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D2.6 – Project Management Report v2

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Work Package	WP2		

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Key Data

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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 second PIXEL project management reporting. The present document provides the Project Management Report (PMR) for the second period of 6 months of the project. This report includes all the activities and advances performed from M7 to M12 of PIXEL. All WP have already started except WP7.

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 (M7-M12). 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.

With this report the Consortium wraps the work performed during the first year of the project. A summary of this period can be seen as follows: (i) finished a detailed specification of the use-cases and scenarios to be demonstrated at a later stage, (ii) clear view and roadmap for development of the main functional enablers: a) models and simulation, b) PEI and its methodology, c) requirements to meet and d) baseline and strategy for impact evaluation, (iii) technological specification setting the ground for developments in forthcoming months and, finally (iv) clear advance on dissemination, both in virtual presence and in attendance to relevant events and fora, including naturally liaison with CSA DocksTheFuture and the MG-7-3 actions.

Statement of originality

Table of contents

List of tables

List of figures

List of acronyms

Acronym	Explanation
AB	Advisory Board
CA	Consortium Agreement
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
SILI	Sistema Informativo Logistico Integrato (Integrated Logistic Informated System), a system provided by Regione Friuli Venezia Giulia and managed by Insiel to monitor and authorize entries to the Ports of Monfalcone and Trieste; it also monitors dangerous goods flows along the regional motorway network
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 first report of the project. After 12 months of the project, 7 work packages have started and various meetings have taken place. The scope of this document is to summarize the advances of the project and the obtained results within this period.

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 to keep PIXEL remains towards its goals.
Exploitable results	This deliverable does not generate any exploitable result.
Work plan	The Project Management Report involves, really, some activity from all the tasks in the project, as every one of them has been analysed and reported. Howver, this deliveable is framed in the WP2 structure and, particularly, it is assigned to T2.1, T2,2, T2.3 and T2.4. Particularly more to T2.1 than the rest of tasks in the work package.
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 D3.1, D3.2, D3.4, D4.1, D4.3 D5.1 and D6.1, as those have been the most relevant outcomes of M7-M12 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, this one (D2.6) corresponds to the second semester of the project and it includes previous advances, the actual evolution of tasks and the results produced by all work packages.

The methodology followed has been to: (i) summarise previous advance, (ii) work package leaders, altogether with the coordination have elaborated "progress reports" that has 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. It is forecasted that this methodology will be followed by the rest of Project Management Reports to come.

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 second period are in the line of accomplishing these global objectives. At this point, the consortium has delivered all the promised deliverables, in few cases with short justified delays, ensuring the maximum quality of work and clear alignment with agreed scope through GA. Technical activity is advancing and several developments are ongoing and dissemination and communication activities have been performed to maximize impact.

2.1.1. Research and innovation objectives

To meet this goal, the **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 second 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 second period of project management reporting: M7 to M12. For a full understanding of activities executed towards PIXEL goals the reader should come back to deliverable D2.5, in which the Consortium made the same exercise for period M1 to M6.

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 actions taken to accomplish this objective during the period M7-M12 of the project have been:

- Full definition of set of functional and non-functional requirements of PIXEL
- Finalised first version of the architecture
- Full list of components for each module of the architecture is closed
- Development environment is setup and running

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 actions taken to accomplish this objective during the period M7-M12 of the project have been:

- Final description of use-case and scenarios, providing a useful baseline and guidance for forthcoming technical development both for WP4, WP5 and WP6.
- List of data sources to integrate into PIXEL infrastructure to develop models and predictive algorithms (through deliverables D4.1 and D4.3)
- PIXEL Data Acquisition Layer (main work of T6.2) has been defined, methodology clarified and the advance of software development is ongoing.

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 actions taken to accomplish this objective during the period M7-M12 of the project have been:

- All task leaders have work on identifying input and output of their models and compared with available data in ports.
- PIXEL Dashboard and notifications module (main work of T6.5) has been defined, methodology clarified and the advance of software integration is ongoing. Technologies and programming languages are defined.
- PIXEL Operational Tools work is also advancing. A plan for the whole task is completed, as a draft layout of the UI and the description of its component is done.

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 M7-M12 of the project have been:

- A common vision of PIXEL models has been shared and validated by all WP4 partners in D4.1.
- WP4 partners worked on the link with the other PIXEL's WPs. This is reflected in D4.1. This is still an ongoing work. WP4 partners are now working on the link WP6.
- Interaction with ports in order to better understand the models needs and constraints.

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 actions taken to accomplish this objective during the period M7-M12 of the project have been:

- 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
- Analysis and plan of actions to create predictive algorithms.
- Knowledge generation and documentation creation about: (i) use of AIS open data, (ii) prediction of vessel call data from FAL forms and other sources, (iii) use of satellite imagery, (iv) prediction of road traffic data, (v) prediction of renewable energy production.

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 actions taken to accomplish this objective during the period M7-M12 of the project have been:

- The technical team assigned to the PEI (WP5), altogether with the view of stakeholders, mapped environmental aspects with respect to their significance to the PIXEL ports
- Establishment of a clarified methodology for algorithms behind PEI which will include: data imputation methods, normalization methods, weighing methods, data aggregation and finally uncertainty and sensitivity analysis of the PEI model

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 actions taken to accomplish this objective during the period M7-M12 of the project have been:

- A list and an understanding of the significant environmental aspects of port operations;
- First round of identification of KPI measurability and appropriateness for all use-cases under the umbrella of WP8

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, we 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 (Mr. Dimitris Spyrou) 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 s**pecific Ethics-related raw data.**

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.

2.2.1.3. Progress in M7-M12

For the second management reporting period (M7-M12) the activity on WP1 has been diminished in terms of establishing procedures and documentation and has focused on continuous monitoring of ethical issues along the project execution. Having established the guidelines, the main task performed in M7-M12 has been to analyse whether the information handled by the project partners raised any ethical concern. The assets analysed have been:

- Generic documentation of the project (day-to-day documents exchange, etc.)
- Forms and questionnaires needed to conduct our work
- Data about sensors, data sources, internal aspects of ports
- Communication with external agents (liaison with other projects, CSA, IMO, other entities)
- Advisory Board
- Dissemination of PIXEL

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

Our Ethics Mentor (see deliverable D1.4) has supervised the main processes of information exchange and he has been 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 WP3 mainly) has been anonymised and only aggregated data has been used to create PIXEL documentation (e.g. D3.1). No official meetings have been conducted yet with the Advisory Board, so no special concern about ethics has raised. However, data exchange with the AB has occurred always under optimal ethical awareness. No pilot trial has been executed yet, so no Human information might have been processed.

With regards to topics covered by D1.2, the PIXEL Information Hub and PIXEL ICT infrastructure is still not developed, so no personal data that was detected is being processed yet. Furthermore, no pilot trial has been executed yet, so no previously or currently processed personal data from PIXEL stakeholders might have been processed.

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.

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

- All members of AB will be provided with the Participant Information Sheet and will need to complete and agree with the Informed Consent for Human data and Protection of personal data issues. This means they will need to follow the templates established in D1.1 and D1.2.
- Whenever time comes, in WP7, the same procedure must be followed.

2.2.1.4. Results after M7-M12

- 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

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 during the first year of the project has been one of the most time-consuming and effort-spending items in the day-to-day work.

Most remarkable actions in period M7-M12 have been to organize the 1st Technical and 3rd Plenary Meetings and managing the Grant Agreement Amendment process that concluded at January 2019. The project consortium has generated six deliverables in this second period, associated with WP2 (1), WP3 (3), WP4 (2), WP5 (1) and WP6 (1), 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

This task was continuously performed during M1-M6. The main activities undertaken in the past reporting period were:

- Organise and coordinate Plenary Meetings: (i) 1st Plenary Meeting: Kick-Off at Brussels on 3rd and 4th of May. ALL partners attended the meeting and (ii) 2nd Plenary at Valencia on 11th and 12th of September. ALL partners attended the meeting.
- Organise and coordinate biweekly management telcos (in alternative Thursdays) and keep updated a TO-DO list for letting partners know the more compelling issues.
- Creation, maintenance, hosting and population of the document repository of the project (OnlyOffice).
- Writing of deliverable D2.1

Task 2.2.: Administrative and financial management

In previous periods (M1-M6), this task consisted of:

- Distribution of pre-financing was executed during the first month of the project,
- Kicking a GA Amendment request. The amendment has been worked over and finalised within the current reporting period (M7-M12)
- Conduction and conclusion of several reporting actions from all partner to keep track of deviations and proper use of resources

Task 2.3: Advisory Board Management

The summary of advance of this task during M1 to M6 is:

- Decision of which profiles should be addressed for selecting PIXEL's Advisory Board members.
- Partners proposed people/corporation that could fit those profiles.
- Several rounds of calls and first contacts and preselection of 10 members.
- Establishment of a plan on final selection, outcomes expected and draft schedule.

Task 2.4: Risk management and Quality Assurance

Some actions have been undertaken during its first 6 months.

- Increased number of risks identified
- Some mitigation actions were implemented
- Quality assurance procedure was established through deliverable D2.1
- Deliverables sent till M6 were validated through quality assurance procedure

Task 2.5: Data and ethical management, planning and assessment

PIXEL advance the following from M1 to M6 on T2.5:

- Identification of data subject to protection
- Elaboration of Data Management Plan (D2.2 and D1.5)
- Forwarded information about data management plan and data protection to WP3 (requirements) and WP6 (data processing).

2.2.2.2. Summary of results after previous periods

Main achievements of this WP in previous periods (M1-M6) were:

- Definition and assurance of compliance with administrative, documentation and internal communication procedures
- Deployment of the different collaborative tools in order to manage the execution of the project.
- Advances on the establishment of the AB composition.
- Amendment requested, in process of fine-tuning and submission
- Deliverables in this WP successfully submitted:
  - D2.1 - Project management and quality handbook
  - D2.5 – Project Management Report v1

2.2.2.3. Progress in M7-M12

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 specific mailing lists, supervising the whole work execution, uploading documentation (deliverables) to the EC, ensuring a good communication among the partners and keeping track of the work plan, ensuring the proper pace of work looking for the sake of the project and having 2 meetings in which all partners reunited:

- 1st Technical Meeting at Bordeaux on 12th, 13rd and 14th of November 2018. It was conducted as Technical Meeting to advance in use-case definition, requirements and eKPIs definition (WP5).
- 3rd Plenary at Piraeus on 5th and 6th of February 2019. ALL partners attended the meeting.

With regards to the documentation, from M7 to M12 the common documentation repository has been 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 3 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.

Coordination methods established and used by the Coordinator are also 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.

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 particular, three points are highlighted:

- Fluent communication with the Project Officer has been conducted through this task.
- The Consortium finalised the process of amend the Grant Agreement (summary below)
- An extraordinary PCC session was called upon celebrated in order to solve a conflict (summary below)

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 are to mention up to now.

