.5

Table 6. WP6 Partner contribution summary table M25-M30

Partner	Contribution
P01 UPV	• Attendance to all WP6 bi-weekly conferences. • Attendance to joint WP6-WP7 control sessions under Agile Development management • Management tracking as coordinator • Leading Task T6.4 Operational Tools (OT)

	○ Development and containerization of the final version of the OT module ○ Integration of the component (v2) with the rest of modules of the platform • Anticipation of the start of technical work packages by starting to work on several points to align the scope and pace of the project between port needs and technical forthcoming development • Collaboration in the global PIXEL Agile execution • Analysis on the integration between models and Operational Tools (links between • Participation as member of the team of "Data Models" Task force. • Proposition of various Data Models • Development of various NGSI agents, specially those related to THPA pilot • Deployment of the implemented version of OT v2 in FILABs Lead of deliverable D6.5: Preparation of ToC, main edition and contributions integration. • Leading tasks of documentation and port to open platforms (GitHub, DockerHub, ReadTheDocs)
P02 PRO	• Organize the code camp to evaluate the current status of the platform, take some integration decisions and plan the following months. • Attendance to all WP6 bi-weekly conferences. • Lead WP6-WP7 control sessions under Agile Development management • Organize several working groups (Agile development session control, data models team, new approach of the model Dockerization). • Leading Task T6.5 Dashboard ○ Development and containerization of the final version of the Dashboard ○ Fine-tuning and delivering the second version of the component, ○ Documentation of the second version of the Dashboard via D6.4 and D6.5 ○ Development of an automatic report generation tool to support the generation of valuable information in ports for official reports ○ Integration of the component (v2) with the rest of modules of the platform ○ Development of various widgets to smooth the transition to pilots • Leading deliverable D6.4: ToC preparation, main edition and contributions integration.
P03 XLAB	• Attendance to all bi-weekly Agile Development teleconferences • Finalise the IH covering the interaction with all needed modules and the flattening od the data models to ensure compliance • Support dockerization of WP4 results - models. • Dockerization of PA algorithms • Definition of APIs to interact IH with the Operational Tools • Prepared final release of the Operational Tools • For the Dashboard Module (T6.5): Work on solutions for PIXEL information hub UI - how to provide data to different Dashboard components through the IH DataExtractor and ElasticSearch indexes – provided more information to project partners. • Analysis of authorisation mechanisms and consequences for IH components in T6.6
P04 INSIEL	• INSIEL developed the components to put in communication the intermodal transport model with the operational tools in order to allow to the simulation of some port operations using the data collected in the Information Hub. • In addition, INSIEL started to work on the component generated by the model to integrate for the Dashboard.

	• INSIEL developed a piece of software such as JSON file of generated output of intermodal model to provide input to the dashboard (interface of the PIXEL users). • INSIEL contributed to the development of component related to the DAL in order to integrate the different data sources of the pilot Monfalcone Port and SDAG. I • NSIEL contributed to design the IH and the related infrastructure within INSIEL to host the PIXEL platform for Monfalcone and SDAG. • INSIEL developed the connectors with the Operational Tools module in order to put in communication the model developed within WP4 and the OT. • INSIEL contributed to define the logic behind the dashboard in order to identify the alert or messages to display related to the use of the models. • In the period M28-M30 the main focus was the installation of the PIXEL platform in the INSIEL infrastructure provided to the Port of Monfalcone. Due to the structure of the PIXEL platform, INSIEL worked in parallel on one side, in cooperation with Orange team, on the installation of the available PIXEL components; on the other side with PRO on the release of the update version of other components.
P05 CATIE	• Attendance to WP6 telcos • Integration of PAS model and energy models through the Operational Tools • Report information and bugs to WP6 regarding the use of the PIXEL platform and the integration of models. • Close interaction with PRO for the dashboard and visualization of the PAS model • Interaction with UPV regarding the operational tools and use of PAS model through the PIXEL platform. • Interaction with Orange about the NGSI agent development.

P06 ORANGE	• As WP6 leader:
	  ○ Managing the WP6 as Work Package
	  ○ Leading the tasks T6.2 and T6.6 and contributing to other WP6 tasks.
	  ○ Following development progress with WP7
	  ○ Supervise production of D6.4 and D6.5
	• In the task T6.2:
	  ○ Developing the Data Source Discovering working with IH
	  ○ Finish the implementation of the DAL orchestrator
	  ○ Finish the implementation of the Data Source trash collector
	  ○ Support partners in developing their own agents
	  ○ Support use of the pyngsi framework
	  ○ Finishing the development of DAL Orchestrator 2.0 with DataModel full integration and integration with Keyrock
	• Enhance the NGSI agent python library and the documentation to allow other partners to develop their own agent.
	• Specially, in T6.6: Analyse the different connection between PIXEL components to provide the better security solution.
	• Support Dashboard for user integration

2.2.6.3. Results after M25-M30

The main results that we have obtained in this second period of the project (M25-M30) in the context of WP6 are the following:

- DAL agents orchestrator developed and integrated

- Finalisation, dockerisation and integration of Operational Tools v2 (OTv2)
- Finalisation, dockerisation and integration of Dashboard and global UI v2
- A series of NGSI agents for ports (all the ports). Decision to complete this in the next WP.
- FIWARE security modules completely customised and integrated in the development environment
- Documentation of all code (done through D6.4 and D6.5).
- The following deliverables were submitted successfully:
    - Deliverable *D6.4 – PIXEL Data Acquisition, Information Hub and data representation v2*
    - Deliverable D6.5 – *APIs and documentation for software extension*

2.2.6.4. Deviations

As it was forecasted in the last reporting period (D2.7), the COVID-19 epidemic has affected (though slightly) the actual execution of WP6. Technical teams have diminished the coding pace that was installed during M19-M24 but specially ports are highly affected by the outbreak. Some activities were stopped, which has hampered the development of NGSI agents associated to the four ports.

While the task T6.5 has completed all its objectives and is covering fully its description, an additional activity was opened. Besides the visualisation framework including the widgets structure, notifications and all the required traits, some partners (mainly PRO) started to develop specific visualisation widgets to cover and represent the results of specific models in certain ports of PIXEL. First, a list of the total widgets to be created in the project to cover the pilots' functionalities was created. At the closure of the task, some of them were developed and others did not.

This cannot be considered a deviation because it was not planned to be conducted in this task; however the PIXEL partners wish to depict this scenario in the reporting document. This activity will not be leave unfinished and will be under the responsibility of WP7 task leaders. a

2.2.6.5. Corrective actions

Similar to what has happened in WP5, the WP6 team (and the whole Consortium) considers that the WP6 was formally finalised in M26 with the proper submission of deliverables D6.4 and D6.5. However, certain NGSI agents are left pending to be developed. This work has been translated into WP7, which also involves the agents development and integration as one of the main enablers to run the pilots.

In particular, the division has been done as follows:

- NGSI agents to bring raw data from GPMB sensors/data sources to run the use cases selected for that port are being developed, finalised, dockerised and made ready under task T7.2.
- NGSI agents to bring raw data from ASPM sensors/data sources to run the use cases selected for that port are being developed, finalised, dockerised and made ready under task T7.3.
- NGSI agents to bring raw data from THPA sensors/data sources to run the use cases selected for that port are being developed, finalised, dockerised and made ready under task T7.4.
- NGSI agents to bring raw data from PPA sensors/data sources to run the use cases selected for that port are being developed, finalised, dockerised and made ready under task T7.4.
- NGSI agents to convert from raw data into eKPIs to run the PEI pilot in all ports are being developed under task T7.5. This is aligned with the explanation provided in the WP5 report above related to allocate certain gluing tasks to T7.5. As a matter of fact, the mentioned specifications (detailed documentation with mathematical formulae) are forming the basis of the agents developed in T7.5.

To tackle the second issue exposed in the deviations section, the Consortium decided to assign the "specific widgets" development to WP7. The structure of the widgets assignment respond to the same categorization as above. However, the PEI will not be visualised through widgets, therefore the last bullet point does not apply.

2.2.7. Work Package 7 – Pilot trials integration, deployment and evaluation

This work package is in charge of integrating all the modules developed in WP6, properly applying the models described in WP4 and applying the methodology and techniques of WP5 to calculate the PEI in ports. The output will be the prototypes, adapted to the specific case studies in each port and with the PEI calculation implemented according to their requirements.

WP7 lasts (initially) from M14 to month M33 and constitutes one of the most important WPs for the project. As it has been indicated many times, PIXEL is use-case driven, so a good plan, execution and validation of the pilots will mark the future of the PIXEL tools and research lines.

At management level, WP7 is being a complicated work package as it includes the integration of developments made in other work packages and the realization of 4 pilots. The delay of other WPs may affect this one, for this reason a close and fluent communication between work packages is needed.

The status of the WP in this reporting period is considered "on-track" from the side of the software integration and pilots execution. During this period, an incredible amount of work has been to convert from isolated WP6 modules into a full functional, end-to-end, seamless platform able to run pilots and obtain results. However, there is still a lot of work to do to consider the WP close-to-an-end, thus some deviations and corrective actions have been needed to analyse.

On a broader scope, the current scenario of the WP in this reporting period (M25-M30) is considered "slightly behind schedule". It has been mainly characterised by a general unrest that has sometimes forced the team to adopt a wait-and-see strategy.

On the one hand, the WP6 modules have been made available for its total integration and usage in the pilots. The technology is available in the internal Git of the project and has been tested in the "test environment". The installation of the whole framework is being done in all the ports. However, the integration in real servers in the port brings some problems that cause some delays on the final availability of installation manuals. Additionally, as it has been commented in previous WP reports, certain "undefined" activities that are needed to ensure an end-to-end integration have been scheduled to be done in WP7. These were not initially planned and are causing slight delays that should be welcome with the aim of ensuring quality in the product deployed. The corollary on this regard is that the technology is already usable, but the additional burden and the deviations experienced in the last periods of WP6 and WP7 have prevented the proper integration to take place till now.

On the other hand, the WP7 is highly dependent of the availability and work capacity of the port personnel and equipment. These barriers (that may always exist) have gotten harder to overcome due to the COVID-19 effects:

- **Paralysis of activity in ports due to the COVID-19 outbreak**: during part of this reporting period (specially M25-M28), the activity in ports was clearly diminished, even paralysed. Not only the vessel operations activity decreased, but the availability of the personnel in Port Authorities was scarce if any. Besides, most ports decided to adopt mixed approaches on the work shifts (e.g. half week teleworking, half week physical attendance to port premises), which has had huge influence will delay the installation of all kind of equipment, the availability of the personnel and the difficulty to access to certain agents within the port (other departments, other entities such as terminals).
- **Sensors provision and installation**: The distancing measures are being applied all across Europe and the reduced staff availability are prolonging the timelines for sensors installation.

All of these risks are being handled by the Consortium, and mitigation measures are being put in place within the reasonable manoeuvring margin of each partner. From a global perspective, certain actions have already taken place to cope with the risks via the amendment #2 launched during this reporting period.

During the M25-M30 period, one of the most intensive for this work package, the work has been focused on: (i) finalisation of software integration in the "development environment",, (ii) PIXEL framework installation in each of the "pilot environments" in virtual machines in the servers of the ports, (iii) beginning of models installation in the different PIXEL instances, (iv) development of NGSI agents to set the "data acquisition" part of the pilots ready, (v) acquisition of the needed equipment and (vi) preparation for the validation.

Additionally, during this period a new task has been devised to be incorporated to the work plan. The EC requested EC-funded projects to (voluntarily) perform **COVID-19 pilots** with the aim to help stakeholders and citizens to deal with the pandemic as long as their project would fit that scope. PIXEL partners analysed the possibility and decided to include in the amendmend #2 **request a new task (T7.7)** to develop and execute a pilot in the Port of Monfalcone to help understand the effects of the social distancing at the terminal operations and facilitate work shifts based on that information.

In order to conduct the work package in the best way as possible, during this period (M25-M20), the project team has designed and put in place a new **Pilot Validation Methodology** as follows:

a) For the WP6 modules integration in each PIXEL instance (each port) based in a set of incremental states for each type of component/task, until the component is completely validated

b) Separation in phases, establishment of a process flow, responsible per step and estimated duration of each subtask. The objective of this plan is to control, model per model, the execution and completion from the very beginning (data acquisition) till the obtention of results (via visualization). One pilot (e.g. task T7.3) will be considered finished whenever all the models identified to be covered in that task will have successfully gone through all the phases.

c) A procedure for controlling the advances of each pilot depending on the state (a) of each phase (b) per model in the port:

- Leading: WPL
- Controlling: task leaders
- Executing: task participants
- Validating and proposing corrective measures if behind the schedule: Project Coordinator

2.2.7.1. Summary of progress in previous periods

At the beginning of the execution of the work package and before the start of the tasks, time was devoted to define how the execution of the work package was to be managed (define the responsible for each organization in the different tasks, define how WP7 would manage at the level of meetings, emails, deliverables, how to perform validations and test plans).

To validate the technical developments made in this project, including the pilots, it was decided to follow ISTQB guidelines based on the best practices and testing standards. The three main testing techniques are being used during the execution of the project:

- Individual test (unit test), focussed on the validation of specific functionalities
- Module test, focused on the validation of modules or components, and
- Integration test that allow us to validate the integration of different components and use cases.

To facilitate the management of tests, the web tool "TestLink" is being used, that is one of the most widely used tools to carry out the management of software tests.

Progress by task

Task 7.1: Integration of PIXEL components

This Task started in M13 and will end in M27. Till M24, the phase corresponding to the integration and testing of the software components developed in PIXEL was covered. The following activities took place:

- Definition of the integration strategy and its depiction via deliverable D7.1
- Creation (in TestLink) of the test cases for evaluating the integration.
- Definition of the models (out of WP4) that will be integrated; by when and by whom.
- Selection of a microservices strategy to be used for integrating all models as containers under a common mechanism.
- A proof of concept demo has been defined using the developed components and interfaces
- This demo was shown in the mid-term review in January 2020 (M21).
- Integration of GPMB data, T7.2 model and WP4 outputs from a supervision point of view in order to present a working demo in the mid-term review in Brussels.
- PAS outputs fine-tuning and the conversion into an actionable UI for ports
- Revision and clarification of pilot scenarios and expected impacts (KPIs) in alignment with the technical implementations (interaction with WP8).

Task 7.2: Energy Management trial: Port of Bordeaux

This task started in M16 and will end in M33. During the first half of the project (till M24), only three months of this task had taken place. In that short time, just some actions were performed:

- A first work of identification of software and hardware that have to be integrated for the GPMB pilot execution, resulting in a to-do list for the integration that was included in the deliverable D7.1
- A first set of integration tests were identified and defined in the TestLink web tools
- Identification of the end-points of the data sources to be integrated
- Identification of how to integrate weather station data and data coming from electrical sensors already installed inside the port but not already connected.
- Start of the work for integrating PAS model execution and outputs to feed the energy demand model with live data.
- Data gathering, selection of data models, planification of NGSI agents development
- Development of NGSI agents
    - Vessel calls (from VIGIEsip)
    - PV output prediction

    - Tide level sensor
    - Data from supply chains of GPMB
- Final clarification of the equipment needed to run PIXEL, collection of the equipment and start the phase of putting it in place
- Designing and starting software and hardware integration
- Collaboration with WP4 partners in order to prepare the software and operational mechanisms to achieve having the models running.

Task 7.3: Intermodal Transport trial: Port of Monfalcone

Same as for T7.2, the task T7.3 had also executed three months before this reporting period (M24). The works initiated (to be continued) in that time were:

- Establishment of the basis on how to manage the execution to achieve the scope of the task, including a work plan and assignment of duties to the different partners involved.
- A first work of identification of software and hardware that have to be integrated for the ASPM/SDAG pilot execution, resulting in a to-do list for the integration that was included in the deliverable D7.1
- A first set of integration tests were identified and defined in the TestLink web tools
- Data gathering, selection of data models, planification of NGSI agents development
- Development of NGSI agents
    - Vessel calls (from the website of ASPM)
    - Certain SILI data needed for running models
    - Data from the videocameras of (already installed in) Monfalcone
- Final clarification of the equipment needed to run PIXEL, collection of the equipment and start the phase of putting it in place
- Designing and starting software and hardware integration
- Collaboration with WP4 partners in order to prepare the software and operational mechanisms to achieve having the models running

Task 7.4: Port-city integration trial: Ports of Piraeus and Thessaloniki

Same as for T7.2 and T7.3, the task T7.4 had also executed three months before this reporting period (M16-M18). The works initiated (to be continued) in that time were:

- Planning of the separate tasks took place redounding in two Gantt charts that were included in the deliverable D7.1. One sub-task is the pilot to be deployed in THPA and the other sub-task is the pilot to be deployed in PPA.
- A first set of integration tests were identified and defined in the TestLink web tools
- Data gathering, selection of data models, planification of NGSI agents development
- Development of NGSI agents
    - THPA:
        - Wind data
        - Weather data
        - Traffic data at the gates
        - Vessel calls
    - PPA
        - Weather data from open data sources
        - Traffic data from open data sources
- Final clarification of the equipment needed to run PIXEL, collection of the equipment and start the phase of putting it in place
- Designing and starting software and hardware integration

- Collaboration with WP4 partners in order to prepare the software and operational mechanisms to achieve having the models running

Task 7.5: Transversal trial: Port Environmental Index development

The Transversal Trial Port Environmental Index (PEI) development started in M14 and will end in M33, so five months were executed till the end of the last reporting period.

During the first months of the task, the main points of discussion were on data availability and automated data retrieval for the PEI calculation in order to calculate and visualize the Port Environmental Index in real time. Data availability was identified as the main and critical point to be addressed during the transversal trial on which the success of the transversal trial will depend.

It was decided that the Port Activity Scenario (PAS) will be deployed in all ports and will be used as a way to bypass certain data inputs for the PEI deployment.

Later, although it was analysed that PIXEL pilot ports would likely not have all the necessary data to fully parametrize the PEI calculation, mechanisms were provided through deliverable D5.3 to lallow a feasible implementation and deployment of task T7.5.

During M19-M21, the team developed a working version of the (partial) PEI in order to be shown during the mid-term review in Brussels.

Other activities performed in the task so far (M24) have been:

- Experiences from the noise modelling done in previous periods were used to determine the optimal positions for the placement of noise sensors in the pilot ports
- During the Plenary meeting in Thessaloniki sensor purchasing by the ports has been addressed and recommendations have been provided.
- The next NGSI agents have been developed during this reporting period for the PEI execution:
    - Vessel calls of THPA
    - Waste of ships berthing at THPA
    - Terminals waste 2019 of THPA

Task 7.6: Inter-pilot integration and collaboration

Task T7.6 started on month M18. During the first month of execution, a time plan was established, different responsibilities were assigned and the initial works on recognising the different points (especially, models) that can be re-used and leveraged among the different pilots were done.

During M19-M24, as the developments are highly dependent on the results of the rest of the tasks in the WP, not many materialisations have been performed. The points that have been working on are:

- Analyse the data sources that will be available in the different pilots to define which possible new models can be applied to existing pilots that were not initially planned
- Identify new models/combination of existing models

2.2.7.2. Summary of results after previous periods

The main results that WP7 obtained till M24 of the project in the context of WP7 are the following:

- Definition of the validation approach to validate the platform integration and pilots.
- Definition of test plans, test cases and the initial execution plan.
- Clear planification by sprints following agile methodology has been set, put in place and is being followed by technical partners in charge of the integration.
- An integrated working demo functioning that was shown during the mid-term review

- Assignation of technical experts to different pilots in order to establish a parallel tracking and execution of the deployments (one port – one pilot – one technical partner assigned)
- Development of NGSI agents of the different pilots: T7.2, T7.3, T7.4 and T7.5 have developed several NGSI agents that are already integrated in a "development environment" that will be later translated to the on-premises servers.
- Certain remote servers and on-premise infrastructure prepared for the integration.
- Deliverables submitted successfully:
    - Deliverable *D7.1 - Integration Report V1*

2.2.7.3. Progress in M25-M30

Progress by task

Task 7.1: Integration of PIXEL components

Task T7.1 has been executed during the whole period, being one of the most crucial activities of the project in this moment. In this period (M25-M30), this task has been pursuing the achievement of the following items:

1. The proper integration of all WP6 modules in a development environment.
2. The proper integration of all WP6 modules in a real scenario "demo"
3. Documenting the integration procedure and forward it to T7.2, T7.3 and T7.4 leaders to replicate it in the corresponding servers in the ports
4. Make sure that the infrastructure is ready in all the tasks in the WP to run PIXEL
5. Test an end-to-end data flow in a real scenario
6. Test an end-to-end functionality execution (e.g. running one model and checking that it works) in a real scenario

Apart from those activities, the task T7.1 (which has been on of the most intensive of the project in this period) has overseen:

- Definition of a new Pilots Validation methodology that will allow the WP7 leader, technical coordinator and PC coordinator to keep track ok
- Specification (in detail) of all the NGSI agents to be developed under all the tasks in WP7, including port-specific use cases, PEI pilots (in all 4 ports) and the cross-port use-case.
- Distribution of tasks among technical partners to ensure coverage to: (i) WP6 modules responsibles interaction in WP7, (ii) maximisation of skills leverage, (iii) speeding the integration with the aim of start evaluating the pilots as soon as possible.
- A proof of concept "infrastructure" has been created (called "demo") in which any model, data source and functionality might be run with testing purposes. Additionally, it is planned to use this installation for "improvements" of the global PIXEL framework requested/designed during the course of WP7.

Task 7.2: Energy Management trial: Port of Bordeaux

Task T7.2 has been being executed the whole 6-months period M25-M30. The main activities conducted during this period have been (in parallel, mutually feeding and interacting with WP6 partners):

- Data gathering, selection of data models, planification of NGSI agents development
- Development of NGSI agents
- Setting up the needed equipment to run the pilots. As per technical decision, the computing equipment has been divided in two virtual machines. Since the beginning of the period, the equipment (Linux servers) has been made usable. Technical partners more involved in this task (ORANGE and CATIE) have been granted with VPN credentials and SSH access to proceed with PIXEL installation.
- PIXEL modules installation.

- Designing and starting software and hardware integration
- Installation of additional sensors (purchased within PIXEL) and integration in the infrastructure. This activity will be ongoing during the next reporting period as well.
- Incorporation of new data sources gathered with the purpose of covering PIXEL use-cases.

The following advances have been experienced in the period M25-M30 are the following – note: this reporting format has been extracted from the new pilots validation methodology:

- PIXEL installation level: 100%
- NGSI agents developed: 6
- NGSI agents fully (end-to-end) integrated: 2
- Dockerised models integrated: 2
- Models completion level reached:
    - PAS modelling: agents ongoing, model integrated, agreements closed, visualisation ongoing, end-to-end pending.
    - Vessel calls prediction: agents finalised, model integration ongoing, agreements closed, visualisation ongoing, end-to-end pending.
    - Prediction of renewable energy production: agents ongoing, model ongoing, agreements closed, visualisation ongoing, end-to-end pending.
    - ETA prediction with AIS agents ongoing, model ongoing, agreements closed, visualisation ongoing, end-to-end pending.
    - Energy demand prediction: agents almost finalised, model integrated, agreements closed, visualisation ongoing, end-to-end pending.

Task 7.3: Intermodal Transport trial: Port of Monfalcone

Task T7.3 has been being executed the whole 6-months period M25-M30. The main activities conducted during this period have been (in parallel, mutually feeding and interacting with WP6 partners):

- Data gathering, selection of data models, planification of NGSI agents development
- Development of NGSI agents
- Setting up the needed equipment to run the pilots. As per technical decision, the computing equipment has been divided in two virtual machines. Since the beginning of the period, the equipment (Linux servers) has been made usable. Technical partners more involved in this task (ORANGE and CATIE) have been granted with VPN credentials and SSH access to proceed with PIXEL installation.
- PIXEL modules installation.
- Designing and starting software and hardware integration
- Installation of additional sensors (purchased within PIXEL) and integration in the infrastructure. This activity will be ongoing during the next reporting period as well.
- Incorporation of new data sources gathered with the purpose of covering PIXEL use-cases.

The following advances have been experienced in the period M25-M30 are the following – note: this reporting format has been extracted from the new pilots validation methodology:

- PIXEL installation level: 80% (v2 of OT and Dashboard pending)
- NGSI agents developed: 3
- NGSI agents fully (end-to-end) integrated: 1
- Dockerised models integrated: 2
- Models completion level reached:
    - Traffic prediction: agents finalised, model available but not yet integrated, agreements closed, visualisation finalised, end-to-end pending.

- PAS modelling: agents finalised, model integrated, agreements closed, visualisation ongoing, end-to-end pending.
- Hinterland multimodal: agents finalised, model integrated, agreements closed, visualisation closed, end-to-end pending.

Task 7.4: Port-city integration trial: Ports of Piraeus and Thessaloniki

Task T7.4 has been being executed the whole 6-months period M25-M30. The main activities conducted during this period have been (in parallel, mutually feeding and interacting with WP6 partners):

- Data gathering, selection of data models, planification of NGSI agents development
- Development of NGSI agents
- Setting up the needed equipment to run the pilots. As per technical decision, the computing equipment has been divided in two virtual machines. Since the beginning of the period, the equipment (Linux servers) has been made usable. Technical partners more involved in this task (ORANGE and CATIE) have been granted with VPN credentials and SSH access to proceed with PIXEL installation.
- PIXEL modules installation.
- Designing and starting software and hardware integration
- Installation of additional sensors (purchased within PIXEL) and integration in the infrastructure. This activity will be ongoing during the next reporting period as well. A noise sensors placement analysis was performed both for THPA and PPA, and further testing of the air emission model was performed a discussion as well.
- Additionally, integration of air and noise pollution models was discussed and guidelines for future actions were provided.
- Incorporation of new data sources gathered with the purpose of covering PIXEL use-cases.