In the following paragraphs there are some details about the most demanding tasks that have been conducted under task T2.2:

- Amendment to the GA:
  - Change of PMs and/or key personnel of Section 4: Six partners of the Consortium (UPV, PRO, XLAB, CATIE, MEDRI and THPA) requested to review the allocation of PM due to change of team assigned to the project, sabbatical courses, personnel availability and other reasons. Rationale was enough justified and the GA was modified accordingly.
  - Addition/modification of subcontracting: Partners THPA and GPMB requested to shift some budget from personnel cost to subcontracting due to changes in shareholding structure and legal status and team assignment and availability for PIXEL. Mainly, technical teams have been reduced or assigned to other affairs, therefore subcontracting for particular technical tasks has become a necessity. However, this change does not modify the total figures for both partner, neither does the scope or objectives of their participation.
  - Addition of 3rd Linked Parties: Due to Orange group internal reorganization between the submission date of the proposal and the kick off of the project, the most relevant competencies moved to entities that are now Orange affiliates. These competencies were identified and a most proper distribution of personnel is needed. Therefore, ORANGE SA is now participating through 4 entities: ORANGE SA, ORANGE LABS, ORANGE CONSULTING, ORANGE APPLICATIONS FOR BUSINESS and ASSOCIATED IMAGES & RESEAUX. This change does not modify the total figures of the, neither does the scope or objectives of its participation. Administratively, ORANGE SA is the contact point, while internal management will be done between the 3rd Linked Parties and ORANGE SA.
  - Minor changes in the text of the GA: typos, former names of deliverables and tasks corrected, etc.
- PCC session – Conflict resolution according to the CA:
  - WP3, communication tasks and, specially, deliverable D3.1 were detected to be slightly underperformed by the partner responsible due to several reasons.
  - Whenever certain facts happened, the Coordination altogether with several partners realised that the situation may suppose a clear risk for the project. In order not to jeopardize the advances in the rest of the tasks, the Coordination endeavoured an official procedure for breach of GA risk. A PCC session was then summoned and everything was satisfactorily solved for all parts.
  - Solution consisted of shifting PMs among partners (leaving IPEOPLE with less participation), creation of special team to complete the conflictive deliverable, change of responsibilities in WP9, establish internal milestones for ensuring commitment of the partner.
  - A voting was conducted. Enough quorum for voting was present. The decision was approved.
  - Official minutes of the session are available in case they were requested from the Project Officer or the EC.

Task 2.3: Advisory Board Management

This period (M7-M12) has been a very active one with regards to the Advisory Board Management. In this period the final composition was agreed among the partners. At this point, an official letter was sent by the Coordinator to each one of the selected members to confirm their willingness to participate. All of them replied affirmatively to the letter. Afterwards, all AB members were provided with a document specifying: (i) PIXEL information and role of AB, (ii) expected participation and (iii) meetings attendance details. Then, a validated Non-Disclosure-Agreement (NDA) was prepared by Coordination and sent to the members. All members signed it with the needed adjustments.

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.

Selected members of this board will meet regularly with the Consortium throughout the project. At the same time, the Consortium will allow the members to keep track of global advance of the project and to be aware of scientific and industrial discoveries to be reached.

The final composition of the AB is the following:

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

The main format of collaboration among AB members and the PIXEL consortium will be 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 is 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 are:
- Face-to-face meetings: PIXEL partners plan to have two physical meetings with the Advisory Board, coinciding with Plenary/Technical Meetings of the project. Planned dates for these meetings are:
    - 3rd PIXEL Plenary Meeting - May 2019
    - 5th PIXEL Plenary Meeting – September 2020

Next steps to be performed in this regard will include to check all Ethical requirements depicted in WP1 and undertake the proper actions. If needed, templates will be followed to report any concern arising and consent forms will be shared and asked for completion when applying.

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 have been undertaken during its first 6 months.

Particularly, the identification of risks has been slightly enhanced 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

Regarding this advance on risk detection and mitigation, a sheet has been created and uploaded to each WP folder (managed by WP leader) to specify and propose mitigation actions to risks that have been arising/may arise in the future of their tasks.

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 M7-M12. Particularly, deliverables D3.1 (re-edition), D3.2, D3.4, D4.1, D4.3, D5.1 and D6.1 have passed through the quality assurance process (Internal Review plus Innovation Review, meeting certain timing). These have been actions for both quality and risk mitigation.

Finally, it is worth to mention that one crucial activity for risk mitigation in the project has been the conduction of the PCC session for conflict resolution. Whenever certain facts happened, the Coordination altogether with several partners realised that the situation may suppose a clear risk for the project. In order not to jeopardize the advances in the rest of the tasks, the Coordination endeavoured an official procedure for breach of GA risk. A PCC session was then summoned and everything was satisfactorily solved for all the parts. Identification and mitigation of risk have worked in this case for now.

Task 2.5: Data and ethical management, planning and assessment

This task, to be executed during the whole project length, is somehow embedded into the first work package (WP1), and its activity within the scope of WP2 of PIXEL has been the following from M7 to M12.

The identification of data subject to protection, personal data and sensitive information from different points of view (Humans, environmental…) was conducted in the first months of the project. In this regard, we ve included a specific field into the Requirement definition template to indicate whether a particular requirement (piece of needed feature for the project: data, development, outcome, process, etc.) applies in some sense to the Ethical observance. In the first 6 months of the project, the WP in charge of ethical requirements definition ended (WP1). Therefore, the activity carried out in this regard in M7-M12 has been to observe project activities and apply the requirements whenever any ethical concern is detected. Every template is uploaded and available at OnlyOffice and a list of concerning situations was shared with the partners.

Very related with this task, in this period another task of the project has been conducted and finalised. Task *T3.2 – Regulation, policies and recommendation* has included 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. In this regard, an ethical analysis of the regulations to comply with has been also performed.

Table 3. 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 D2.6
	• Advisory Board management:
	  ○ Interaction with candidates
	  ○ Preparation of documentation
	  ○ Arrangement of meetings and other agreements
	  ○ Adjusting CA and other documents to comply with current AB status
	• Preparation and closure of the Grant Agreement amendment
	• Lead PCC session
	• 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 • Create, update and maintain the WP2 To-Do sheet in the common repository, thus keeping track of the WP activity • Organisation of bi-weekly Plenary Telcos • Lead the risk identification and mitigation process
P02 PRO	• Supporting Coordination in its majority of tasks from their position of Technical Coordinator • Search of suitable members for the Advisory Board focused on ports business, industrial port sector and ICT-ports junction • Supporting Coordination specially in Risk detection, mitigation and taking actions • Organisation of different sessions for technical advance in Bordeaux and Piraeus Meetings. • Huge participation in the process and execution of PCC session and its conclusion • Oversight of proper technical advance of the project, acting as a technical leader in several occasions in different work packages
P05 CATIE	• Assistance to all Plenary Telcos. • Usual actions corresponding to a WP leader (WP4) • CATIE organized and hosted the first technical workshop of PIXEL project in their premises on November 2018. • As a WP4 leader and lead editor of D4.1, CATIE spent time to provided comments and improvements for deliverable D4.1 to improve the quality of the description of data analysis and modelling that are expected by ports. Thus, CATIE aims to reduce the risks for the real implementation of models (which is largely related to the description of the use cases). So CATIE has participated actively in the risk detection and management task during this period. • Assistance to PCC telco.
P06 ORANGE	• Supporting Coordination specially in Risk detection, mitigation and taking actions • Usual actions corresponding to a WP leader (WP6)
P08 MEDRI	• Supporting Coordination specially in Risk detection, mitigation and taking actions • MEDRI contributed in all project administrative issues and corrective actions regarding p/m. Ethical approval for all project activities planned within PIXEL project, has been obtained by Ethical Committee of the Faculty of Medicine, University of Rijeka • Usual actions corresponding to a WP leader (WP5)
P11 PPA	• Organisation, hosting and attendance to the Plenary Meeting at Piraeus on February 2019
P14 IPEOPLE	• Supporting Coordination specially in Risk detection, mitigation and taking actions • Usual actions corresponding to a WP leader
P15 CERTH	• Supporting Coordination specially in Risk detection, mitigation and taking actions • Supporting Coordination in management of relation with ports specially • Usual actions corresponding to a WP leader

2.2.2.4. Results after M7-M12

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:

- Amendment to the Grant Agreement concluded and agreed with INEA to reflect some administrative changes of the project
- 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 report deliverable (D2.6) reflecting the reality of the project at this moment.
- Quality control of the deliverables and results of the project.
- Conduction of a PCC session to solve one conflict as specified in our Consortium Agreement.
- Finalisation of the AB composition, documentation and scope closed. Meetings planned and collaborations conditions established and signed.
- Deliverables in this WP successfully submitted:
    - *D2.6 - Project Management Report v2*

2.2.2.5. Deviations

No significant deviations have been produced, apart from the extra work needed to undertake the creation and management of the amendment request by Consortium partners.

Administrative breach procedure (first step) was launched in order to keep up the effort and level of commitment of one partner. This matter was successfully closed via a PCC session.

2.2.2.6. Corrective actions

No additional corrective actions have been required.

2.2.3.Work Package 3 – Requirements and Use Cases

At the time of delivering this report (D2.6), work package WP3 has just finished. Having lasted from month M1 till M12 of the project, we consider 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 this second management reporting period (M7-M12) the work package has been 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.

Primarily, deliverable D3.1 was catalogued as a shortcoming from the Consortium after its first internal draft delivery for many reasons. Additional issues arose with regards to this deliverable 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 discussion, a new ToC and first approach for D3.1 was proposed by PRO and partners such XLAB and UPV worked a lot on this to overcome the situation. This redounded on a delay on deliverable submission but a clear consciousness of quality and 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, during this period the main action of requirements gathering and wrapping has been 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.

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

In previous periods (M1-M6), 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

Task 3.2: Regulation, Policies and Recommendations

In previous periods (M1-M6), 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

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

This task was continuously performed during M1-M6. 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)
- Description of the further works to be accomplished to deliver the second and last expected document (D3.4 - "use cases and scenarios manual v2") on M9.

Task 3.4: Requirements specification

This task was continuously performed during M1-M6. 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)
- 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.

2.2.3.1. 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 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)
- Deliverable D3.3 – Use cases and scenarios manual v1

2.2.3.2. Progress in M7-M12

Progress by task

Task 3.1: Market study with stakeholders

This task as it was indicated from the Grant Agreement, intended to provide an insight to the current and emerging situation of port-related solutions focused on the interoperability between agents (cities, transportation companies, port agencies, etc.), the communication and storage of data of port activities, exploitation of this information and optimization of those operations from different points of view (namely environmentally).

This task has been aligned with the work on Innovation Management regarding the description of business models, the deployment, interoperability and operational strategies to be validated by ports, end users and operators.