The following advances have been experienced in the period M25-M30 are the following – note: this reporting format has been extracted from the new pilots validation methodology:

- PIXEL installation level: THPA 50%, PPA 50%
- NGSI agents developed: 5 THPA, 3 PPA
- NGSI agents fully (end-to-end) integrated: 1
- Dockerised models integrated: 1
- Models completion level reached:
  - THPA – Air pollution: integration ongoing, visualisation ready, agreements ongoing
  - THPA – Noise pollution: integration ongoing, visualisation ready, agreements ongoing
  - THPA – Traffic predictions: agents finalised, model dockerised not integrated yet, agreements closed, visualisation ready, end-to-end pending.
  - THPA – PAS modelling: agents ongoing, model dockerised not integrated yet, agreements closed, visualisation ongoing, end-to-end pending.
  - PPA – Air pollution: integration ongoing, visualisation ready, agreements ongoing
  - PPA – Noise pollution: integration ongoing, visualisation ready, agreements ongoing
  - PPA – Traffic predictions: agents ongoing, model dockerised not integrated yet, agreements closed, visualisation ready, end-to-end pending.
  - PPA – PAS modelling: agents ongoing, model dockerised not integrated yet, agreements closed, visualisation ongoing, end-to-end pending.

Task 7.5: Transversal trial: Port Environmental Index development

The task T7.5 in M25-M30 was continuously advanced building upon the results provided by deliverable D5.3. As it has been commented in previous sections, the development of NGSI agents for the PEI pilots has been placed in this task.

A clear strategy on that regard was devised in the Plenary Meeting in July 2020. During the virtual session of T7.5, deployment of the PEI to pilot ports was in the centre of discussion. It is planned for ports to deploy the PEI after the work done in D5.3, which was also finished during this period. Plans for the future actions were adopted and some general guidelines for future work provided.

Besides, according to what was agreed, for the PEI pilot the approach starts by developing all the agents and deploying the PEI in one port (THPA) and then taking advantage of the code generated, documentation and lessons learned to tackle the rest of pilots in a serialised fashion: THPA->ASPM->GPMB->PPA.

All the previous has been designed considering that the "backend of the PEI" – PEI as a model- was already developed during the last reporting period. This packed piece of software has already been improved during the current reporting period (M25-M30), refining the mathematical methods being used, adding certain options and including functionalities such as external database consultation.

Additionally, other activities were tackled during the period:

- Control and monitoring of the purchase and installation of the sensors to provide information for the PEI (namely light, noise and odour) by some ports
- Continuing the work done on the Ship Environmental Index in the previous reporting period, the calculations were now expanded to include port authorities and terminals, or port authority/terminal, as in the case of the Port of Thessaloniki they are one and the same for the requirements of the PEI.
- The next NGSI agents have been developed during this reporting period for the PEI execution:
    - Improvement of Vessel calls of THPA. This model has been developed using the pyngsi library provided in WP6. This model has been properly dockerised.
    - Improvement of Waste of ships berthing at THPA. This model has been developed using the *pyngsi* library provided in WP6. This model has been properly dockerised.
    - Terminals waste 2019 of THPA
    - Terminals wastewater THPA
    - Gas and energy production THPA

Task 7.6: Inter-pilot integration and collaboration

The task T7.6 has been executed during the period under report. However, as the developments are tightly depended on the results of the rest of the tasks in the WP, not many materialisations have been performed. The points that have been working on are:

- Analyse the data sources that will be available in the different pilots to define which possible new models can be applied to existing pilots that were not initially planned
- Identify new models/combination of existing models
- Review potential synergies among models under integration.

Table 7. Summary contribution of partners WP7 M25-M30

Partner	Contribution
P01 UPV	• Attendance to all WP7 bi-weekly conferences. • Attendance to joint WP6-WP7 control sessions under Agile Development management. • Develop NGSI agents in tasks T7.4 and T7.5 • Develop visualisation interfaces in tasks T7.4 and T7.5

	• Start the installation of PIXEL (v2) in THPA premises • Help in the process of integration of WP6 components in the PIXEL framework end-to-end as defined in task T7.1 • Extensive work on enhancing PEI backend model • Collaboration with PRO in devising a new Pilot validation methodology
P02 PRO	• Lead WP7 bi-weekly conferences and WP6-WP7 control sessions under Agile Development management. • Lead the creation of a new Pilot validation methodology • Lead the integration of all WP6 components in the installed PIXEL framework according to T7.1 definition • Development of several widgets for the Dashboard to cover pilot needs • Lead of task T7.6 • Usual activities of WP leader • Organisation of many specialised telcos to tackle specific problems of integration, platform installation, infrastructure setup and pilot advance in general.
P03 XLAB	• Attendance to all WP7 bi-weekly conferences • Attendance to joint WP6-WP7 control sessions under Agile Development management • Work on IH integration activities and testing of new data sources, as they are being added to the pilots.
P04 INSIEL	• In the context of T7.1 and T7.3, during the first part of this reporting period INSIEL worked to prepare the infrastructure to host PIXEL platform in its Data Center, in particular 4 virtual machine have been configured based on PIXEL architecture, moreover have been developed components to integrate model to PIXEL architecture and supported Monfalcone to define the acquisition of environmental sensors. • Later, INSIEL was focused in the integration of the new environmental sensors for noise to be integrated in the INSIEL infrastructure for the Monfalcone pilot while continued working on the integration of the newest PIXEL modules in the platform.
P05 CATIE	• Attendance to WP7 telcos • Task 7.1: CATIE follows the integration plan in GPMB and test and validation of models as leader of WP4; • Integration of the PAS model in the PIXEL architecture for the PIXEL platform installed in GPMB. • Implementation of an end-to-end scenario with many feedbacks to the WP6. • Usual activities as task leader (T7.2) • Leading of task T7.2: CATIE has organized the work within partners. CATIE in collaboration with GPMB and ORANGE work on software and hardware integration for the energy management use-case. Many data sources have been integrated. PIXEL platform has been deployed in GPMB. • Coordination of integration actions in the GPMB pilot.
P06 ORANGE	• Work with model developers to see how to collect data needed and integrate the model on the PIXEL Platform. • Create the initial installation process for pilot deployment • Deploy the first version of the PIXEL platform on GPMB premises • Following all pilots integration and NGSI Agent creation • Investigate end-to-end data flows on the PIXEL platform on GPMB premises

	• Participate into the elaboration of the best strategy to upgrade all platforms and be able to welcome upcoming v2 software components

P08 MEDRI	• Attendance to all WP7 teleconferences
	• T7.4:
	  ○ Discussion and analysis of further actions were discussed and defined for integrating the air and noise emission models in the PIXEL pilots.
	  ○ First (M25-M27)Analysis of the connection of the air emission model with other models in the project like the Port Activity Scenario model and the Sip index emission calculation model (form the PEI).
	  ○ Afterwards (M28-M30), continuing exerting effort to complete the implementation of the air emission model.
	  ○ Additionally, some work was done on the visualization of the results of the noise model.
	• Usual work as task leader (task T7.5). Additionally, the following activities we carried out in the context of the PEI pilots during the M25-M30 period:
	  ○ Finalising the first version with real data of the Ship environmental index.
	  ○ Demonstration to other partners the functioning of the Ship index calculation.
	  ○ Based on THPA's gas and electricity data, previously developed methodology was adapted in order to make it possible to calculate the eKPIs for port authorities and terminals (it is one entity in the case of the Port of Thessaloniki).

P09 SDAG	• SDAG contributed for the implementation of the task T7.5 by providing feedback on the related activities lead by PRODEVELOP and MEDRI and helping the Port of Monfalcone with the implementation of the PEI and the integration. • SDAG is implementing internal activities for the implementation of the FVG pilot trial. • SDAG also participated in some TelCos WP7 related and contributed for the ppt presentation related to FVG Pilot for the virtual plenary meeting in July 2020. • Finally, also in the context of T7.3, some internal meetings were arranged also together with INSIEL regarding SDAG the integration of the Pixel Hub and COVID pilot.

P10 THPA	• Attendance to all WP7 – pilots + integration teleconferences
	• T7.4: All tasks were related to the pilot implementation preparation. Issues regarding the platform and its use, were addressed by the Consortium and actions were defined. Many issues were finalised in the Plenary meeting that took place in July 2020.
	• T7.4: Meetings were held with all involved Departments of ThPA SA., regarding the draft of the "worst case scenarios", that are required for the noise and air pollution models
	• Telcos as well as, physical meetings were held, with the project's subcontractor, assisting in WP7 tasks
	• T7.4 and T7.5 applied to THPA:
	  ○ The timeframe for the relative scheduled actions, was defined, while other issues regarding the pilot implementation, were addressed.
	  ○ Moreover, the purchase of the new sensors was finalised, with their integration stage to be completed in the next reporting period

P11 PPA	• Attended to all WP7 – pilots + integration teleconferences
	• Within the PPA pilot task (T7.4):
	  ○ Drawing up the pilot activity work plan
	  ○ Arrangements to operate the subscriptions to the virtual cloud servers with Microsoft Azure and the real time vessel traffic data with marinetraffic.com.

	○ Start of data integration (see previous point) into PIXEL with the collaboration of PEOPLE and the subcontractor. ○ Activation of the Microsoft Azure cloud servers for installing the PIXEL software ○ Collaboration with subcontractors for the pilot workplan. ○ Air pollutions-noise sensor tender contract finalized and signed. ○ MARPOL data collected. ○ Contract preparation, finalisation and signature for the air pollutions-noise sensor tender. ○ Participated in the deployment of the 5 NGSI Agents ○ completed the installation of the pollution-weather sensors and the sound meter hardware ○ Sensors and sound meter software was installed on the PPA laptops. PPA is collaborating with the partners and the sensors and vessel traffic data subcontractors for the pilot activities arrangements to export the real time data to the PIXEL modules on the Microsoft Azure cloud servers • Acquisition of committed equipment took place. • Provided COVID-19 PPA project ideas • T7.5: Provided PEI data on terminal -port waste and energy
P12 ASPM	• Attendance to all WP7 teleconferences • ASPM contributed to T7.3 and 7.5 providing feedback on the activities lead by PRODEVELOP and MEDRI, helping with the implementation of the intermodal trial for the port of Monfalcone and transversal trial for the PEI. • Preparation of presentation related to FVG Pilot for the virtual plenary meeting. • ASPM organized various meeting along with INSIEL and Technical partners in order to evaluate the installation of an environmental sensor in the port of Monfalcone premises and its data sharing with PIXEL. • Finally, some internal meetings were arranged also together with INSIEL and SDAG regarding the integration of the Pixel Hub and COVID-19 pilot. • The environmental sensor was purchased, received and it is under installation.
P13 GPMB	• Attendance to all WP7 teleconferences • Infrastructure for PIXEL hosting installation • Purchase of Sensor station for Noise and Light • Provision of data: IoT Electrical Consumption data and interface PIXEL, WASTE information gather (Ship and terminal), Energy Use case information gather • Green Marine exchange
P14 IPEOPLE	• Attendance to all WP7 teleconferences • Leading task T7.4 carrying out usual management activities • Technical work in task T7.4: ○ Organized and conducted Telcos with ThPA and PPA regarding Task 7.4 ○ Providing support to ThPA and PPA in numerous issues. ○ Reviewing and correcting greek translation for Dashboard and IH ○ Developing NGSI Agents for ThPA (during all the reporting period) ○ Following sensors procurement and installation processes for ThPA and PPA ○ Overseeing sensor installation and data availability

	• Organized and conducted Telcos with ThPA and PPA regarding Task 7.5
P15 CERTH	• Attendance to serveral WP7 teleconferences • Interaction between WP7 and WP8.

2.2.7.4. Results after M25-M30

- A new Pilot validation methodology
- Huge advances in the pilots: agents integration, model integration, new visualizations.
- Platform PIXEL installed 100% in one port and more than 50% in the others.
- New sensors being installed and integrated for PIXEL
- Creation of a new task T7.7 (result related with WP2) that will be reported in the next period.
- Complete version of ship index calculation.

2.2.7.5. Deviations

For the moment, the only remarkable deviation is the (already forecasted) delay on the execution of the pilots

Besides, a new task has been introduced in the work plan of WP7. The task T7.7 will be in charge of conducting the COVID-19 pilot. To introduce this task, the scope of the WP7 has been modified to some extent.

The proposal is to diminish the scope of three (already planned) pilot tasks:

- Air pollution model integration and usage of ARPA open data (T7.3): The air pollution model will not be real-time integrated in the Monfalcone pilot. The approach will be similar than the noise modelling for the Greek ports: running AERMOD offline, exporting results and then just monitoring available environmental data in Monfalcone.
- Gathering, processing, exploitation and visualization of data coming from the PMIS (national owned) system (T7.3). We have been experiencing huge difficulties to obtain all permissions and authorizations to access the PMIS of the port (property of the region). The COVID pilot will help this task alleviate its dependency of this data. Efforts will be focused on the COVID use-case and the PMIS integration will take place (if arrived on time) at a later stage of the project.
- Accepting short periodicity for the PEI applied to terminals and Port Authority-related data (T7.5). One of the most constraining issues for PEI deployment in Monfalcone is the need of manually fulfilling certain data associated to the port authority (e.g. energy consumption, waste, wastewater, etc.). According to D5.3, these data must be typed by the port with “as soon as possible”, which would require too extensive amount of communications between port agents and departments. Relaxing these requirements will allow ASPM and other partners to be focused on the useful COVID use-case.

This modification of scope does not alter the ambition of the work package at all. This change has been requested in the amendment #2. The results of this amendment will be reported in the next period.

2.2.7.6. Corrective actions

As it has been explained before, some of the risks foreseen in the last reporting have been materialised due to the COVID-19 effects. This led the WP7 team to included in the amendment #2 a request of extending the WP5 activities still alive:

- End of WP7: M33->M38
- End of T7.1, T7.2, T7.3, T7.4, T7.5, -T7.6: from M33->M38
- Due date of D7.2: M33->M38
- Due date of D7.3: M33->M38

2.2.8.Work Package 8 – Assessment and expansion plan

The objectives of this work package are diverse: (i) to develop an evaluation plan for guiding the assessment activities of the project outputs, (ii) to define quantitative and qualitative KPIs for PIXEL involving partners and stakeholders, (iii) to assess the technical performance of the PIXEL 'enabling IT infrastructure' and of the ICT solutions implemented within each use case, (iv) to identify and provide guidance for improvement in regards to possible system gaps (e.g., flexibility, reliability, scalability, safety, etc.), (v) to define the business potential of PIXEL and the economic impact of its implementation, (vi) to specify scalable transferability of the results to other ports with independence of the size and (v) to provide evidence of PIXEL's proof of concept and R&D potential.

WP8 was initiated in month M10 of the project, hence it has been running for 14 months during the current reporting period. In terms of tasks, all tasks have been initiated by M30 and only T8.1 has been finalised.

The most prominent aspect of the WP8 execution is the dependency with the results of two previous work packages: WP6 and T7.1 (especially for the technical assessment in T8.2) and the completion of the pilots in WP7 (especially in regards to the business assessment in T8.3). These dependencies are already being materialised in delays in the execution of WP8. The risk assessment task in WP2 carefully analyses this evolution and puts in place any possible mitigation measure. The WP8 tasks are being normally executed, having prepared all means for the evaluation to take place as soon as the pilots will be running and generating results.

COVID-19 outbreak and its associated measures may have impact in the assessment and evaluation of PIXEL In particular, the value of some KPIs may be lower or higher than those which would be obtained in a normal situation.

Besides the cascade effect of the most likely delays on WP7, the impacts (KPIs) that will be measured, especially from the point of view of T8.3, will be completely biased by the effects of the COVID-19. For most ports (data from PIXEL ports), the number of vessels and the numbers of operations in the port are being reduced by 40-60%.

This very fact has meant **the inclusion in the amendment #2 of a request to extend all current activities in WP8 5 months**. This way, tasks T8.2, T8.3 and T8.4, altogether with deliverables D8.3, D8.4 and D8.5 will have as due date M41: 31-May-2021..

2.2.8.1. Summary of progress in previous periods

Progress by task

Task 8.1: Evaluation Plan

The ultimate goal of the first task of WP8 was to formulate a concrete evaluation plan which will be implemented in the months to come so as to evaluate and validate the main results of the project. This task run from month M10 and finished on M16. The different activities that were carried out were:

- Design of the plan of the technical impact assessment. It was decided to use evaluation models based on the Square assessment framework.
- Identification of specific expected impacts, evaluation methodology and KPIs for evaluating the PIXEL technical framework and the use-cases from a functional point of view.
- Design of the plan of the business impact assessment. It was decided to use the classical CBA model for conducting the evaluation. One CBA per pilot will be conducted.
- Identification (for each use case/port) specific expected impacts (quantitative and qualitative), as well as KPIs along with the relevant units and methods of measurement
- Design of plan for conducting the proof of concept and the future research lines after PIXEL.
- For the implementation of some PIXEL tools to external ports, it was also foreseen the data collection methodologies, responsible parties, time plan and potential risks and mitigation plans.

This task was successfully finalised in M16.

Task 8.2: Technical Impact Assessment

Task T8.2 started in month M15, therefore by the end of the past reporting period (M24), ten months of the task were executed. The activities conducted till that point were:

- Definition, discussion and agreement on the task time planning and the ToC (Table of Content) for the deliverable (D8.2).
- Creation of a first version of the questionnaires for TAM3 and AIMQ questions.
- Creation and sharing of a collaborative document for D8.2.
- Writing of a first draft for a majority of sections.
- Measurement of some technical impact assessment characteristics in order to derive KPIs for the different modules.
- The four pilot sites fine-tuned and finalised the description of their final pilot case and the measures that will be finally implemented with regards to technical impact assessment. This finalisation has included a review and update of the KPIs that will be included in the evaluation methodology.
- Finally, one of the main actions in the task was the writing of the deliverable D8.2 with the most updated information about the business impact assessment.

Task 8.3: Business & economic impact assessment

Task 8.3 started during the previous reporting period (M19). Till the beginning of this reporting period (up to M24), task 8.3 had intensive activity that can be summarised in the following.

- Update and/or verification of the KPIs included in D8.1 after specific request of the task leader
- A set of guidelines were prepared for each Port, as well as indicative questionnaires, in order to conduct the business and economic evaluation, that will lead to the formulation of a CBA per port. These guidelines included a brief description of each pilot case, their expected impacts KPIs, guidelines on how to measure them and brief information on how to formulate and use the questionnaires.
- KPIs to be updated, enriched or deleted
- Guidelines on how to conduct the measurements
- Brief information on how to formulate and use the questionnaires.
- In parallel, the four pilot sites have fine-tuned and finalised the description of their final pilot case and the measures that will be finally implemented with regards to business impact assessment.
- Writing of the deliverable D8.5 with the most updated information about the business and economic impact assessment.

Task 8.4: PIXEL proof of concept and future R&D potential

This task had not officially started till M25 (in the current reporting period). However, the task leader (UPV), prepared in the previous months (M19-M24) a clear plan with the different actions to be performed (technically, temporally and with regards to assignation). This plan was made available to the partners and has been discussed and agreed in Plenary meetings.

Additionally, initial contacts were made with external ports to check their willingness to be involved, in the evaluation – interest already expressed by the ports of Valencia, Rijeka and Trieste.

2.2.8.2. Summary of results after previous periods

The main results that were obtained in the context of WP8 are the following:

- Formulation of the Evaluation Methodology to be implemented for the:
  - Technical Impact Assessment of the PIXEL Platform in each use case
  - Business and economic impact assessment of the ICT solution implemented in each use case
  - Proof of concept and future R&D potential of PIXEL.

- Progress in evaluating part of the module characteristics.
- A set of guidelines for the Business and Economic Assessment guidelines for each PIXEL port
- Deliverables submitted successfully:
    - Deliverable *D8.1 - Evaluation Plan*
    - Deliverable *D8.2 - Technical Evaluation v1.0*

2.2.8.3. Progress in M25-M30

Progress by task

Task 8.2: Technical Impact Assessment

Task T8.2 has set all the technical evaluations that must be done to consider full assessment of PIXEL platform.

During this reporting period, T8.2 has been mainly waiting for the integration of work done in the framework of WP7, particularly in the advances of every pilot framed in T7.2, T7.3, T7.4 and T7.5. As soon as a functionality will be totally ready (OK message must be received from WP7 leader and Technical Coordinator), CATIE will be provided a link (URL) that will include a UI with the needed instructions for conducting the technical assessment. This will be done mainly for the real implementation in a pilot, but it is also planned to validate functionalities over the "development environment".

In the meantime, some additional tasks have been performed:

- Preparation of the tool for the technical evaluation
- Analysis and review of requirements in D3.2, both functional, non-functional and pilot-specific in order to streamline their assessment.
- Participation in the discussions of WP6 integration in WP7, the different advances in the pilots. Helping in the issues occurred.

Task T8.2 will be continued during the last reporting period.

Task 8.3: Business & economic impact assessment

T8.3 has been running during the whole period M25-M30. The progress can be summarised as follows:

- Preparation of the main deliverable that will report the work in the task: deliverable D8.4 (Business and economic assessment report):
    - Formulation of the ToC
    - Finalisation of pilot guidelines and questionnaires
- Definition of evaluation procedures to be carried out whenever the ports will have deployed their pilots
- Analysis of the timing to be tied to: months to be running the pilots, assessment timespan, etc.
- Gathering information from ports: a comprehensive list of the activities performed by all PIXEL ports was carried out. This has been done to contextualise and complete the business and economic analysis that will be conducted in this task during the next reporting period.
- Update and/or verification of the KPIs included in D8.1, including the design of customized indicators to finely measure the impacts in each user story.

Task T8.3 will continue running during the last reporting period and until the end of the project when the final report will be prepared and submitted.

Task 8.4: PIXEL proof of concept and future R&D potential

Task 8.4 is devoted to two primary goals: (i) Identify future research directions and (ii) implement Proof-of-Concept pilot tests in external ports. For the first sub-task, and aligned with the proposed plan in deliverable D8.1, the team carried out the identification of main and specific research topics according to the available literature. The timeframe is being split into past trends (1980-2015), recent ones (2015-2020) and future

forecast, where PIXEL results will apply. Some links were also established with the DSS tool developed by the CSA DocksTheFuture.

For the second sub-task, alignment with WP9 was established to provide a homogeneous PIXEL offer and identified some potential candidate ports to make initial contacts. Two ports (Valencia, Trieste) already showed interest and provided initial feedback, which was used to start a FAQ document. Some work has also been carried out to align the methodology described in deliverable D8.1 with the CSA Transferability Analysis tool.

Table 8. WP8 Partner contribution summary table M25-M30

Partner	Contribution

P01 UPV	• Attendance to all WP8 monthly teleconferences
	• T8.2: Help preparing the scenarios for the technical assessment.
	• Link of the T8.2 KPIs with the technological module of KPI analysis in the OT v2
	• Work on the definition of thresholds, data model and description of the KPIs aligned with the T8.2 work.
	• Leading T8.4:
	  ○ Main and specific research topics analysis in the available literature.
	  ○ Contacts with external ports for the deploying of some PIXEL features.
	  ○ Established some links with the DSS tool developed by the CSA.
	  ○ Established links with the CSA DtF Transferability Analysis.

P02 PRO	• Attendance to all WP8 monthly teleconferences • T8.2: Help preparing the scenarios for the technical assessment. • Link of the T8.2 KPIs with the technological module of Alerts in task T6.5 • Setting the TestLink tool to prepare the work for T8.2 – technical assessment.
P03 XLAB	• Attendance to all WP8 monthly teleconferences • T8.2: Working on definition of KPI tests for the final deliverable • In the frame of T8.2 XLAB has been supporting the integration and deployment of WP6 results (Information Hub) and WP4 results (predictive models) for pilots, so to create a comprehensive testbed for the technical impact assessment. • Working on definition of evaluation procedures for the final deliverable.
P04 INSIEL	• In the context of T8.2 and T8.3, INSIEL worked in cooperation with Monfalcone Port and SDAG on technical and business impact assessment, designed customized indicators to evaluate PIXEL solution impact on Italian pilot.
P05 CATIE	• Attendance to all WP8 telcos • Establishment of a work plan for the second round of the evaluation of the PIXEL modules and the evaluation of the PIXEL Use-cases. • As the T82. Leader, CATIE has delivered the ToC of D8.3 and informed WP8 what is expected for the round 2 of technical evaluation
P08 MEDRI	• Attendance to all WP8 monthly telcos • Preparation has been done for future work, especially regarding eKPIs.
P09 SDAG	• Attendance to all WP8 monthly telcos • SDAG contributed to the implementation of the task T8.3 by providing feedback on the related activities lead by CERTH, gave comments and contributions about documents/information asked by the task leader.