Despite being finished after M6, this task continued in order to provide a high quality deliverable D3.1. After the internal review of the draft document, several issues arose that prevented the document to be submitted. Partners working on the document exert the work needed, but from Technical and Coordination review the document presented several shortcomings: (i) not all contents were indicated for proper market analysis, so not Total Addressable Market (TAM) was considered, (ii) the document scope was very broad, without clearly framing the analysis towards a PIXEL-oriented reflection, (iii) container terminals were too much analysed while the rest of typologies were almost overlooked, (iv) formatting and consistency issues, (v) oversize and lack of accuracy.

After this discussion, the Consortium decided to modify the ToC and begin a new iteration of writing of the document. This fact has caused an unexpected delay of 3 months in the final delivery of the document. This has been motivated by the intention from the whole Consortium on creating only high quality documents that represent the view and wish of all partners included.

Therefore, this task was extended in order to finalise the document with the highest quality as possible taking always into account temporal restrictions and the need to not affect other tasks in the project. As it has been commented, a new ToC was established and all partners involved in the writing contributed in an agile way to provide content and achieve a successful delivery. In this second stage, a relevant quantity of information was kept from the original version, so it did not consist of a work from the scratch.

The market analysis was based on a comprehensive state of the art review on existing solutions and trends - where special attention was paid to vendor specific solutions, existing and proposed standards and research projects - an analysis of the market of specific elements took place. It was comprised of the following different approaches:

- A comparison between the current and emerging situation of port-related solutions that are focused on the interoperability between agents (cities, transportation companies, port agencies, etc.), the communication and storage of data of port activities, the exploitation of this information and the optimization of those operations from different points of view (mostly environmentally).
- State of the art review on existing solutions and trends and analysis of the market of specific elements
- An examination between the various port operations (shipping agents, forwarders, customs agents and storage terminals) and public authorities (Customs, inspection services, the harbour master and the Port Authority) involved in maritime goods transport.

- A review of the current approaches for addressing and mitigating adverse environmental impacts of port's operations.

Additionally, the task was completed by performing some additional actions. As contemplated from the task description in the Grant Agreement, the partners carried out the following activities:

Table 4. Methodology items

Action	Details	Lead partners	Dates	Section
Desk research	Study of the global state of the art through a thorough review on existing solutions and trends (literature and projects)	IPEOPLE, PRO, MEDRI	July 2018-October 2018 and January 2019	2.1, 3.1, 4.1, 4.2
In-depth interviews with market experts	This action was led by internal experts on ports' market and technological solutions for ports. It included interviews among these partners that have been depicted in some sections of the document.	PRO, CERTH, XLAB, INSIEL and IPEOPLE	September 2018 – December 2018	3.1, 3.2, 3.3
Interviews with PIXEL stakeholders and use-case pilots host partners, users' surveys and Workshops	Technical partners performed internal interviews with the ports within PIXEL. Sub-actions were teleconferences and specific timeslots to conduct agile Workshops in two PIXEL meetings (Valencia and Bordeaux)	PRO, IPEOPLE, CERTH, XLAB, MEDRI and UPV. Ports: GPMB, ASPM, PPA and THPA	July 2018, September 2018, November 2018	2.2, 2.3, 2.4 and global considerations for 3 and 4.
Market studies & reports analysis	Analysis of market trends, global numbers of the sector, current opportunities, PIXEL's position in the whole framework and study of main concepts and classifications.	PRO, IPEOPLE, CERTH	July 2018-October 2018 and January 2019	2.3, 2.4

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. In this second period of management reporting the activity has concluded by continuing the work expected from GA and D3.3.

Lead by PPA, partners (specially ports) made an effort to identify and report their Legislation, policies, and regulations at National and Local Level in the areas of: Environment (waste, pollution), Environment policies, regulations, Transportation legislation, Safety and security legislation, Personal data management legislation, ISO certification for Environmental Management, Quality control policies and a list of the regulatory/supervisory bodies (Ministries, National, regional and local organizations) relevant to the project activities in the port pilot areas.

All the participating partners duly replied with their legal and regulatory framework directives, policies and local laws under which their port operations take place on the basis of the answered questionnaires of the PIXEL task 3.2 partners and in regards to their operational legislative framework. Then, task leader drafted the PIXEL Activity task 3.2 report, exhibiting the aim of the activity task, describing the main European directives, legislation framework in specific port operation relevant areas followed by the corresponding national and local legislation and policy making in the areas mainly related to the port activities as listed in the relevant report and in the relevant Deliverable D3.4 sections. Each PIXEL port use case was also associated with the corresponding EU Legal framework to be considered as described in the PIXEL deliverable D3.2.

In T3.2, such legal requirements and issues have been collected for each port, in order to identify legally available legislation and compliances at European, National and Local level and related Authorities. Such compliances spread between several different aspects regulated in a general way at European level and implemented nationally by each country with respective laws and regulations.

D3.4 includes 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. Legal departments in each pilot port will define a proper strategy in order to involve national regulatory bodies in legal requirements validation, for each use case.

The European regulatory context refers to the areas related to:

- The Vessel traffic monitoring in EU waters and the (SafeSeaNet) network aiming to link the European maritime authorities for the provision and exchange of information on ships, ship movements, and dangerous cargoes
- The European maritime single window environment in order to simplify and harmonize the administrative procedures applied to maritime transport
- The Air Emissions standards for the regulation of the ship generated specific emissions and discharges
- The Air Pollution legislation to achieve emission reductions of the main pollutants
- The Greenhouse Gas directives aiming to improve and extend the greenhouse gas emission allowance trading scheme.
- The Sulphur Directive for the reduction of Sulphur Dioxides (SO2)
- The Alternative Fuels directive aiming to substitute fossil oil sources in the energy supply to transport
- The Port Reception Facilities regulations to limit and control the discharges generated at sea
- The European Commission, Transport regulation for the ports development
- The EU data protection rules related for the protection of natural persons regarding the personal data processing and also the free movement of personal data.

The national regulatory context has been examined for France, Italy, Spain and Greece and refers to:

- Environment (waste, pollution) legislation
- Transportation legislation
- Safety and security legislation
- Personal data management legislation

The legislation, policies and regulations at local pilot port level has been examined by the PIXEL pilot ports of Bordeaux, Monfalcone, Piraeus and Thessaloniki in the areas related to the use cases as follows:

- Environment policies and regulations
- ISO certification for Environmental Management
- The processing of personal data and on the free movement of such data
- The regulatory/supervisory bodies in each pilot area

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

The task 3.3 has been dedicated to the use cases and scenarios definition for port environmental issues.

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.

The work behind this goal has been diverse, focusing on a continuous discussion between ports and technical partners of PIXEL to analyse the objectives and final achievements and how to be reached. This involved reviewing previous statements, comparing to the current situation of the port, of the literature analysis and to the technical work advanced so far (WP4, WP5 and WP6). Partners realise that several actions were needed to be done in order to provide the most complete information to forthcoming tasks. This has been addressed carefully so that technical partners can easily map from a more "abstract wishes" to more "concrete implementations" guiding them to establish an architecture, components composition and modules interactions. Furthermore, expectations on performance, visualization and other features of PIXEL solution have been contemplated during the road to D3.4.

Considering all this, deliverable D3.4 (the most important outcome of T3.3) has aimed to provide a final detailed description of the use-cases that form part of the project. PIXEL is very use-case centred, considering the needs of the ports as well as their expectations as a substantial part of its nature. In this document, all considerations of the ports (global situation, the problems they are facing, available data and infrastructure) are depicted, establishing a complete development lever for further technical work packages of the project.

PIXEL Consortium restates that D3.4 is one of the pillars of the PIXEL project because it sets the basis of the technical work packages. Indeed, it will feed the works carried out on WP4 "Modelling, process analysis and predictive algorithms", WP5 "Port Environmental Index Development", WP6 "Enabling ICT Infrastructure Framework" and WP8 "Assessment and expansion plan". Therefore, the execution of this task has been of prime importance and thus has involved the participation of the majority of partners.

However, its writing has been marked by a change on methodology due unexpected circumstances. Originally, the leader of this deliverable was (as well as D3.3) the partner GPMB. At a certain moment (December 2018), partner GPMB approached Project Coordinator (UPV) stating that the company was under unpredictable and major changes. Due to its lowest income ever and a fierce decrease on traffic in 2018, all the managers and relevant staff was about to be set to address the situation. This scenario was forecasted to last for few months, so scarce useful effort could be exerted to lead deliverable D3.4, thus not guaranteeing its completion in time and format. Being aware of the risk, the Coordination took the mitigation decision of assuming the leadership of the deliverable and devoted a lot of effort to submit a solid document. After this discussion, the deliverable was slightly delayed (1 month) but it has been submitted under ideal conditions of quality, format appropriateness and coverage of objectives and expectations. It is worth to mention that D3.4 has not only been tied to what was promised in D3.3 but it has gone beyond, providing additional useful information for the future of the project.

Regarding the technical aspects that have been depicted in the document, it can be summarised us:

- **Context conditions of the use-case**: the main information regarding the port, traffic, geographical situation, relevant conditions affecting PIXEL execution and its regulatory context.
- **Technical context**: identification of the systems already available at the ports, the data which are currently collected and processed, software and hardware capacity plus sensors.
- **Description of the use-case**: what are the ports expecting from the project, what are they contributing for, how is it aligned with the whole consortium and objectives, and the global flavour of the use-case.
- **Scenarios**: definition of scenarios that compose the use-case.

These items of information will allow the technical work packages (WP4, WP5, WP6 and WP8) to continue working on their tasks with a detailed complete set of input parameters.

This deliverable, as a final version, contains all necessary level of detail to generate final requirements (WP3), design the necessary models (WP4), draft the architecture (WP6) and integrate and evaluate the generated pilots (WP7 and WP8). For example, the relevant port processes a described thanks to UML diagrams. Moreover, the interfaces between local IT systems and PIXEL will be specified, too.

Task 3.4: Requirements specification

The task 3.4 Requirements specification started in month 2 and has been closed in month 12.

The scope of this task has been to provide PIXEL requirements to support the design and the implementation of the PIXEL solutions in order to meet the pilots' needs. All the work conducted in this task has been depicted in deliverable D3.2. In that document, requirements (the list has been extracted from JIRA) are collected and classified, using the VOLERE methodology. All requirements have been identified by pilot and technical partners, with the support of all project partners, that will guide the next technical stages of PIXEL with a focus on the peculiarity of each pilot partner and the related needs and its position within PIXEL platform. For the requirements gathering has been used JIRA in order to allow to each pilot to insert its own needs and to share them with all partners in order to detail the requirements and to refine them in the PIXEL perspective. Moreover, part of the work on this task during months M7-M12 received input from D3.3 and its final version D3.4, and the interviews of the pilots, allowed to better specify their needs and to carry out the requirements

Requirement elicitation and analysis have been performed by involving all different stakeholders of the PIXEL project, such as ports, technical partners, research and academicals partners. The use cases of each stakeholder have been analyzed in order to describe the functionalities the PIXEL tools must provide and how such tools must work in order to satisfy both project's goals and users' expectations. Requirements are classified in functional requirements, non-functional requirements and constraints.