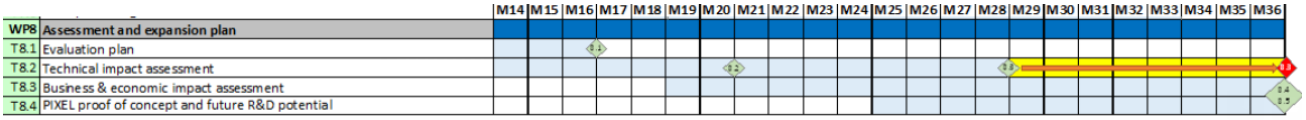
P10 THPA	• Attendance to several WP8 telcos • Meetings with the project's subcontractor, assisting in WP8 tasks
P11 PPA	• Attendance to all WP8 telcos • Provided contribution for D8.3.
P12 ASPM	• Attendance to all WP8 telcos • ASPM provided feedbacks and information to CERTH in order to fulfil the activities related to the implementation of T8.3.
P14 IPEOPLE	• Attendance to all WP8 monthly telcos • Organized and participated in T8.4 meeting about PAS.
P15 CERTH	• Organisation of all WP8 monthly telcos • Coordination of WP8 with its usual activities associated • Undertaking of preparatory actions for the execution of the business and economic evaluation in the 4 pilot sites. Guidelines and questionnaires have been finalized and agreed in cooperation with the representatives of the Ports. • Work on D8.4 (Business and economic assessment report) – o Formulation of the ToC o Finalisation of pilot guidelines and questionnaires • Work on D8.5 (PIXEL external evaluation and proof of concept report): o Analysis of previous research undertaken in the ports' domain o Further search and analysis of previous research undertaken in the ports' domain, focusing on more recent papers (from 2012 to now)

2.2.8.4. Results after M25-M30

The results in this period have been summarised in the consolidation of the achieved status. The tools are ready for the validation, the ports have provided information for performing the business analysis and the externalisation strategy is designed. It must be remarked that WP8's results are highly dependent of WP7 execution, both in time and in content.

2.2.8.5. Deviations

Task T8.2 should have ended by M28 (during this reporting period) according to the initial workplan. However, as it was already indicated in the previous report (D2.7), the duration was extended to M33.



2.2.8.6. Corrective actions

As it has been explained before, some of the risks foreseen in the last reporting have been materialised due to the COVID-19 effects. This led the WP8 team to include in the amendment #2 a request as follows:

- End of WP8: M36->M41
- Task T8.2: from M28->M41
- Tasks T8.3 and T8.4: from M36->M41
- Due date of D8.3: M36->M41
- Due date of D8.5: M36->M41

2.2.9. Work Package 9 – Exploitation, dissemination and communication

The general objective of this WP is to organise in a coherent way the activities leading to maximise impact for the overall project. The main objective for each partner is to have a structured, complete and achievable business model strategy and a proper communication of results.

This period has been anomalous compared to the M1-M22 period. This is because the months M25 to M30 have been strongly marked by the effect of the COVID-19. The outbreak of the pandemic that has been whipping Europe since March-2020 (M23 of PIXEL) has drastically changed a huge part of the dissemination structure as it had been known till that moment.

The majority of events that PIXEL was tackling were cancelled due to **COVID-19** associated restrictions, and it is foreseen that the team will not be able to attend to physical events for a certain time.

On that regard, the task T9.3 is in continuous watch of relevant events that are being postponed, cancelled, re-arranged in order to have PIXEL still present at relevant events in a virtual fashion. Additionally, some strategies (that were already foreseen in the Dissemination Plan) are being reinforced aiming at covering the audience of former physical events. Those actions are Webinars, Virtual dissemination, social media presence and recording and uploading of more videos to the YouTube channel, all of it accompanied by marketing campaigns that will be put in place during the last year of the project.

Additionally, with the purpose of maximising PIXEL impact, a request for extension of WP9 (all tasks) have been included in the amendment #2. This will mean ending the WP9 by M41: 31-May-2021.

Regarding the normal course of WP9 actions during this period (those that have been able to be executed), the same pace as before regarding communication is being followed.

However, those activities that were marked as “urgent” during the previous reporting period (D2.7) were especially addressed. In particular, the influence of the “Task forces” created is helping increase the performance on those activities: The number of scientific publications published has increased sensibly during the M35-M30 period. The communication with policy-oriented initiatives has led the Consortium to incorporate a new member to its Advisory Board (José Sánchez from AIVP). The plan for conducting webinars to internal and external people has been finalised and the means have been put to have them celebrated.

2.2.9.1. Summary of progress in previous periods

Progress by task:

Task 9.1: Communication and impact creation

This task promotes PIXEL as a major driver for development and uptake of a genuine solution for ports and associated smart-city agents to achieve a new cleaner, more-sustainable and more-efficient model for interconnected multi-modal port activities. A coordinated Dissemination Plan was provided (via D9.3 and updated via D9.4) within this task so far in terms of releasing the following material/elements:

- PIXEL logo
- External communication and publication templates (e.g. PPT templates) to be used when presenting PIXEL features in communication events
- PIXEL website in two iterations. The second version is the currently active, implemented using WordPress CMS, within which all relevant content of PIXEL is disseminated following a timely plan.
- Presence in social networks, namely Twitter, LinkedIn, ResearchGate and our YouTube channel.
- PIXEL videos: a total of 10 videos of mixed content (mainly technical) were uploaded.
- PIXEL official poster: 2 versions were created (M1 and M18).
- PIXEL official leaflet: 2 versions were created (M1 and M18).
- PIXEL stickers were designed, printed and are part of the dissemination kit of PIXEL from M6.

- Newsletter: following a plan of one issue each 5 months, 2 newsletters have been generated and submitted to the mailing list of subscribers.
- Continuous update of the website each time a new deliverable was submitted, a new event was attended or any other dissemination and technical related activities have been going on in the project.
- Continuous update of social media channels following the same strategy and timely pace than for previous reporting periods.
- Creation and submission of the newsletter #2
- Generation of videos and upload to the YouTube channel:
    - Energy model
    - Transportation model
    - Air Pollution model
    - Port-City Environmental model
    - Operational Tools

Task 9.2: Scientific dissemination

Through this task the consortium intends to develop a data access strategy to stablish the scientific dissemination of the project, including Open Access publication based on (i) presence with technical papers, demonstrations, or talks/panels; (ii) production of leading-edge research material suitable for publication in international Journals specialized in Maritime and Port technological trends, transportation and Smart-Cities, (iii) Cooperation with other projects, and (iv) other dissemination activities devised to promote the PIXEL concept and methodology.

The activity and planning has been conducted jointly to adjust the events to attend and the papers to be submitted to fairs and congresses. For tracking and planning scientific publications (equal than for other dissemination activities) an Excel sheet-based tool has been used during all the M1-M24 period (also for M25-M30 and it will be used as well till the end of the project). The publication results are summarised in the following table:

Table 9. Publication results/statistics by M24

	Presented	Accepted	Success rate	Published	IoT/ICT (presented)	Environment (presented)	Logistics (presented)	Global (presented)
With congress	10	8	80%	4	6	3	1	3
No congress	3	3	100%	3	1	2	0	0

- Additional actions were conducted in the period M1-M24 in this task:
    - A set of KPIs for Scientific dissemination were drafted and finally converted into a more specific table within the reporting period
    - Press releases: Several press releases have been made so far related to PIXEL objectives and advances
    - Lectures at the University.
    - PhDs started: for now, 4 PhD programs have started by people working directly in the project
    - Continuous monitoring of publication opportunities
    - Design of a new methodology for scientific publications, accompanied by an Excel file available via the online repository to all the partners:
    - Contribution to open-source initiatives:
        - FIWARE Data Model request was made
        - Updated to GitHub some models and the algorithms of the results of WP4
        - Different use from external organisation of PIXEL code/projects made public
        - PyPl – pyngsi framework library

Task 9.3: Industrial dissemination

The General objective of this task, extracted from the Grant Agreement is: "to organize in a coherent way the activities leading to maximize impact for the overall project. The main objective for each partner is to have a structured, complete and achievable business model strategy and a proper communication of results".

During the period M1-M24 the activities conducted in this regard were:

- Correlation of presence to the industrial events with the PIXEL' exploitable results or technologies, that have been produced (and that will be produced)
- Continuous surveillance of dissemination opportunities
- Definition (and following) of a 11-steps methodology in order to be more effective in managing the task. This is described in deliverable D9.4
- For tracking and planning events attendance, an Excel sheet-based tool has been used, in which all the information associated to each initiative tackled
- Same as for the scientific dissemination, the industrial dissemination also included a list of KPIs to be evaluated throughout the project
- Participation at physical events where PIXEL has been presented.
- Exploit results of the "Relevant entities of the port sector" task force, establishing written contact with ESPO, IMO, IAPH and other entities.
- PIXEL was included in the IAPH website.
- New plan for webinars conduction as a mitigation measure for not being able (probably, for a long time) to be present in events.

Task 9.4: Exploitation and Business Plan

The effectiveness of the exploitation of PIXEL's results is much dependent of a good and concise planning, including enough flexibility to adapt itself to the evolution of the technological development, and to enable the dynamics of the good practice of business development. In this effort, a healthy innovation management is essential for the appropriate selection of assets with commercial potential.

The tasks conducted during M1-M24 to be aligned with the previous were:

- To clarify what are exploitable results, how is the IPR protected in which they are based on, and how this information is being collected in parallel to the progress of the project.
- Logging of upcoming IP results, discussion of their protection with IP owners, and refinement of the product definition.
- To make available meaningful and useful tools that can promote the commercialisation of PIXEL.
- Establishing an early version of the business model canvas (BMC) and the SWOT analysis
- Two rounds of questionnaires to the partners about individual and joint exploitation plans.
- Refining the value proposition items, ranking those to assess their relevance in the PIXEL value message.
- Development of a market monitor where the main PIXEL competitors were listed, described and evaluated
- Exhaustive work with regards to PEI value proposition
- Development of the PIXEL equilibrium triangle, where the cost of environmental action is complemented by the cost-reduction inherent to the optimisation of port processes
- The innovation manager participated in four major networking events pitching the PIXEL message and creating space for an upcoming go-to-market strategy
- Strategy for the validation of the value proposition by DocksTheFuture and COREALIS stakeholders
- Plan for ROI analysis, with analysis of specific challenges
- Strategy for the ROI at PIXEL

- Update IPR and exploitable results, and further product definition
- Identification and description of main innovations
- Further definition of assets of PIXEL, and complementary analysis with those of COREALIS and PortForward in the context of an exploitation-based liaison
- Preparation and discussion to approval and release of value proposition validation questionnaires for PIXEL ports but also for ports and stakeholders at DocksTheFuture, CORIALIS and PortForward
- Analysis of ROI and plan of ROI assessment at PIXEL

2.2.9.2. Summary of results after previous periods

The main results that were obtained during the first half of the project in the context of WP9 are the following:

- Effective communication materials (2 leaflets, 2 posters and several videos). Access to all of them are available through our PIXEL website.
- PIXEL website active and continuously updated with all recent information, including events, publications, marketing material and deliverables as they are being released (public ones). The website is GDPR compliant. Metrics monitoring tools are available to evaluate the impact.
- PIXEL social network active with periodic updates on our PIXEL events. Twitter and website are linked to increase the impact. Metric monitoring tools are available to evaluate the impact
- Effective dissemination plan in terms of scientific and industrial dissemination. Methodology for identification and tracking of events (how, who, when, preparation and outcomes)
- Business and Exploitation Plan and New (updated in M24) dissemination plan
- Newsletters #1 and #2
- PEI value proposition
- Initial RoI calculation and RoI calculation tool
- Formal contacts and certain commitments with IAPH, ESPO and IMO organizations.
- A total of 14 videos uploaded to the YouTube channel.
- Deliverables submitted successfully:
  - Deliverable *D9.1 – Virtual Presence*
  - Deliverable *D9.2 – Communication support*
  - Deliverable *D9.3 – Dissemination Plan*
  - Deliverable *D9.4 – Report on Dissemination and Update of the Dissemination Plan v1*
  - Deliverable *D9.6 – Draft Exploitation Plan (CO)*
  - Deliverable *D9.7 – Business and Exploitation Plan v1 (CO)*

2.2.9.3. Progress in M25-M30

Progress by task:

Task 9.1: Communication and impact creation

The following activities were performed within task T9.1 in the period M25-M30:

- Continuous update of the website each time a new deliverable was submitted, a new event was attended or any other dissemination and technical related activities have been going on in the project.
- Continuous update of social media channels following the same strategy and timely pace than for previous reporting periods.
- Definition of content for the newsletter #3
- Continuous creation of dissemination material such as images for representation, pitches.

- Preparation of the script and plan for the next (and last) commercial video to be delivered during the next reporting period
- Generation of 5 new videos and upload to the YouTube channel:
    - Video extracted from UPV's presentation in: "The Future of the ports: a vision for 2030 at TRA2020 Helsinki (virtual conference)"
    - Video extracted from ORANGE's presentation in: "FIWARE Green Economy day (virtual conference)"
    - Video extracted from CATIE's presentation in the OR62 conference (virtual): "Supply Chain Model as a Transversal Tool: Port Activity Scenario model"
    - The Operational Tools module in PIXEL: visualisation and functioning
    - Video uploaded by the MDM conference channel: Presentation of the paper: "Machine Learning based System for Vessel Turnaround Time Prediction" by XLAB.