An iterative process has been exploited in order to improve both quality and soundness of collected requirements. Requirements analysis represents, in fact, one of the most important task of each project concerning software development and impacts significantly on the quality and effectiveness of the overall project. The definition of rigorous requirements can reduce the development effort, by minimizing the risk of re-design, re-coding and re-testing to take place, by allowing project managers to estimate both time and cost of required development tasks. Finally, the requirements can set the evaluation and validation criteria to obtain a quality product.

In order to optimize the outcomes of WP3, in PIXEL a standardized and largely adopted methodology for requirements analysis has been followed the VOLERE Methodology. Described in detail in Chapter 2 of this document, VOLERE Methodology represents a leading solution in requirements analysis, by allowing its practitioners to collect, classify and analysis requirements in a systematic way. In particular an ad-hoc template, based on the standard VOLERE template, has been proposed in order to include specific information related with the PIXEL project and its deliverables. VOLERE Methodology, already known by several partners of the Consortium, has been effectively exploited by adopting the JIRA tool.

Deliverable D3.2 represents a description of the results generated by task T3.4 but, at the same time, it should be seen as a synergistic path with the other tasks of the WP3. In particular deliverables D3.1, D3.2 and D3.4 represent the starting point for interviews with stakeholders, by describing the different use case each partner is interested in.

PIXEL's stakeholders provided more than 100 validated requirements, covering all different use cases defined by the project for each port and for the PEI calculation process. In particular, such set of requirements includes both functional requirements (what the system must do) and non-functional requirements (which properties the solution must be able to provide), which will be used as a reference during both design and development activities. Such set of requirements may change during the life-cycle of the PIXEL project, due to the iterative nature of requirement analysis process; in order to support future evolution of requirements the JIRA platform will stay active until the end of the project and work as a knowledge base for each stakeholder involved in the project.

Most of the collected requirements are functional requirements: they are used by stakeholders to describe the functionalities that PIXEL tools must provide in order to allow use cases to be effectively exploited. In particular, such requirements, for each port, cover several aspects related with IoT (integration with sensors or existing systems, providing information), modelling (which models are required by each use-case in to provide a value to each stakeholder according to its context) and data availability.

Non-functional requirements, collected mostly by technical partners, describe, on the other hand, which properties the proposed set of tools must achieve in order to implement required functionalities and grant

interoperability and portability (in particular by considering that the PIXEL project is aimed at being adopted by several small or medium European ports).

The priority of most requirements is perceived as very high by stakeholders for each category, including non-functional requirements. PIXEL project, in fact, impacts on several aspects of ports 'activities, for each proposed use-case, and requires several information (provided by sensors of third party entities) to be collected in order to train and feed advanced models and generate relevant information (e.g.: PEI calculation, impact of port air pollution on the city, port energy consumption, etc.).

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

Table 5. WP3 Partner contribution summary table M7-M12

Partner	Contribution
P01 UPV	• Attendance to different WP3 specialized telcos • Internal Review of D3.1 • Take charge of D3.4 writing and submission • Suggestion of D3.4. ToC • Writing of D3.3 sections • Creation of diagrams out of user-stories of the different use-cases • Leading the THPA's use-case technical alignment in D3.3, D3.4, D4.1 and requirements (D3.2) • Introduction of requirements related to THPA's use-case • Introduction of requirements related to task T6.4 Operational Tools • Contribution to writing sections related to T3.2 (regulations) both for D3.4 and D3.2
P02 PRO	• Attendance to different WP3 specialized telcos • Internal Review of D3.1 • Suggestion of new D3.1 ToC • Writing of sections in D3.1 • Requirements associated to tasks T6.2 and T6.5 • Technical validation of all requirements in JIRA that have been assigned to. PRO is the Technical Coordinator of the project so their activity in this regard has been extensive • Leading the PPA's use-case technical alignment in D3.3, D3.4, D4.1 and requirements (D3.2)
P03 XLAB	• Attendance to different WP3 specialized telcos • In T3.3: Inputs about innovation, technical requirements, support the port of Monfalcone scenarios. We dealt with innovation management related to this task. Identification of ICT-related content and relation with technical tasks. Critical review of the deliverable D3.4. Innovation review using appropriate form. • In T3.4: Captured requirements for a specific use case (Bordeaux). Captured technical requirements. Assisted partners on the creation of requirements in JIRA. • Technical validation of a large set of requirements • Contribution to D3.2 • Assisting partners (specially ports) in the use of JIRA and introduction of requirements • Part of the team of ASPM/SDAG's use-case technical alignment in D3.3, D3.4, D4.1 and requirements (D3.2)

	• XLAB participated in deliverable D3.1 by contributing to Innovation and Exploitation subjects. Critical review of the deliverable. • For the requirements, (T3.4) and its associated deliverable (D3.2) XLAB firstly contributed to JIRA requirements description and to the Volere methodology specification and particularization. • For the writing of deliverable D3.4, initially XLAB contributed in review, comments on technical aspects of use cases; assistance to the Monfalcone use case. • Sections of D3.2 writing • Collaboration on the D3.1 new iteration with full sections writing • Collaboration with Coordination on solving issues related to deliverables D3.1 and D.34 • Internal review of D3.4 • Innovation review of D3.4
P04 INSIEL	• Attendance to different WP3 specialized telcos • In task T3.2, INSIEL contributed to the deliverable 3.4 Use cases and scenario manual v2 and to the specialized section in D3.4 related to legal and regulatory aspects. • INSIEL proposed, encouraged and set the JIRA platform to include specific legal requirements in the whole list of PIXEL needs. • Leading the ASPM/SDAG's use-case technical alignment in D3.3, D3.4, D4.1 and requirements (D3.2) • INSIEL has lead task T3.4: o Initially, upgrading the configuration in JIRA to meet project needs and started the gathering of the requirements, using face-to-face interviews or the user stories produced within the task 3.2. o Setting the JIRA framework o Lead of deliverable D3.2: (i) elaboration of ToC, (ii) writing of sections, (iii) integration of contributions, (iv) final delivery of the document to Coordination. o Review of requirements, correction of mistakes in format and content o Alignment of consistency o Analysis of conclusions and elaboration of aggregated diagrams and tables to extract summarised information from the list of requirements
P05 CATIE	• Attendance to several WP3 specialized telcos. • Internal Review of D3.1 (second time after a complete rewrite by IPEOPLE) • Definition with GPMB of their scenarios. • Technical validation of all requirements in JIRA that have been assigned to. • Participation and contribution on the Port Business Session during Bordeaux Technical Meeting to help port to have better definition of their modelling and data analysis needs. • Review, analysis and comments on the user-stories coming from all ports with a specific focus modelling and data analysis needs. Contribution and assistance of GPMB to write their user-stories. • Review and comments on requirements in JIRA tools. • Comments and contributions on the deliverable D3.4 with a specific focus on GPMB use-case. • Huge work to better understand modelling needs and available data in all ports to be able to advance on WP4 (a specific section for this was implemented in deliverable 4.1). Review and comment contribution of the ports.

	• Leading the GPMB's use-case technical alignment in D3.3, D3.4, D4.1 and requirements (D3.2) • Technical review of requirements of GPMB use-case • Technical validation of several requirements assigned to the partner
P06 ORANGE	• Attendance to several WP3 specialized telcos • Added some technical requirements for T6.6 added in Jira. • Enter Jira tasks for the release 1 of D6.3 deliverable • Requirements associated to tasks T6.2 and T6.6 • Internal review of D3.2 • For deliverable D3.1, ORANGE contributed by: (i) finding and exposing concrete examples to better understand how European ports use their ICT System from an internal benchmark and (ii) writing a section with market information regarding IT/Data solutions available. Related to the use cases defined in another section of the deliverable. • At the beginning of the period (M7-M9), ORANGE contributed to deliverable D3.3 mainly proofreading, researches on other use cases implemented in other ports in Europe using ICT technologies, that were finally added in T3.1.
P08 MEDRI	• Collaboration in task T3.4 by including particular environmental-related requirements into JIRA platform • Review of use-cases-related requirements in JIRA, especially regarding environmental/pollution modelling scope and objectives for each scenario contemplated • For deliverable D3.1, MEDRI has contributed to the sections on environmental indexes as well as the best practices for environmental standards. • Insertion of requirements related to environmental pollution modelling and related to PEI
P09 SDAG	• Attendance to specific WP3 telcos • Stakeholder validation of ASPM/SDAG's use case requirements • Internal review of D3.2 • For deliverable, D3.1, SDAG has contributed along with INSIEL and Port of Monfalcone regarding market analysis, ICT systems etc. Besides, via their participation in a specific telco for the deliverable, SDAG provided many information related to SDAG to the Task Leader in order to improve the Deliverable content • SDAG answered to the questionnaire sent to the Consortium providing information such as: technical descriptions of technological devices and equipment that can be used for the use case and market analysis referring to the devices included • Regarding task T3.2, SDAG continued to improve internal documents and processes related to the GDPR according to the European and national regulation. • Regarding task T3.3, at the beginning of the period, SDAG was strongly committed in T3.3, since it was involved from Month 1 together with the Port of Monfalcone in the analysis of the FVG scenario. • SDAG took part in several technical Telcos and internal physical meetings along with ASPM and INSIEL for the FVG use-case sake. • For this reason, SDAG collaborated in the writing of deliverable D3.4 in sections related to the Multimodal traffic use-case, including writing of user-stories together with the Port of Monfalcone.

	• Requirements in JIRA specially for the FVG use-case, being one of the main actors involved in the pilot. • SDAG in cooperation with INSIEL and the Port of Monfalcone contributed to the specification of the requirements in JIRA. Furthermore, it was also arranged a technical face-to-face meeting in Monfalcone in order to discuss all the requirements to make them clearer and coherent, and proceed with the validation together with INSIEL too. • SDAG was one of the partners involved in the stage of "Stakeholders review" of requirements. • SDAG was nominated as formal reviews of D3.4, the deadline to give the final feedback is set in April 2019. SDAG met the deadline and has effectively conducted the review.
P10 THPA	• ThPA SA team of the PiXEL project, had numerous meetings with stakeholders, for requirements specification and their expectations after the implementation of the project. Moreover, internal meetings with ThPA SA management have taken place, regarding equipment needs, the progress of the project, as well as future actions • Stakeholder validation of THPA's use case requirements • Compilation of user stories, depicting the expectations from the project, which were used to set and prioritize the requirements in the JIRA software. After that, ThPA SA team of the PIXEL project, having met with ThPA SA management and stakeholders, validated the requirements • Collaboration in deliverables related with use-cases, data availability and ports expectations and requirements description: D3.1, D3.3 and D4.1. • Numerous meetings were held with ThPA SA legal department, regarding all relating legislation, resulting in the contribution for task T3.2 and deliverable D3.4
P11 PPA	• Stakeholder validation of PPA's use case requirements
P12 ASPM	• In task T3.1, ASPM joined the TelCos referring the activity and kept updated about the task activities. • With reference to the technologies analysed in T3.1, ASPM under task T3.2 prosecuted to evaluate the data protection system involved with the SILI System with reference to the General Data Protection Regulation and how to get a proficient access to the system data, keeping in mind the recent Decree of the President of the Italian Republic n. 57/2018 that merged the Port of Monfalcone with the Port of Trieste inside the Port Authority System of the Eastern Adriatic Sea can affect the project activities. • In task T3.3 ASPM, along with Insiel and SDAG, ASPM continued to analyse the scenario of Friuli Venezia Giulia use case, also referring to the context deriving from T3.1 and T3.2. ASPM has continued to analyse technologies, actors and data involved, data and goods flows, main constraints and critical aspects of the use case. ASPM has cooperated with other FVG project partners in technical telcos. • In task T3.4 ASPM in cooperation with INSIEL and SDAG defined the requirements of its use case in JIRA. This activity took place in various telco and in a specific technical meeting held in Monfalcone where the working group proceeded to the validation • Stakeholder validation of ASPM/SDAG's use case requirements
P13 GPMB	• In task T3.2: contribution with the questionnaire led by PPA related to legal requirements • In task T3.3, GPMB was initially the leader of D3.4. Due to circumstances the partner could only finally contribute preparing the first steps of the drafting of D3.4. • In task T3.4, regarding the requirements, GPMB defined their user stories and performed the stakeholder validation of GPMB's use case requirements

P14 IPEOPLE	• IPEOPLE has been the WP3 leader. This meant conducting the usual tasks associated: (i) organising telcos, (ii) managing the whole communication of the WP, (iii) ensuring effective exchange of information and views of all task leaders, (iv) report to coordination.
	• For deliverable D3.1, IPEOPLE was the leader and the partner carried out:
	  ○ Full Sections writing.
	  ○ Gathering contributions.
	  ○ Fine tuning of document after internal and innovation review.
	  ○ Finalization and submittal
	• After the change of their team, IPEOPLE also lead the writing of the second round of writing of deliverable D3.1

P15 CERTH	• Attendance to specific WP3 telcos • Participation to the Technical Meeting in Bordeaux and contribution to the development of the PIXEL use cases • Contribution to D3.1 (Stakeholders and market analysis report) • Contribution in clarifying the PIXEL conceptual approach • Internal review of D3.4 (Use cases and scenarios manual v2)

2.2.3.3. Results after M7-M12

The main results that we have obtained in this second period of the project (M7-M12) in the context of WP3 are the following:

- Full definition of set of functional and non functional requirements of PIXEL
- Full market analysis and 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 *D3.1 – Stakeholders and market analysis* (already accepted by the PO)
  - Deliverable *D3.4 – Use cases and scenarios manual v2* (already accepted by the PO)
  - Deliverable *D3.2 – PIXEL Requirements Analysis*

2.2.3.4. Deviations

Deviations on D3.1 and D3.4 date of submission were experienced. Both situations have been detailed before. Both situations were solved during the execution of the work package without affecting further elements or tasks of the project.

So far no else deviations have been detected

2.2.3.5. Corrective actions

Due to the change of leadership on D3.4, 1 PM allocated to GPMB will be reallocated to UPV. This is properly reflected on WP2 report and will be formalised in the project through the next amendment. This has not affected scope, objectives or current evolution of the project.

No else corrective actions were needed.

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

WP4 goal is to provide several PIXEL Modelling Tools to PIXEL Hub. Actually, WP4 will propose models, data analysis and algorithms in order to manage port efficiently and adapted to the environmental stakes. To do this WP4 will consider 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 will be implemented in the software operational tools. Thus, WP4 propose a clear and validated model adapted to the need of ports define in WP3.

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.

WP4 considers cargoes (liquid/dry bulk, breakbulk, container or passengers) transitions between areas (from sea to hinterland) through transition operations (i.e. unload, load and transport) by machines (e.g. crane, truck etc.). A specific composition of cargo's transition operations (involving different machines and operators) will be referred as a supply chain.

For each cargo, there are several ways to arrange transition operations between areas. A hypothetical combination of those transition operations (for one or more cargo) is called a scenario. This scenario will be design by port operators and the end-users of modelling and data analysis tools.

WP4 will provide the ability to get environmental impact metrics for any scenarios, and to compare it with alternative scenario. Thus, PIXEL modelling tools will order scenarios according to an optimization metrics
A special attention has been given to identify and manage main risks for WP4's achievement. Four main risks have been targeted:

1. WP4 is limited to the input data quality, about which some difficulties may rise.
2. Confusion should be avoiding between Environmental Impact Assessment Models and other tools in demand by uses cases.
3. There may be a lack of degree of freedom about modification of port processes schedule or organization for environmental impact optimization.
4. A nice balance has to be found between high model's customization to perfectly answer a use-case, and a more general scope of the model in order to be easily transposed to most of the small ports.

2.2.4.1. Summary of progress in previous periods

In this regard, this work package only has been being executed for three months, so it is in its very first stages.. During months M4 to M6, WP4 undertook the following actions:

- Kick-off of the WP4 in M4 and definition of the WP execution plan, internal milestones and the methodology to be followed in the second plenary meeting in Valencia. This work has been done in interaction with task leaders.
- Several WP4 specialized teleconference have been organized
- Interaction with ports in order to better understand the models needs and constraints.
- Beginning of a state of the art about available models, current solutions and general port's operation knowledge.
- Internal review of D3.3 with a close look at modelling and data analysis part.
- Beginning of a data mapping in ports.
- Production of knowledge, internal documents and proposals for the project.

In this sense, this is how we can summarize the actions that partners carried out during the first months of tasks T4.1, T4.2, T4.3 and T4.4.

- **Technical description of the use-case for the model and data analysis part.**
    - Port processes description: flow diagram, user stories (support of task leader and technical partners)
    - Modelling objective: analysis, prediction, comprehension, measurement, …
    - Identify actors, inputs, outputs
    - Data needed to understand and explain

  This technical description of the different use-case has been done and fully described in deliverable D4.1 PIXEL Models. WP4 partners have also contributed to clearly define user-stories related to modelling and data analysis (This users' stories can be found in deliverable D3.4).

- **Definition of scope and boundaries of the study.** Technical work has been done on this point and described in D4.1 but also in D4.3.
- **Work on data**
    - Available data, data to collect
    - Validity, reliability, completeness, accuracy and integrity of data
    - Based on data and technical description, define limits, hypotheses and area of validity of models and data analysis

  A lot of man power has been used to work on the data description and availability. Since data are the basis for modelling and data analysis, it is crucial to clearly understand what are the data really available and in which format. Every WP4 task leaders is confronting with lack of data (not enough historical data), data availability (it takes times to obtained data from port), data quality (a lot of work must be done in order to have a good dataset). Task leaders has also spent time to search open-data to use and to integrate in PIXEL Models.

- **Definition of the models / data analysis functionalities** First initial insights and work have been done and described in deliverables D4.1 and D4.3. This work is still an ongoing work and will be consolidated in the next months.

- **Establish a clear state of the art about environmental impacts assessment models.** First initial insights and work have been done and described in deliverables D4.1 and D4.3. This work be will completed and consolidated in the next months.

2.2.4.2. Summary of results after previous periods

- Definition of a WP4 technical roadmap and execution strategy
- Definition of the whole workplan, internal milestones and the methodology to be followed. Every sub-task has its corresponding plan and first approach to the technologies to be used

2.2.4.3. Progress in M7-M12

As a summary, the advances done in M7-M12 with regards to WP4 have been the following:

- A common vision of PIXEL models has been shared and validated by all WP4 partners and reflected in D4.1.
- All task leaders have work on identifying input and output of their models and compared with available data in ports.
- WP4 partners worked on the link with the other PIXEL's WPs. This is reflected in D4.1. This is still an ongoing work. WP4 partners are now working on the link WP6.
- The deliverable D4.1 was successfully deliver in M9.
- The deliverable D4.3 was successfully deliver in M12.

- Several WP4 specialized teleconference have been organized.
- Technical work for WP4 have been done in the technical meeting organized in Bordeaux in November and also in the plenary meeting in Piraeus in February.
- Interaction with ports in order to better understand the models needs and constraints.
- Production of knowledge, internal documents and proposals for the project.

Interaction with others WP

WP4 is working closely with three others WP:

- WP3: a lot of work have been done in WP4 during M7 to M12 to clarify user stories and scenario relating with modelling and data analysis. This implies that a common work has been done between task leaders, ports and technical partners.
- 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 supplychain modelling) and the impact on the PEI.
- WP6: works has been done to have a full set of model's requirements definition. This work is still an ongoing work.

Risk identification and management

A special attention has been given to identify and manage main risks for WP4's achievement. WP4 is limited to the input data quality, about which some difficulties may rise. Even though a lot of work have been done during M7 to M12 to mitigating this risk, this risk still exists for some WP4 task.

Current status of each task

T4.1 – Port and City Environmental Management Models

This task is advancing on modelling the port's supply chain and describing the port activities scenarios. Work have been done to gather data about supply chain and build activity scenario. 39 different scenarios have been already created based on the data given by ports. Works have also been done in order to link WP4 with WP6 using FIWARE data models.

T4.2 – Energy Demand Models

This task is advancing on modelling the energy demand and production. Work have been done on:

- Modelling the process of loading/unloading vessels. All the different elements have been listed and identified. Task leader is waiting for some electrical consumption's measurements form GPMB to continue to advance on this point.
- Predictive algorithms for solar energy production: Based on historical irradiance data and associated weather conditions, obtained either by measurement or by satellite-based tools (PVGIS), we will propose a full methodology to predict one-point irradiance for a time horizon from a day to year. Based on historical production data, mainly obtained as open-data, we will implement predictive algorithms for photovoltaic production based on past data of real production and associated weather conditions. Even if the models will be not directly design for an in-site PV system, the full methodology will be reproducible. The objective here is to provide port with a tool to estimate their production based on their real installation

T4.3 – Hinterland multimodal transport Models

This task is advancing on the modelling of multimodal transport. A real complete set of data relating to vessels incoming and outcoming ASPM throughout the whole 2018 have been collected. Work have been done on a single algorithm able to convert vessels incoming into a trucks traffic flow inside port area depending on type and amount of goods carried on. Task leader is analyzing PMIS system as well, in order to understand if it will be feasible to connect with it real time using web services call. Work on the existing Fiware data models is still an ongoing work.

T4.4 – Environmental Pollution Models

This task is advancing in the air and noise dispersion modelling. Modelling software have been purchased and modelling requirements will be described soon.

MEDRI, as task leader, has lead the investigation of available numerical models for assessing the environmental impact of port activities in general and cargo handling in particular on the environment. In cooperation with the ports several environmental aspects of interest were identified with which mainly related to the impact that ports are having on air quality as well as their contribution to environmental noise levels.

To effectively deal with the tasks the technical team has decided to use the well-known and widely used and described Gaussian steady-state and puff pollutant air dispersion models AERMOD and CALPUFF. Both of those models can be integrated in a GIS environment for visualization of the modelling results.