Task 9.2: Scientific dissemination

The following activities were performed within task T9.2 in the period M25-M30:

- Continuous monitoring of publication opportunities
- Following and tracking the scientific dissemination activities by using the new methodology described during the previous reporting period.
- Regarding the technical collaboration with other projects, PIXEL has reinforced its provision to the DataPorts project. In particular, the architecture devised for the latter is being hugely inspired by PIXEL approach. Additionally, the acquisition of data in DataPorts will follow the same implementation schema than in PIXEL (agent NGSI powered by the pyngsi Python library).
- Contribution to open-source initiatives:
    - Updated to GitHub some PIXEL modules, agents and other contributions.
    - Different use from external individuals/organisation of PIXEL code/projects made public
    - Contact with FIWARE to propose new data models (e.g. tide sensor).
- Scientific publications:
    - "Noise Dispersion Models - Methodology for Making Noise Maps" : Scientific paper on noise pollution, submitted to the "Noise Mapping" peer-reviewed journal in March 2020, was finally accepted during this reporting period
    - "A Novel approach for assessing the ports' environmental impacts in real time - the IoT based Port Environmental Index",: A short communication was written on the subject of the PEI and the use of IoT and submitted to "Ecological Indicators" peer-reviewed journal. The paper has been published during this reporting period. This is considered a high-impact relevant journal in the environmental field.
    - Two scientific papers twat where elaborated, submitted, accepted and presented in a virtual conference event in previous reporting periods (November 2019), were published in this reporting period:
        - "Noise pollution – introduction to the state of the research and the implementation in the horizon 2020 project PIXEL"
        - " Air pollution dispersion modelling in port areas"
    - "Framework and methodology for establishing Port-City policies based on real-time composite indicators and IoT: a practical use-case": A paper was elaborated about the Port-City integration models for traffic monitoring and its utility for establishing city-port policies. This paper was accepted and published in a high-impact journal in the ICT field: "Sensors".
    - "Influence of meteorological conditions on noise dispersion in the Port of Thessaloniki" – Collaboration framed within T4.4 and T7.4. This paper was published during this reporting period.

  - "Machine Learning based System for Vessel Turnaround Time Prediction": A paper was presented drawing from the works done by XLAB in task T4.5 using AIS data in the port of Bordeaux (GPMB).
- Preparation of scientific contribution:
  - "Estimating the ship emissions to the air during manoeuvering and hotelling in ports in an automated fashion. A case study of the passenger terminal in the Port of Piraeus",: This paper deals with the estimation of ship emissions, is in its final stages and will soon be submitted for review in a peer-reviewed journal. It is expected to be submitted by end of M30 or beginning of M31.
  - Another paper is being prepared about the smart networking and IoT connection technologies for Smart Ports. This paper will be the result of a shared work of PIXEL with other research projects. This will be reported more clearly

Task 9.3: Industrial dissemination

The following activities were performed within task T9.3 in the period M25-M30:

- Continuous tracking of industrial events. Due to the COVID-19 effects, no targeted conference by PIXEL is taking place physically. Every event is being conducted in virtual fashion. Likewise, many foreseen events for this period have been cancelled or postponed. The task leader (CREO) is carefully monitoring these facts and proceeding with proper actions.
- Participation at MariMatch event
- Participation at FIWARE Green Economy event
- Participation at OR62 event
- Presentation of the works prepared for TRA2020 (CSA promoted conference to substitute the cancelled TRA sessions)
- Results of the "Relevant entities of the port sector" task force:
  - Publication of PIXEL in the IAPH website
  - Article about PIXEL, its innovation and utility for Port-City interface in the AIVP website
  - AIVP has been actively participating by providing feedback of the project
  - One person from AIVP is the new PIXEL's AB member
  - Telcos organised and conducted with CSA-related entities
  - Working on follow-up documents to enhance relation with those organisations
- Extensive work in the design of the new webinars plan. The WP9 team has decided to reinforce the relevance of this activity, considering that it may well be the main "industrial dissemination" forum that will be available for the project members during the next months
  - Division of the content in 5 webinars from November 2020 till June 2021
  - Selection of targeted audiences per each webinar
  - Distribution of work among PIXEL partners
  - Selection of platform to conduct the webinars
  - Linkage in the PIXEL website
  - Start the creation of the contents

Task 9.4: Exploitation and Business Plan

The following activities were performed within task T9.4 in the period M25-M30:

- Further IPR management activities and protection analysis
- Early draft of the commercial offer

- Continuing complementary analysis with those of COREALIS and PortForward in the context of an exploitation-based liaison
- Analysis of value proposition validation questionnaires for PIXEL ports but also for ports and stakeholders at DocksTheFuture, COREALIS and PortForward
- Continue the analysis of ROI and plan of ROI assessment at PIXEL
- Progress on the ROI definition based on PIXEL ports WP7 deployments
- Refinement of PIXEL's 4-tiered commercial offer
- Coordination of content on KER description feeding communication
- Pitch canvas description and first draft of 2nd PIXEL video storyline
- 1-to-1 IPR management meetings

Table 10. WP9 Partner contribution summary table in period M25-M30

Partner	Contribution

P01 UPV	• Organization of all WP9 telcos and session in both physical and virtual meetings
	• Attendance to all Innovation telcos
	• Usual tasks of Community Manager, as responsible of all social channels:
	  ○ Posting of various content
	  ○ Periodic update of profile
	  ○ Re-share content of other projects and relevant news/events
	  ○ Analysis of trends on communication by other projects/entities in the sector
	• Continuous update and hosting of the new website: https://pixel-ports.eu/
	  ○ Creation of a specific landing page on PIXEL website for the webinars
	  ○ Consideration of virtual teleconference as "events" in the website, as this will be the most common presentation type in the forthcoming months.
	• Assistance to CREO in the Industrial dissemination tracking and monitoring
	• Conduction of all the relation and interaction with CSA DocksTheFuture and other EC funded projects:
	  ○ Creating common dissemination action and material
	  ○ Lead the presentation of PIXEL outcomes contextualised in the DSS and TA tools of the CSA DocksTheFuture (DtF)
	  ○ Fulfilment of documents and participation in the teleconferences organised by the CSA about their DSS and TA tools.
	• Update (periodic and asynchronous) of social media accounts and communication channels (Twitter, LinkedIn)
	• Providing suggestions/requests/recommendations for the website
	• Supporting XLAB in the innovation and exploitation management tasks
	• Strong collaboration in T9.4, specially in the tasks related to communication with COREALIS, PortForward and the CSA
	• Active participation within the task force of "Relation with relevant agencies/entities in the port sector" that is being led by CERTH
	• Upload to YouTube channel the different videos developed by the partners
	• Generate the Operational Tools video
	• Help in the preparation of the OR62 presentation

	• Creation, elaboration, submission of the paper "Framework and methodology for establishing Port-City policies based on real-time composite indicators and IoT: a practical use-case". • Collaboration in the short communication published in "Ecological Indicators" • Active participation in the analysis of PIXEL KERs, commercial offer and other innovation/exploitation-related activities
P02 PRO	• Attendance to all WP9 telcos • Attendance to all Innovation telcos • Post several tweets in Prodevelop's account • Creation of a video explaining PIXEL technical integration and global pilots flavour • Preparation of PIXEL Dashboard video • Collaboration in the definition of PIXEL ROI and IPR • Participation in devising the webinars plan • Preparation of the script and plan for the next (and last) commercial video to be delivered during the next reporting period

P03 XLAB	• Contribution to online visibility (website, social) with Key Exploitable Results planning
	• Contribution to marketing materials and its update (coordinated suggestions)
	• Video presentation for "Machine Learning based System for Vessel Turnaround Time Prediction."
	• Usual tasks of Innovation Management leadership
	• T9.3
	  ○ Pitch deck update and initial pitch canvas
	  ○ Pitch activities coordination and implementation over brokerage events and specific meetings
	  ○ Refinement of pitch materials
	• Leading the Exploitation task T9.4 emphasising the following activities:
	  ○ Further IPR management activities and protection analysis
	  ○ Early draft of the commercial offer
	  ○ Continuing complementary analysis with those of CORIALIS and PortForward in the context of an exploitation-based liaison
	  ○ Analysis of value proposition validation questionnaires for PIXEL ports but also for ports and stakeholders at DocksTheFuture, CORIALIS and PortForward
	  ○ Continue the analysis of ROI and plan of ROI assessment at PIXEL
	  ○ Progress on the ROI definition based on PIXEL ports WP7 deployments
	  ○ Refinement of PIXEL's 4-tiered commercial offer
	  ○ Coordination of content on KER description feeding communication
	  ○ Pitch canvas description and first draft of 2nd PIXEL video storyline
	  ○ Planning of Information Hub video
	  ○ 1-to-1 IPR management meetings

P04 INSIEL	• Attendance to all WP9 monthly teleconferences • Participation with all partners in WP9 activities, included the participation to webinar organized by Dock of the Future project.
P05 CATIE	• Attendance to several WP9 specialized telcos: communication/dissemination and exploitation/innovation • Following all the social networks of the PIXEL project (Facebook, LinkedIn and Twitter) and participates in the creation of impact by relaying various information related to PIXEL on their own social medias.

	• Participation to the innovation team: definition expected IP and results • Participation by Charles Garnier to the MariMatch Event • Participation by Erwan Simon to the OR62 event
P06 ORANGE	• Attendance to several WP9 specialized telcos: communication/dissemination and exploitation/innovation • Reference ORANGE's DataModel to prepare communication to FIWARE • Prepare PIXEL documentation to be present to the "Salon de la recherche Orange" internal event (December 2019) • Prepare and conduct the FIWARE Green Economy Day presentation • Start the creation of the presentation video of the Data Acquisition Layer module • Further investment in different tasks and proactive approach towards work package leaders • Contribute to different tasks of WP9 Innovation 2020 stream, especially on leading the contributions to open source initiatives (FIWARE and others)
P07 CREO	• Attendance to several WP9 specialized telcos: communication/dissemination and exploitation/innovation • Usual activities as task T9.3 leader • Monitoring of the 11-steps methodology for all attended industrial dissemination events • Tracking of interesting industrial events. • Tracking of events delayed / cancelled due to the Covid-19 pandemic. • Questioning / accompanying the PIXEL partners related to their attendance to selected industrial events.

P08 MEDRI	• Attendance to all WP9 specialized telcos: communication/dissemination and exploitation/innovation
	• Huge participation in the task T9.2 (scientific dissemination):
	  ○ Lead of 4 papers that have been published
	  ○ Current writing of another paper to be submitted to a journal
	• Participation in the webinars plan devising
	• Participation in the KERs, especially in the PEI exploitation discussion
	• Participation in the RoI description
	• Fostering the visibility of PIXEL project and EU funding.
	• Promotion of the project actions through a bilingual web site MEDRI PIXEL to spread the information about the PIXEL project, which are updated on a daily basis

P09 SDAG	• Attendance to all WP9 specialized telcos: communication/dissemination and exploitation/innovation • SDAG analysed the content of project communication/dissemination and exploitation tools trying to give useful comments in order to improve the result. • SDAG is continuing to update its social media (Facebook, Twitter, LinkedIn and Company Website) trying also to include PIXEL project news and relevant information to improve the project dissemination. • SDAG also participated to the Docks the Future Workshop in June 2020. • Finally, an article in a local newspaper "Il Piccolo" was published about SDAG activities (in general) including PIXEL involvement together with Port of Monfalcone and INSIEL.

P10 THPA	• Attendance to all WP9 specialized telcos: communication/dissemination and exploitation/innovation • Telcos as well as, physical meetings were held, with the project's subcontractor, assisting in WP8 tasks • Furthermore, meetings were held with both local stakeholders and ThPA administration on the progress and outcomes of the project, as well as public relations department.
P11 PPA	• Attendance to all WP9 specialised telcos: communication/dissemination and exploitation/innovation • Finalized the project appearance on the PPA web site.
P12 ASPM	• Attendance to all WP9 specialised telcos: communication/dissemination and exploitation/innovation • ASPM attended to WP9 teleconferences and to the CSA Workshop in June 2020. • ASPM analysed the content of project communication/dissemination and exploitation tools trying to give useful comments from the Port point of view in order to define interesting events and publication for the specific sector. • ASPM continued updating personal Twitter pages, with specific interaction with Pixel profiles to spread project's contents. • ASPM started evaluating an involvement of the Monfalcone Municipality in the project tools/results in order to use them to monitor/manage the road congestion in the port surroundings. • ASPM discussed and shared with Port network Authority of the Eastern Adriatic Sea the innovation survey provided by XLAB.
P14 IPEOPLE	• Attendance to all WP9 specialised telcos: communication/dissemination and exploitation/innovation • Webinars plan preparation. • Webinars preparation (testing, market research and scheduling) • Participation in authoring, reviewing and suggesting changes in the exploitation documents. • Drafting of exploitation user stories

P15 CERTH	• Attendance to all WP9 specialised telcos: communication/dissemination and exploitation/innovation
	• Contribution to the webinars plan preparation.
	• Contribution to T9.3 (Industrial dissemination)
	  ○ Presentations of PIXEL to AIVP and discussions on potential cooperation
	  ○ Preparation of material for the ESPO/IAPH follow-up
	  ○ Contribution to an article published to the AIVP website by UPV (article review).
	  ○ Exploration of the possibility to present the project at the ESPO 2021 conference.