Regarding Environmental Noise modelling, we have opted for PREDICTOR, a powerful software used for assessing and predicting environmental noise levels.

T4.5 – Predictive Algorithms

This task is advancing on predictive algorithms. 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.

- Prediction of vessel call data from FAL forms and other sources.
- Use of AIS.
- Use of satellite imagery.
- Analysis and prediction of road traffic conditions with connection to port operations.
- Prediction of renewable energy production

Table 6. WP4 Partner contribution summary table M7-M12

Partner	Contribution
P01 UPV	• Attendance to specific WP4 telcos • Internal review of D4.1
P02 PRO	• Attendance to specific WP4 telcos • Internal review of D4.1

P03 XLAB	• Attendance to different WP4 specialized telcos
	• During the first months of the period (M7-M9), XLAB collaborated in the writing of deliverable D4.1 through a short section on predictive algorithms; Innovation review.
	• XLAB is leader of T4.5, thus in this period has been in charge of:
	  ○ Discover a list of Predictive algorithms to be potentially implemented in the first phase
	  ○ Describe objectives and brief analysis of SotA of Predictive algorithms
	  ○ Include the advances into deliverable D4.3
	• XLAB has lead the deliverable D4.3:
	  ○ At the beginning of the period, leading the deliverable, ToC, drafting sections.
	  ○ Leadership of the document
	  ○ Writing of sections

P04 INSIEL	• Attendance to different WP4 specialized telcos • Internal review of D4.3 • INSIEL leads task T4.3.

	○ At the beginning of the period, INSIEL proposed a model for the hinterland multimodal transport to the WP leader CATIE in order to harmonize the structure of the model with other models.
P05 CATIE	• Leadership of WP4. To-Do list monitoring. Tracking and checking advancement of each WP4 tasks. • Organization of WP4 specialized telcos • Organization of a specific telco with WP6 leader to discuss links between WP4 and WP6. • Organization and animation of one-to-one telcos with each task leaders to work on clarifying each task and expected work. • Definition of actions points and deadline to write deliverable 4.1. • Lead editor of the deliverable 4.1: huge assistance, contributions and requests to write, review and edit the deliverable. • Ensure a continuous relation with WP3 relating the description of the use cases and the technical requirements that must be carried out. • T4.1: Contribution on defining what is a port environmental management model. Due to a lack of work of task leader, CATIE spent a lot of work on this task, proposing supply chain modelling, activity scenario and how PIXEL models will interact. • T4.2: CATIE is leader of this task. State of the art, definition a first structure of energy model, interaction with GPMB to identify data. Contribution to deliverable 4.1 to define energy model and energy prediction. First work to implement the energy model. • T4.3: Review of section in deliverable D4.1. Telcos and exchanges with tasks leader. • T4.4: Huge contribution on the definition of environmental model in deliverable 4.1. Telcos and exchanges with tasks leader. Support of the task leader to help him clarifying the scope of this task. Interaction with ports to better understand their needs on this point. •
P07 CREO	• For deliverable CREO provided several inputs for deliverable D4.1: in section “2. Introduction to Pixel’s models” and “2.2.2 WP5: Environmental impacts measurement for ports activities”: emission inventory to the seawater. In section “3. Pixel’s Models Definition” and “3.4 Environmental Pollution models”: description of marine existing tools and software. • Collaboration in task T4.4 with regards to marine/coastal Env. Pollution model inputs •
P08 MEDRI	• Attendance to specific WP4 telcos • MEDRI has performed an overview on the key environmental aspects to be included in the port and city environmental management model: pollutant dispersion in air, emission inventories, environmental noise etc. • MEDRI is the leader of task T4.4: ○ Study, design and advance on available numerical models for modelling ○ Identification of environmental aspects of interest of the ports ○ Collection of extensive information for data needed to run models • At the beginning of the period, further information about additional software was gathered in order to properly implement the required work on task T4.4 • Start gathering the necessary data to parametrize the models

	• Start of selection and design of models for pollution dispersion in air and environmental noise modelling, considering that the tools to be used will be CALPUFF, AERMOD and PREDICTOR. • Provide help in data collection to the ports and to other partners, guiding the process thanks to their experience in environmental aspects. • For deliverable D4.1, MEDRI has contributed to the sections on environmental models to be deployed under PIXEL for estimating and mitigating the impacts of port activities in general and cargo handling in particular.
P09 SDAG	• Attendance to different WP4 specialized telcos • At the beginning of the period, M7-M9, SDAG participated in deliverable D4. 1 along with Port of Monfalcone for Technical description of ports activities for modelling and data analysis • SDAG provided a list of needs and data available/to be collected together with a description of all related technical aspects. • SDAG has contributed in tasks T4.1, T4.2 and T4.3 as the task leaders have requested: participating in deliverables D4.1 and D4.3, and providing data and information needed. • At the last months of this period, M10-M12, SDAG has provided additional information about the data available (what, how, when) for the FVG use case implementation.
P10 THPA	• Attendance to specific WP4 telcos • ThPA SA team of the PiXEL project, had numerous meetings with stakeholders, for requirements specification and their expectations after the implementation of the project. Moreover, internal meetings with ThPA SA management have taken place, regarding equipment needs, the progress of the project, as well as future actions • Internal review of deliverable D4.3 • Recording of data availability and metrics that can be measured. • THPA was asked to explain in detail the processes that will be modelled and set the supply chains per type of cargo. The partner successfully satisfied the requirements. • Evaluation of ThPA SA in sensor needs, so as to serve the purposes of the project
P11 PPA	• Attendance to specific WP4 telcos
P12 ASPM	• Attendance to specific WP4 telcos • In the whole WP, ASPM participated providing further data and information as well as verify the availability of port traffic data from Maritime authority • In task T4.3, ASPM participated to the activities led by CATIE with reference to data modelling for the Monfalcone-SDAG use case. ASPM contributed in the writing of D4.1, and in the modelling and data analysis questionnaire in cooperation with SDAG and INSIEL. ASPM participated in WP4 telcos
P13 GPMB	• Attendance to specific WP4 telcos • Collaboration with the writing of document D4.1 • Collection of physical data for logistics chains • For task T4.3, GPMB discovered and aggregated some data for CATIE
P14 IPEOPLE	• Attendance to specific WP4 telcos • For deliverable D4.1, IPEOPLE was in charge to write the chapter 3.1 – Environmental Management Model

	• IPEOPLE is task T4.1 leader. In this management reporting period (M7-M12) the partner conducted the following tasks: ○

2.2.4.4. Results after M7-M12

The main results that we have obtained in this second period of the project (M7-M12) in the context of WP4 are the following:

Two deliverables have been successfully delivered during M7-M12. These two deliverables reflect the work done during this period.

Deliverable D4.1: *This document aims to present the models and data analysis that will be implemented as part of the PIXEL project. These ones deal with issues of energy consumption and production, multimodal transport and environmental pollution in order to improve the environmental management of ports. These models and data analysis are essentially based on the needs expressed by the 4 ports of the project. However, PIXEL also has a generalist scope and will try to develop useful models that can be employed by other ports.*

In this document, we present the first considerations on models and data analysis that will be developed later, and we define the first technical bases for their implementation. This document and its next iteration (D4.2) will provide a complete description of PIXEL models: by reading D4.1 and D4.2 readers will have a description of the overall methodology for the environmental management of port and a description of the models, algorithms and numerical methods for each model.

Deliverable D4.3: *This deliverable presents the first version of predictive algorithms task (T4.5) in WP4 due in M12. We outline the tasks that were identified in detail along with the methodology that will be used to tackle the proposed tasks. The most important ingredient for this task is the data that is captured in the ports or external data that can be used to complement internal data. This document presents data sources that were identified and will be used to successfully implement proposed tasks. The 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.*

2.2.4.5. Deviations

So far no deviations have been detected

2.2.4.6. Corrective actions

No corrective actions have been required.

2.2.5. Work Package 5 – Port Environmental Index Development

WP5 is one of the most important work packages of the project, as it embeds the core of the environmental impact assessment action. At the end of this work package, a single metric for measuring the environmental impact of a port will be obtained as the outcome. The main result that the WP will bring to the project will be PEI itself, accompanied by a set of guidelines on how to use it. During the process milestones will be reached, that will guarantee the proper advancement of the activity.

In the months M7 to M12, there has been intensive activity with regards WP5 in general and Port Environmental Index (PEI) definition, methodology specification and development in particular.

The main concern for partners in WP5 during this period has been to address the deliverable D5.1. This deliverable is the first to be written among several in the work package and it has compiled the work done so far in both tasks T5.1 and T5.2. Partners MEDRI and CREO have provided most effort, requesting contributions

from several partners to compose the document. Among other actions, the ports have been requested to complete questionnaires and provide information on: data availability, environmental concerns and PEI deployment.

In the 1st Technical Meeting at Bordeaux, on November 2018, MEDRI conducted a technical meeting on PEI where the conceptual basis of PEI has been laid down including defining the system boundaries as well as discussing several methods for data imputation, normalization, weighting and aggregation. Also the availability of sensors for automated data collection for PEI computation was discussed

In the 3rd Plenary Meeting at Piraeus, MEDRI and CREO conducted together a fruitful session for gathering ports' feedback on: (i) PEI concept and usefulness, (ii) environmental aspects, (iii) solving and addressing doubts and advancing on questionnaire completion.

2.2.5.1. Summary of progress in previous periods

Progress by task

Task 5.1: Methodology definition

In previous periods (M1-M6), 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.

Task 5.2: KPI Definition

Task T5.2 is being executed since M5. Under this task an extensive list of several eKPI have been compiled and a questionnaire has been developed and filled in by the ports with respect to availability of data for eKPIs. In later iterations the list will be narrowed down and ideally a list of a standardized set of indicators will be created to be used in medium and small sized ports across the EU. After receiving the filled questionnaire on eKPI availability in PIXEL ports, a thorough analysis will be performed.

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:

- Report of the different approaches addressing the environmental aspects of port operations. This benchmarking is a very useful for the first stages of this work package.
- First draft on the the strategy and conceptualization of PEI;
- Agreed document on the common terminology for PIXEL. This clarification covers several work packages, but it has had a special relevance for the WP5 as the role and spot of the environmental solution within the PIXEL framework and solution has been widely discussed.
- Publication of a paper in a peer-reviewed (Q2) journal that depicts the basis on which the PIXEL's PEI will be built.

2.2.5.3. Progress in M7-M12

Progress by task

Task 5.1: Methodology definition

Task 5.1 aims at defining the optimal methodology for computing PEI, including the methodology for weighing and normalizing the eKPIs and their integration into a single metric.