2.2.9.4. Results after M25-M30

The main results that we have obtained in this second period of the project (M25-M30) in the context of WP9 are the following:

- New complete webinars plan
- 5 new videos uploaded to Youtube channel

- 4 more presentations at industrial events
- 2 new scientific contributions published in conferences proceedings
- 5 new papers published in relevant journals
- Article about PIXEL, its innovation and utility for Port-City interface in the AIVP website
- PIXEL's 4-tiered commercial offer

2.2.9.5. Deviations

No deviations in the execution have been occurred but the (out of PIXEL control) the cancellation and/or postponement of relevant events of PIXEL are being tracked continuously and tried to be substituted by alternative virtual events.

As it has been explained before, some of the risks foreseen in the last reporting have been materialised due to the COVID-19 effects.

2.2.9.6. Corrective actions

Realising that not many physical conferences would be able to be attended during the next months, the WP9 team decided to join forces and concentrate on creating an attractive plan of webinars.

Additionally, the COVID-19 effects that have led to a project extension request have driven WP9 team to include in the amendment #2 the following:

- End of WP9: M36->M41
- Tasks T9.1, T9.2, T9.3, T9.4: from M36->M41
- Due date of D9.5: M36->M41
- Due date of D9.8: M36->M41

Other than that, no corrective actions have been set beyond those identified and put in place since the previous reporting period (see deliverable D2.7)

3. Impact

3.1. Update of the plan for exploitation, communication and dissemination of results

The dissemination report will be sent through deliverable D9.5 (at the end of the project), with due date on month M36 (April 2021). Nevertheless, in the following pages there is a summary of the actions undertaken for enhancing PIXEL impact in the community.

3.1.1. Dissemination plan

It is normal that throughout the execution of a project some changes and refinements are needed to be included in a plan. The new (updated) dissemination plan (that was introduced via D9.4) has been consolidated during the period M25-M30 and has considered a continuous activity since the start of the project, but with flexibility and possibility of evolving during the lifetime of the project. That is considered as crucial by the PIXEL Consortium as it will help the final product to reach as more potential interested stakeholders as possible. This plan is accompanied by a monitoring tool created by the WP9 leader (UPV) which serves both for planning, tracking and brainstorming of communication/dissemination opportunities.

The following list summarises the different items included in this document that must be considered from this moment an intrinsic part of the PIXEL Dissemination/Communication Plan:

- New webinars plan
- Introduction of a webinars landing page in PIXEL 's website

With regards to specific the new webinars plan, here below a reference on its structure is reflected. It must be noted that this schedule has been designed assuming that a 5-month project extension will be granted for PIXEL.

No.	Subject	Date	Speaker 1	Speaker 2	Speaker 3
1	PIXEL presentation	05.11.2020 (Thursday)	UPV	XLAB (IM)	
2	Technical explanation of user stories, models and algorithms	12.11.2020 (Thursday)	PEOPLE	CATIE	AB member
3	PEI explanation webinar	10.06.2021 (Thursday)	MEDRI	AB member	
4	Live webinar explaining WP6 technical modules and integration / installation (WP7)	17.06.2021 (Thursday)	ORANGE	PRO	AB member
5	PIXEL solution as a whole, KPIs and results	16.09.2021 (Thursday)	XLAB (IM)	CERTH	UPV

Figure 1. New plan for webinars conduction

3.1.2. Industrial and scientific dissemination

Regarding Industrial and Scientific Dissemination, the activities and impact achieved by PIXEL in the last semester can be summarised in the following:

Table 11. Industrial and scientific dissemination in period M25-M30

Partners involved	Type of activity	Title of the event/meeting/article/social media	Date of publication	Journal /
MEDRI	Publication (Scientific Dissemination)	Noise pollution – introduction to the state of the research and the implementation in the horizon 2020 project pixel,	June 18th, 2020	, Journal of Maritime & Transportation Sciences, Special edition, Vol 3, p. 133-145, 2020.

MEDRI	Publication (Scientific Dissemination)	Air pollution dispersion modeling in port area	June 18th, 2020	Journal of Maritime & Transportation Sciences, Special edition, Vol 3, p. 157-170, 2020.
MEDRI, ThPA	Publication (Scientific Dissemination)	Influence of meteorological conditions on noise dispersion in the Port of Thessaloniki., Stjepan Piličić et al - accepted	July 2nd, 2020.	Noise Mapping, Vol. 7(1), p. 135-145, 2020.
MEDRI, UPV	Publication (Scientific Dissemination)	Short communication on the concept being PEI through IoT, Matija Široka et al.	September 19th, 2020	Ecological Indicators,Vol. 120, January 2021.
UPV	Publication (Scientific Dissemination)	Framework and methodology for establishing Port-City policies based on real-time composite indicators and IoT: a practical use-case	July 24th , 2020	MDPI "Sensors" Special Issue "IoT-enabled Smart Cities"
XLAB, GPMB	Publication (Scientific Dissemination)	Machine Learning based System for Vessel Turnaround Time Prediction	August 7th. 2020	IEEE conference proceedings
UPV	Presentation at conference (virtual) (Industrial Dissemination)	Substitution of PIXEL (UPV, PRO, MEDRI) articles submitted to TRA2020 and accepted.	June, 23rd, 2020	TRA-substitution event organised by the CSA and other related partners
CATIE	Presentation at conference (virtual) (Industrial Dissemination)	Virtual MariMatch event	September, 2nd to 4th, 2020	Virtual event via webinar platform
CATIE	Presentation at conference (virtual) (Industrial Dissemination)	OR62 conference event	September, 15th , 2020	Virtual event via webinar platform
ORANGE	Presentation at conference (virtual) (Industrial Dissemination)	FIWARE GreenDay Economy Day	July, 23rd , 2020	Virtual event via webinar platform
XLAB	Presentation at conference (virtual)	Machine Learning based System for Vessel Turnaround Time Prediction - presentation (virtual)	July 1st, 2020	MDM conference YouTube channel
UPV	Global dissemination impact	Article of PIXEL published in the AIVP website	September, 29th, 2020	AIVP website
UPV, CERTH, others.	Global dissemination impact	Inclusion of PIXEL in IAPH WPSP port-projects website	May, 2020	IAPH-WPSP website

3.1.3.Liaison with other projects

One of PIXEL priorities is networking with other H2020 projects with relevant objectives. An official request of collaboration was made to the leading partners of the relevant projects, at the start of the PIXEL project.

D9.3 considered in the communication action the liaison with different project, and a preliminary plan was drafted. D9.4 updated the different actions carried out on that regards, covering up to month M18. However, during the period M25-M30 the relationship with CSA DocksTheFuture and the rest of the projects has been intensified due to the near-closure of the CSA project. These actions have not been arbitrary but responding to a specific strategy; in particular, the majority of them have been framed in the participation of PIXEL as contributor to the outcome validation of the CSA:

Liaison with the Ports of the Future (PoF) network:

- With CSA **DocksTheFuture**: The CSA action lifetime was originally coming to an end during this reporting period (July 2020). However, due to the COVID-19 outbreak effects, the end of the action has been postponed few months. During this period, PIXEL contributed actively to the following actions:
    - Fulfilment of the DSS tool developed by the CSA.
    - Fulfilment of the Transferability Analysis tool developed by the CSA.
    - Presentation of a careful analysis of PIXEL results from the viewpoint of the two previous tools. This presentation helped the CSA to illustrate to other entities how to proceed with the usage of their outcomes in an applied research action.
    - The CSA altogether with ALICE ETP promoted the celebration of a virtual conference to substitute the physical round table session of PoF that should have taken place in TRA2020. This session included presentations of all the projects. Finally, this did not take place due to the COVID-19 outbreak. On this regard, PIXEL presented some advances and participated in the conference in June 2020.
- With **COREALIS and PortForward**: Peer-to-peer teleconferences have been held involving corresponding exploitation and innovation teams to continue mutual engagement. Additionally, PIXEL has been in conversation with COREALIS, PortForward and the newly-formed Network of Excellence to envision future collaborations.

Consequently, during the period M25-M30, PIXEL has been involved in several actions according to the plan. In order to report the main work performed in this regard, there will be a table in the deliverable D9.5 including information about how PIXEL has collaborated with the CSA and how PIXEL has participated in several initiatives both with DocksTheFuture and individually with other projects of the Ports of the Future Network.

Liaison with other projects:

- With the project **DataPorts**: PIXEL has reinforced its provision to the DataPorts project. In particular, the architecture devised for the latter is being hugely inspired by PIXEL approach. Additionally, the acquisition of data in DataPorts will follow the same implementation schema than in PIXEL (agent NGSI powered by the pyngsi Python library).

4. Risk Management

As commented at the beginning of this report, the last part of the period M25-M30 has been strongly marked by the COVID-19 epidemic outbreak. Project partners have been motley affected (diminish of effort amount able to be provided, non-physical accessibility, etc.) and, therefore, certain tasks have suffered consequences such as delays or postponement of actions.

A lot of work was carried out in the risks' task (T2.4), but the most remarkable effects will be associated to the actions following COVID-19.

Some of the risks identified in the previous reporting period (M19-M24) materialised and the different mitigation measures were applied (e.g. the creation of specific task forces, the request of an extension of the project duration). Although the project has been impacted (no physical meetings, delays on the installation due to inaccessibility of premises, cascading effects, etc.), the task T2.4 has been able to properly manage the situation and the project is advancing correctly. The project extension of 5 months, if accepted, will allow the partners to meet all the objectives of the project.

Additionally, during months M25-M30 (before the epidemic), different risks for current and forthcoming activities were as well identified using the consolidated procedures agreed for PIXEL. It is especially remarkable the influence of the review in the risks identified.

Due to the current point of execution of the project, the most relevant risks to be thoroughly monitored for the next reporting period are those associated to WP2/7 and WP8. All risks have been duly registered and formalised by their introduction on the "Continuous Reporting" tool in the online area of Sygma (Funding and Tenders' portal private space).

4.1. New risks identified in the period M25-M30

A summary of the risks that were identified, described, analysed and provided with mitigation measures is done below. The reference is per WP. A complete description of all those risks is attached at the end of the report in the Appendix A. There, the template agreed for formalising risks is fulfilled for every of them.

WP2

- The COVID-19 pilot is not useful for the port or does not arrive in a useful timing

WP8

- Due to various reasons, including the outburst of the COVID-19 Pandemic, delays are observed in the implementation of the various systems in the 4 ports.

5. Deliverables and milestones

5.1. Deliverables

Table 12. Sent deliverables list

Del	Del.#	Del. Name	WP.	Lead Beneficiary	Nature	Dissemination Level	Delivery Date from Annex-I	Delivered Yes/No	Actual Delivery Date	Comments
D1.1	D1	H – Requirement No.1	1	UPV	Ethics	CO	31/05/2018	Yes	31/05/2018	None
D1.2	D2	POPD – Requirement No.2	1	UPV	Ethics	CO	31/05/2018	Yes	31/05/2018	This deliverable was requested to be corrected due to minor things. Re-sent on 26/07/2018
D1.3	D3	POPD – Requirement No.3	1	UPV	Ethics	CO	31/10/2018	Yes	31/10/2018	None
D1.4	D4	EPQ - Requirement No. 4	1	UPV	Ethics	CO	31/05/2018	Yes	31/05/2018	None
D1.5	D5	POPD – Requirement No.5	1	UPV	Ethics	CO	31/10/2018	Yes	30/10/2018	None
D2.1	D6	Project management and quality handbook	2	UPV	Report	CO	31/05/2018	Yes	31/05/2018	None
D2.2	D7	Data Management Plan	2	UPV	Report	PU	31/10/2018	Yes	31/10/2018	This deliverable was requested to be corrected to comply with FAIR template. Re-sent on 24/04/2019
D2.3	D8	Data Management Plan v2	2	UPV	Report	PU	31/10/2019	Yes	30/10/2019	None
D2.5	D10	Project Management Report v1	2	UPV	Report	PU	31/10/2018	Yes	31/10/2018	None
D2.6	D11	Project Management Report v2	2	UPV	Report	PU	30/04/2019	Yes	30/04/2019	None
D2.7	D12	Project Management Report v3	2	UPV	Report	PU	30/04/2020	Yes	04/05/2020	None
D2.7	D13	Project Management Report v4	2	UPV	Report	PU	31/10/2020	Yes	31/10/2020	None
D3.1	D14	Stakeholders and market analysis report	3	IPEOPLE	Report	PU	31/10/2018	Yes	10/02/2020	This deliverable was requested to be corrected to include details about interviews and workshops carried out to gather stakeholders' input. 10/04/2019. Minor changes 23/04/2019.