Month M4. Due to several managerial reasons (explained in the amendment conducted in this period – see section 2.2.2) the execution of this task has not been conducted at the expected rate and it has been executed during this whole M7-M12 period. Furthermore, the exact procedures for normalization and weighing of the eKPIs will be done in Task 5.3 PEI development. Taks 5.1 and 5.2 set down a generalized workflow and methodological approach for PEI development including the identification of environmental aspects of port operations, mapping the aspects to the PIXEL ports as well as obtaining an extensive list of eKPI and performing an analysis of their robustness and availability. The exact algorithms for normalization and weighing come in the later stages of the process and will be addressed in tasks 5.3 and reported in deliverables D5.2 and D5.3.

Under this task, in this period MEDRI defined a general methodological approach and workflow for constructing the PEI. In this work package, and in order to be aligned with the rest of partners and activities of the project, MEDRI created a useful document regarding the PEI methodology for everyone to reach a conceptual understanding of how this essential asset of PIXEL will be calculated, and which are the inputs needed from the partners in the project. It has been specifically targeted towards ports, since during the task some issues have been risen in that respect. In the document the various methods of data gathering, normalization, weighing, integration, data imputation etc., have been briefly presented and explained.

Afterwards, MEDRI and CREO developed an online questionnaire to be filled by the port authorities and terminal operators to establish environmental data availability. The following has been addressed: type of data which is collected, willingness to share the data including circumstances under which data will be shared, investigating the need of signing a disclosure agreement in case data will be provided, etc. This consists of an environmental questionnaire to identify data availability and other interesting information from the ports to establish the eKPIs for the PEI. In this period MEDRI created the questionnaire, sent it to the ports, received the information and processed it.

During the process, several strategies and methodologies have been contemplated, such as in the case data will be lacking or port authorities and terminal operators would not be able to share data, the use of several data imputation methods. This was commented and discussed in the technical workshop which will be held in Bordeaux, France (12^{th} to 14^{th} of November 2018.).

MEDRI created a ToC for D5.1 and asked for comments to the ports and a brief description of the port and the environmental initiatives undertaken so far (ISO14001 certification, etc.).

Task 5.2: KPI Definition

Task 5.2 aims at defining a standardized set of the most important/relevant KPIs for computing PEI, including the establishment of an optimal monitoring strategy.

It has been executed from month M4. Due to several managerial reasons (explained in the amendment conducted in this period – see section 2.2.2) the execution of this task has not been conducted at the expected pace and it has been executed during this whole M7-M12 period. Furthermore, as stated previously it has been decided to address the normalization and weighing of KPIs in the later stages of PEI development.

First of all, in this task, a specific questionnaire was created in order to obtain valuable information about the environmental status (and possibilities) of PIXEL ports. This questionnaire consisted of a series of questions related to environmental management systems deployed in the ports, data availability, metrics that are currently measured, accessibility to environmental data, etc. The information obtained has been used, together with the objectives and KPIs established in the GA, to elaborate a detailed first approach of specification of KPIs for our Port Environmental Index

Additionally, in order to identify the environmental aspects of port operations a questionnaire has been developed The objective of this questionnaire was to gather data from ports regarding the activities they are

carrying out and the related environmental aspects of each activity. For each activity, obviously, there could be more than one environmental aspect. In addition, the ports have weighted the aspects according to the perceived environmental impact (the probability or likelihood of the impact occurring and the severity).

According to the mapping exercise the most significant environmental aspects identified for the PIXEL pilot ports are emissions to the atmosphere, resource usage and noise, followed by discharges of waste water to the marine environment and the production of waste. Other aspects considered in this document, such as light pollution, odour emissions usage were considered of a lesser importance.

In addition, based on the environmental mapping exercise in the deliverable (D5.1) the key (environmental) performance indicators (eKPI) related to the most significant environmental aspects have been laid down. In addition, the KPI have been assessed according to their robustness and availability. In this stage the list is broad and will be further narrowed down in later iterations of the process of building the PEI.

Task 5.3: PEI development

In T5.3 several tasks have been performed including devising the general steps (methodology) which will be used to develop the algorithms behind PEI. In that respect the process described in the Handbook on Constructing Composite Indicators – Methodology and User Guide, a joint publication by OECD (the Statistics Directorate and the Directorate for Science, Technology and Industry) and the Econometrics and Applied Statistics Unit of the Joint Research Centre (JRC) of the European Commission in Ispra will be used.

After the manual has been reviewed and consulted and a generalized process for PEI computation iwill be as follows:

- developing a theoretical framework and understanding of the problem (partially done in T5,.1 and T5.2);
- selecting variables (eKPIs) (partially done in T5.2);
- testing ways for data imputation (when data are missing or cannot be obtained);
- normalization of data;
- weighting of data;
- aggregation of data into a single metric.

In addition to the above if time and resources will permit it, it is planned to address the uncertainties associated with the modelling and the algorithms behind PEI, to assess how robust the PEI is in terms of input data which will be fed into it.

Table 7. WP5 Partner contribution summary table

Partner	Contribution
P01 UPV	• Internal Review of D5.1 • Collaboration on conducting PEI sessions both in Technical and Plenary meeting • Participation in WP5 specific telcos and discussions
P02 PRO	• Participation in WP5 specific telcos and discussions • Internal review of D5.1
P03 XLAB	• Internal review of D5.1
P04 INSIEL	• Collaboration in task T5.2 to define the eKPIs, particularly focused on the FVG use-case
P05 CATIE	• Participation and contribution to “revisit concept” of PIXEL. • Review and comments on the “PEI document” that was proposed by MEDRI • Go through GLOMeep publications about “Port emissions” and support proposition of CERTH to contact them.

	• Contribute to establish clear link between WP4 and WP5 (a specific section for this was implemented in deliverable 4.1). Review and comment contribution of WP5 leaders.
P06 ORANGE	• Collaboration in task T5.2 to define the eKPIs, particularly focused on the FVG use-case
P07 CREO	Inputs to the methodology for identifying the significant environmental aspects: • Participating in the identification in Pixel ports of the significant environmental aspects of their operations; • Identification (bibliography), validation and definition of a set of representative environmental Key performance indicators (eKPIs) which will be used in algorithms for computing the Port Environmental Index (PEI). • Construction of a list of relevant eKPIs. • Development of questionnaires to Pixel ports (Port activities and environmental impact). • Development of the environmental Key Performance Indicators (PEI)(WP5). • CREO has contributed to the deliverable D5.1 in the following ways: o Comments on the ToC o eKPIs definition o Writing of sections
P08 MEDRI	• MEDRI is the leader of WP5. In this regard, in the period M7-M12 the following tasks have been carried out: o Organising specific WP5 and D5.1 telcos o Kickoff of task T5.3 work o Planning of subtasks. o Review of existing approaches and setup of methods to be used o Proposing the final methodology and development approach o Managing of the work package, including reporting to Coordination • MEDRI has been the main author of D5.1: o Creating the questionnaires for environmental indicators and environmental data and information from ports o Integrating of gathered data from ports into the deliverable • Distributing questionnaires to all partners at the plenary meeting in Athens • Ordering necessary equipment and software • In T5.1: (i) conceptualization of PEI and (ii) internal dissemination of scope and shape of PEI, (iii) definition of general methodological approach to calculate the PEI, (iv) formalization of the methodology through D5.1, (v) specification of phases that will be developed and studied further in task T5.3 for computing the PEI: a) data gathering and imputation, b) normalization, c) weighing, d) integration, e) outcome of calculations. • Identification of relevant eKPIs • Identification, selection and begin configuration of open-data UI for maths behind the PEI and its visualization • In task T5.2, MEDRI was in charge of specifying the eKPIs: (i) preparation of an activity log to be fulfilled by the ports in PIXEL, (ii) processing of the receipt data to determine relevant eKPIs, their nature and whether they will be available to be collected by IoT,

	• In task T5.3 MEDRI has been in charge of the activities which included a procedures for PEI computation including real-time availability of data to calculate the PEI as
	• MEDRI has been the main contributor to deliverable D5.1:
	  ○ Creation of a ToC
	  ○ Filling content on the main sections, together with CREO
	  ○ Review of perspectives from other partners and other deliverables coming from different WPs towards full alignment
	  ○ Completion of the document, together with CREO
	  ○ Submission to Internal Review and iteration of the document to have the final version
	  ○ Writing of most sections
	  ○ Interaction with other partners to improve iteratively the document

P09 SDAG	• Report of environmental-related data for ASPM/SDAG use-case through questionnaire provided by MEDRI • Report of the most relevant environmental indicators for ASPM/SDAG through questionnaire provided by MEDRI
P10 THPA	• Report of environmental-related data for THPA use-case through questionnaire provided by MEDRI • Report of the most relevant environmental indicators for THPA through questionnaire provided by MEDRI • A record of the port's current situation in terms of ICT systems and sensors that must be integrated to PIXEL platform was conducted, as well as, the port's environmental maturity, according to questionnaires provided by the Technical partners of the Consortium (KPI definition, Port Environmental Index) • Evaluation of ThPA SA in sensor needs, so as to serve the purposes of the project
P11 PPA	• Report of environmental-related data for PPA use-case through questionnaire provided by MEDRI • Report of the most relevant environmental indicators for PPA through questionnaire provided by MEDRI
P12 ASPM	• ASPM participated in the activities led by MEDRI with reference to PEI development; Answering PEI questionnaire sent with reference to the Monfalcone port activities and environmental data available. ASPM participated in WP related telcos • In task T5.2, ASPM provided additional data and information as well as verify the availability of environmental data from local institutions.
P13 GPMB	• Report of environmental-related data for PPA use-case through questionnaire provided by MEDRI • Report of the most relevant environmental indicators for PPA through questionnaire provided by MEDRI

2.2.5.4. Results after M7-M12

The main results that we have obtained in this second period of the project (M7-M12) in the context of WP5 are the following:

- a list and an understanding of the significant environmental aspects of port operations;
- mapped environmental aspects with respect to their significance to the PIXEL ports;
- a conceptual understanding of what PEI is between the partners in the consortium;

- a clarified methodology for algorithms behind PEI which will include: data imputation methods, normalization methods, weighing methods, data aggregation and finally uncertainty and sensitivity analysis of the PEI model.
- an understanding on environmental data availability in PIXEL ports (gathered through a questionnaire);
- environmental questionnaire and the identification of the most relevant environmental factors for ports and its associated outcomes.
- Deliverables submitted successfully:
    - Deliverable *D5.1 – Environmental factors and mapping to pilots*

2.2.5.5. Deviations

So far no deviations have been detected.

2.2.5.6. Corrective actions

Since there have not yet been any deviations, not a single corrective action has been undertaken.

2.2.6.Work Package 6 – Enabling ICT infrastructure framework

Work package 6 comprises the tasks that will 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 will be intensive during a considerable part of the project. Particularly, this WP will last a total of 21 months; having started on M4 and finishing on M25. In this regard, this work package has been executed during the whole second management reporting period (M7-M12) and it is currently in a full intensive activity both in design, documentation and software development. In this period tasks T6.2, T6.3, T6.3, T6.5 and T6.6 were launched, and joined T6.1 that had begun on M4.