										This deliverable was re-submitted after the Review.
D3.2	D15	PIXEL Requirement Analysis	3	INSIEL	Report	PU	30/04/2019	Yes	30/04/2019	None
D3.3	D16	Use cases and scenarios manual v1	3	GPMB	Report	PU	31/08/2018	Yes	31/08/2018	None
D3.4	D17	Use cases and scenarios manual v2	3	GPMB	Report	PU	31/01/2019	Yes	15/3/2019	This deliverable was requested to be corrected to add 'Modelling and data analysis questionnaires'. Re-sent on 23/04/2019
D4.1	D18	PIXEL Models v1	4	CATIE	Other	PU	31/01/2019	Yes	30/04/2020	Official submission on time. Request of change after mid-term review: 30/04/20
D4.2	D19	PIXEL Models v2	4	CATIE	Other	PU	31/10/2019	Yes	30/04/2020	Official submission on time. Request of change after mid-term review: 30/04/20
D4.3	D20	Predictive Algorithms v1	4	XLAB	Other	PU	30/04/2019	Yes	30/04/2019	None
D4.4	D21	Predictive Algorithms v2	4	XLAB	Other	PU	30/04/2020	Yes	11/05/2020	Slight delay accepted by the PO.
D5.1	D22	Environmental factors and mapping to pilots	5	MEDRI	Report	PU	30/04/2019	Yes	30/04/2019	None
D5.2	D23	PEI Definition and Algorithms v1	5	MEDRI	Report	PU	31/10/2019	Yes	31/10/2019	None
D5.3	D24	PEI Definition and Algorithms v2	5	MEDRI	Report	PU	30/04/2020	Yes	30/06/2020	Delay of 8 weeks accepted by the PO due to COVID-19 effects
D6.1	D26	PIXEL Information system architecture and design v1	6	PRO	Report	PU	30/04/2019	Yes	30/04/2019	None
D6.2	D27	PIXEL Information system architecture and design v1	6	PRO	Report	PU	31/10/2019	Yes	10/02/2020	Official version submission 24/11/2019 – 1 month delay accepted by PO. Modification request after mid-term review. Submission: 10/2/2020
D6.3	D28	PIXEL data acquisition, information hub and data representation v1	6	XLAB	Other	PU	31/08/2019	Yes	6/02/2020	Official version submission 1/10/2019 – 1 month delay accepted by PO.

										Modification request after mid-term review. Submission: 6/2/2020
D6.4	D29	PIXEL data acquisition, information hub and data representation v1	6	PRO	Other	PU	30/06/2020	Yes	30/06/2020	None
D6.5	D30	APIs and documentation for software extension	6	UPV	Other	PU	30/06/2020	Yes	30/06/2020	None
D7.1	D31	Integration Report v1	7	PRO	Report	PU	31/10/2019	Yes	6/02/2020	Official version submission 24/11/2019 – 1 month delay accepted by PO. Modification request after mid-term review. Submission: 6/2/2020
D8.1	D34	Evaluation Plan	8	CERTH	Report	PU	31/08/2019	Yes	6/2/2020	Submission slight delay: 9/9/2019 – 9 days, accepted by PO. Modification request after mid-term review. Submission: 6/2/2020
D8.2	D35	Technical Evaluation v1	8	CATIE	Report	PU	31/12/2019	Yes	20/12/2019	None
D9.1	D39	Virtual Presence	9	IPEOPLE	Other	PU	30/06/2018	Yes	30/06/2018	None
D9.2	D40	Communication support material (poster, leaflet and video)	9	UPV	Other	CO	31/07/2018	Yes	31/07/2018	This deliverable was requested to be corrected due to minor things. Re-sent on 04/09/2018
D9.3	D41	Dissemination Plan	9	UPV	Report	PU	31/10/2018	Yes	31/10/2018	This deliverable was requested to be corrected due to format things. Re-sent on 11/04/2019
D9.4	D42	Dissemination Plan v2	9	UPV	Report	PU	31/10/2019	Yes	30/10/2018	None
D9.6	D44	Draft Exploitation Plan	9	XLAB	Report	CO	31/10/2018	Yes	31/10/2018	None
D9.7	D45	Business and Exploitation Plan v1	9	XLAB	Report	CO	31/10/2019	Yes	20/11/2019	Slight delay accepted by the PO.

5.2. Milestones

MS No	MS Name	WP.	Lead Beneficiary	Delivery date	Achieved Yes/No	Actual/Forecast Achievement date	Comments
MS1	Kick-off Meeting	2	UPV	31/05/2018	Yes	04/05/2018	The kick off meeting took place in Brussels from 3rd May to 4th May

							2018. Every partner attended the meeting.
MS2	State of the art and use-cases defined	3	IPEOPLE	28/2/2019	Yes	15/03/2019	Final version of D3.4 Use-cases manual and scenarios, was delivered. D3.1 and D3.3, inputs of the former, were also completed.
MS3	Requirements gathered	3	INSIEL	30/04/2019	Yes	30/04/2019	Requirements are gathered and available in our JIRA platform. D3.2 is finished and delivered.
MS4	Environmental Analysis completed	5	MEDRI	30/04/2019	Yes	30/04/2019	Deliverable D5.1 has been completed and released.
MS5	Predictive models/algorithms established	4	CATIE	30/04/2020	Yes	30/04/2020	D4.2 and D4.4 have been completed. Code has been uploaded to GitHub. Algorithms and models are finished.
MS6	PEI developed	5	MEDRI	30/04/2020	Not yet	30/06/2020	PEI development (technological) is done, but mathematical analysis and data integration is pending to consider PEI totally implemented. Forecasted date of delivery of D5.3 is 30/06/2020. The Project Officer has been informed.

6. Explanation on the Use of Resources

6.1. Use of resources

The following graph provides an overview vision of the evolution of resources consumption by PIXEL partners in the period M1-M30. It aims at reflecting the overall status of project financial execution, considering that the project still lasts till M36. If the amendment request gets accepted, it will last till M41. This will be properly informed in the next reporting document:

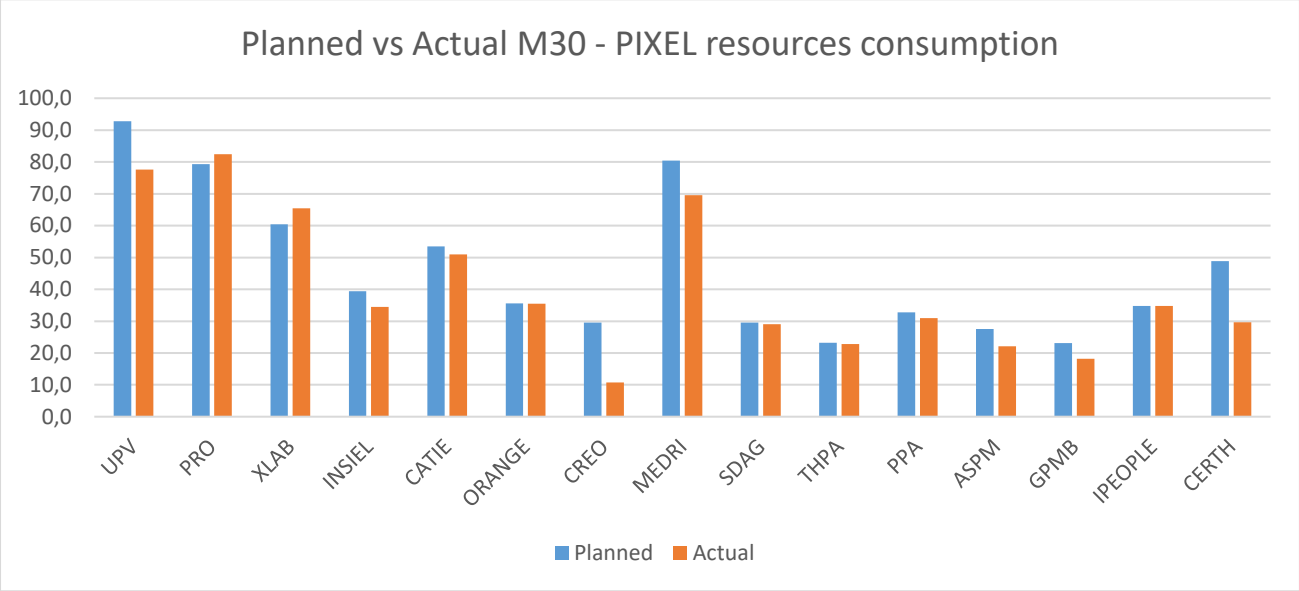


Figure 2. PIXEL resources consumption (evolution graph) M1-M30

Here below, a report summary table on precise figures justified is exposed: globally, underconsumption has been experienced but the situation remains under control.

Table 13. PIXEL resources consumption (summary report) considering PIXEL lasts till M36

	UPV	PRO	XLAB	INSIEL	CATIE	ORANGE	CREO	MEDRI	SDAG	THPA	PPA	ASPM	GPMB	IPEOPLE	CERTH
Planned	***92,8***	***79,3***	***60,4***	***39,4***	***53,5***	***35,6***	***29,6***	***80,4***	***29,5***	***23,2***	***32,8***	***27,5***	***23,1***	***34,7***	***48,9***
Actual	77,6	82,5	65,5	34,5	51,0	35,5	10,7	69,5	29,0	22,9	31,0	22,1	18,2	34,7	29,7
delta pms	*-15,25*	*3,16*	*5,08*	*-4,89*	*-2,54*	*-0,13*	*-18,85*	*-10,87*	*-0,49*	*-0,35*	*-1,83*	*-5,44*	*-4,92*	*0,01*	*-19,19*
delta %	*-16,43%*	*3,99%*	*8,42%*	*-12,41%*	*-4,75%*	*-0,36%*	*-63,70%*	*-13,52%*	*-1,65%*	*-1,50%*	*-5,58%*	*-19,77%*	*-21,32%*	*0,04%*	*-39,27%*

As it can be seen, most partners are pretty aligned with the planned consumption, remaining between the ±25% margin. This is good from a Financial Management point of view, as there are still 6 months to have all partners adjusted to their plan. This report roots on the results of amendment #1. It is not considering the potential acceptance of the changes in amendment #2.

However, two partners show bigger deviations than 25%: CREO and CERTH. The reasons that drove these partners to under-consume resources were thoroughly explained in the Project Technical Report for the mid-term review and in the previous report (D2.7). The problems have been tackled, but other conditions associated to the **COVID-19** outbreak have prevented the partner to recover yet from the deviations. The main problems behind those are: (i) the difficulties in hiring adequate people in companies that have been increased due to (ii) Administrative and Financial departments deadlocks due to the epidemic crisis and (iii) internal prioritization of activities with regards to personnel allocation. Nonetheless, according to the PC these deviations are not affecting the good advance of the project and any budget mismatch will be corrected by the end of the project.

Remarkably, tables included in this section have taken as baseline for estimation a “linear approach” for work package. That is: assuming all tasks in the WP are linear in its execution, and no peak moments or unbalance dedication takes place. This goes in contrast of the internal planning. PIXEL action is following the course established by the Gantt included in section 3 of Part B on the Grant Agreement. This fact may distort the interpretation of the figures, as no “linear approach” is being followed when tackling the needed activities.

Appendix A – Template fulfilled for all risks detected in the reporting period

- **WP2**

Risk subcategory			
technology, organisation,			
Risk Nº	**Risk Name**	**Risk Description**	**Consequences**
R2.13	*The COVID-19 pilot is not useful for the port or does not arrive in a useful timing*	*The incorporation of a new task may imply the risk of not having the result ready (or mature enough) to help the Port of Monfalcone*	*This delay may cause other deviations in the execution of the rest of the pilots of the WP7*

Likelihood	**Severity**	**Impact**	**Criticality**
High	*Moderate*	-	-

Contingency plan	
Avoid/Minimize Likelihood Strategy	**Mitigate Severity Strategy**
The COVID-19 pilot has been defined and approved by both Port of Monfalcone and technical pilots. It builds on validated model (PAS).	*The extension of the project should prevent this risk from happening.*

Handler	**Current Status**	**Creation Date**	**Transfer Strategy**
UPV	*Identified and being managed*	*August-2020*	

Work Log
Continuous work

- **WP8**

Risk subcategory			
technology, organisation,			
Risk Nº	**Risk Name**	**Risk Description**	**Consequences**
R8.7	*Delays in the implementation of the PIXEL Platform*	*Due to various reasons, including the outburst of the COVID-19 Pandemic, delays are observed in the implementation of the various systems in the 4 ports.*	*This delay comes hand in hand with delays in the execution of the evaluation*

Likelihood	**Severity**	**Impact**	**Criticality**

High	*Moderate*	-	-
Contingency plan			
Avoid/Minimize Likelihood Strategy		**Mitigate Severity Strategy**	
Technical partners are taking all the necessary measures in order to proceed asap with the installation and testing of all systems so that evaluation (both technical and business can start)		*The measures taken, in combination with the extension granted to the project, are considered at this point adequate.*	
Handler	**Current Status**	**Creation Date**	**Transfer Strategy**
UPV, CERTH	*Identified and being managed*	*Since the previous reporting period*	
Work Log			
Continuous work			