This period is marked by the preparation of the deliverables D6.1 (architecture and design document) and envisioning and intermediate version of D6.3 (data acquisition, information hub and data representation), which will be a software delivery covering the basis of each module of the architecture. For WP6 management, bi-monthly follow-up calls are being held to check the work progress, organize the work between partners, handle issues, and to monitor development. Additionally, several channels have been open in our Slack platform in order to deal with day-to-day communication and assignments.

An objective was set during 3rd Plenary Meeting in Piraeus with regards to this work package. A bare minimum of software developed and showable must be available for the next Technical Meeting of the project (May 2019). This will be the first software release and must consist, at least, of a relevant components of the modules developed in a primary stage with significant information exchange and clear functionality observation.

Other actions performed during this period were: (i) to create and populate an owned git repository for collaborative development, (ii) creation of slack channels, (iii) creation of a specific project in JIRA for managing WP6 tasks and (iv) setup of virtual integration environment for deploying results in orchestrated virtual machines. The technology used in this latter case is FIWARE Labs.

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 WP6 started in August 2018 (M4 of the project), and the first two months of this task included 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

2.2.6.1. Summary of results after previous periods

During the first 6 months of the project (3 of 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. Every sub-task has its corresponding plan and first approach to the technologies to be used.

2.2.6.2. Progress in M7-M12

Progress by task

Task 6.1: PIXEL information system design and architecture

This task aims at designing the architecture that will be used in PIXEL, as well as identifying and analysing the different high-level modules. Besides, the work on M7-M12 aimed at clarifying the technological choices for implementing each one of the modules. These technological choices have been identified considering the requirements and use cases described in other work deliverables of the project (D3.2 and D3.4 respectively).

After several iterations the initial architecture that has designed is depicted in the following figure:

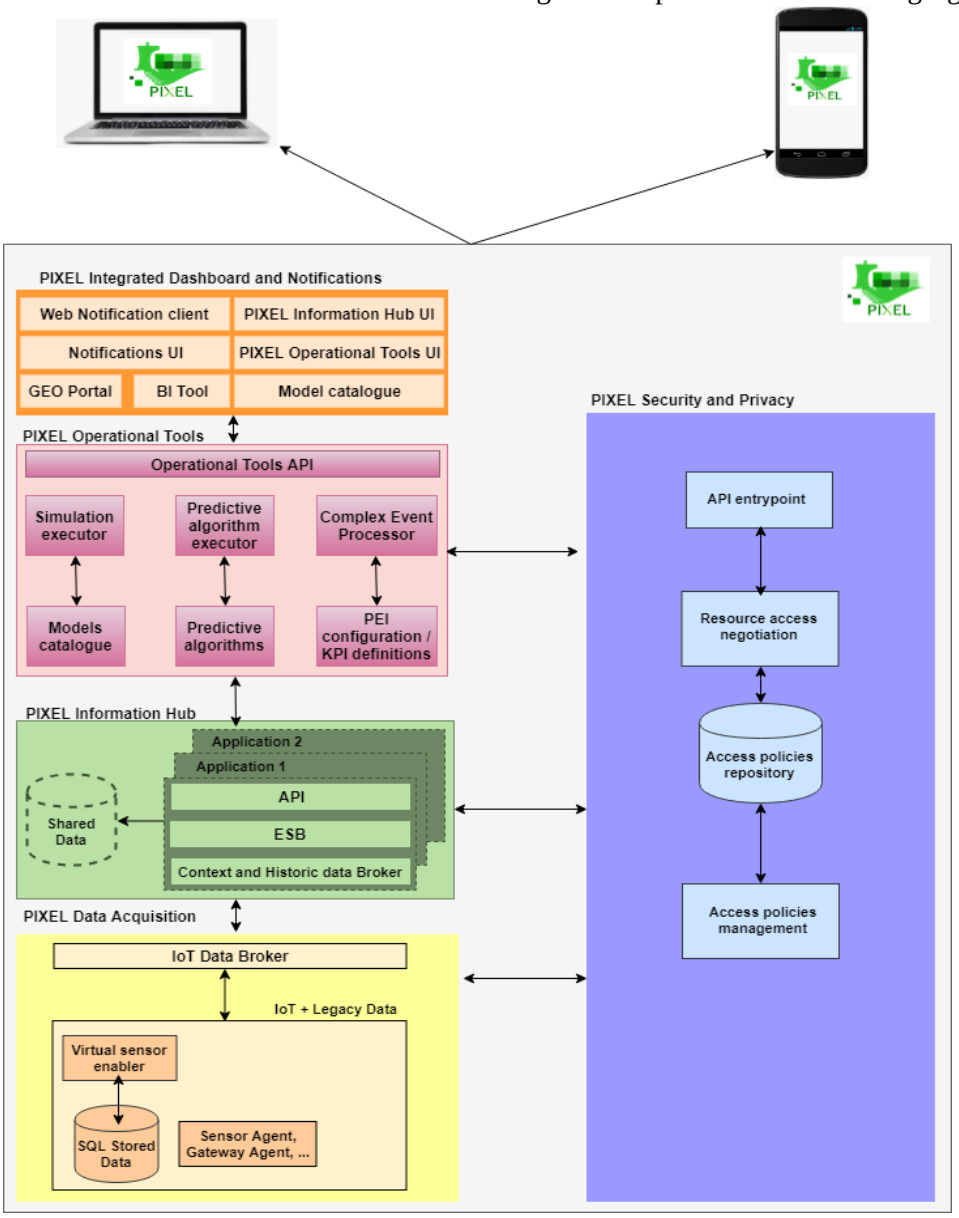

Figure 1. PIXEL Global Architecture

This architecture will be reviewed later on till the final delivery and the end of this task, in month M18. As it can be seen, the architecture is composed by several modules that interact among them. In the following figure there is the relation that exists between modules and tasks. The idea behind all this structure has been to clearly delimitate the responsibilities within the work package and create a collaborative framework for development:

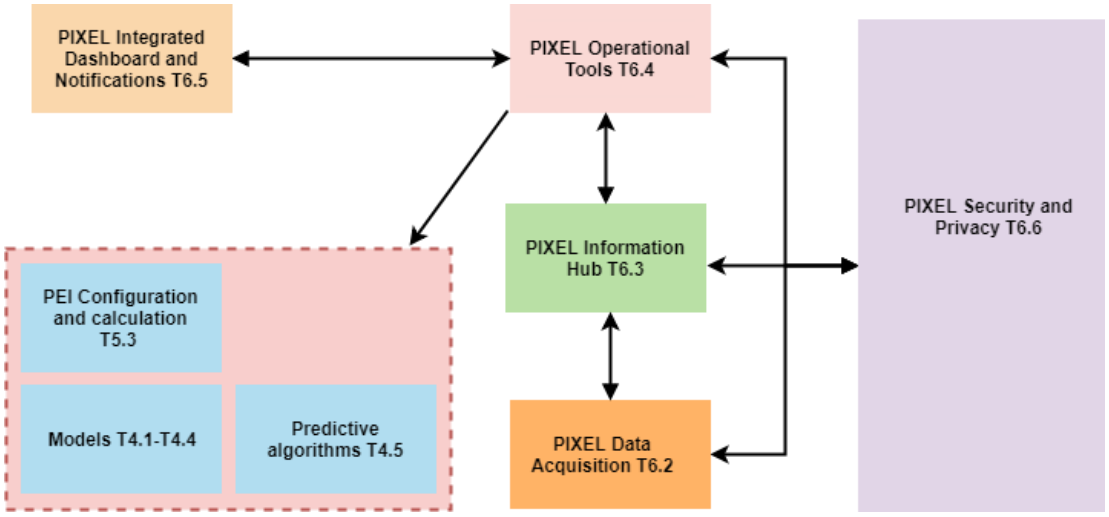

Figure 2. Relation between modules and tasks in PIXEL architecture

To achieve this conclusions, and to start setting the ground for each task's work, a thorough definition of each one of the modules was done, involving mainly their leaders. The details of this definition has been introduced in deliverable D6.1, which is delivered at the same time than this document (D1.6).

It was precisely the main objective (during this period) for T6.1 partners: creating and writing deliverable D6.1. At the beginning of the period (M8) a ToC was suggested and several partners participated providing feedback.

The first part of the task in this regard focused on the necessity to establish a Reference Architecture (RA) and more in concrete in covering PIXEL's use cases. The ambition of this RA has been to be flexible enough to meet PIXEL requirements (extracted from JIRA) while contemplating all technical constraints and needs of all the tasks comprised in Wp6. It has been essential during this period (M7-M12) to establish a relation between the different use cases and scenarios in order to test if the selected architecture it's useful for the proposed objectives.

Afterwards, partners agreed on making an explanation of the architecture by functionalities (PIXEL's components). This way it will be comprehensible both for technical partners (for software developers) and for managers in ports and more business-related entities in the project.

Additionally, a global vision of the state of the art in the different technical choices for each component was realised. It led each task leader to select a list of technologies to implement different components, as well as talking about future work related to PIXEL without forgetting the different principles of architecture adopted related to the deployment and scalability of our solution.

Finally, the writing process ended concluding that the document is technically precise from the point of view of the engineering but at the same time provides a degree of freedom to do some important architectural choices, such as the deployment strategy.

Task 6.2: PIXEL Data Acquisition

The PIXEL Data Acquisition Layer (DAL) consists of several components designed to push data from the several data sources available and the PIXEL Information Hub (IH). The solution provides a standard way to acquire data from different data sources that implements different kind of protocols and different data types.

In this task, the task leader (ORANGE) altogether with other technical partners has defined the main components that form part of the module. Moreover, this has been consolidated with ports as this element of the architecture will be the closer to the real data sources feeding the system. Particularly, to complete this task ORANGE met physically with GPMB and CATIE in Bordeaux to define data models for data acquisition, available data

sources, periodicity, accessibility, etc. Similar actions have been performed with other ports (virtual meetings, WP6 telcos) to advance on the creation of DAL.

During this task partners have aimed at providing a standard way to import data into the PIXEL Information Hub in order to allow an easy use of any kind of data sources available on each ports. It has been decomposed in various components: (i) context broker, (ii) persistent data hub, (iii) short term history, (iv) agent.

It has been custom designed but it will leverage as much as possible existing tools for deploying the inner components. Particularly, partners agreed on using FIWARE's most relevant components in this regard (ORION, STH…). This responds to a two-fold rationale: a) ORANGE is a FIWARE Foundation member, and specially staff involved in PIXEL is very familiarised with integration and development over FIWARE technologies and b) FIWARE has been selected as an official enabler of QQQQ.

On the other hand, the "Agent" component is to be customised for each type of data source providing data to PIXEL. Depending whether it is a sensor (and how it can send the information), a software-based data source (API, isolated database, legacy system, etc), a particularised agent that complies with FIWARE specification (NGSI) will be developed to guarantee connectivity and information exchange.

Currently, at the end of this reporting the partner in T6.2 are involved on both integrating different DAL components and developing agents tackling diverse types of data sources. With this aim, one technical partner has been assigned to select, for the first software milestone, various data sources from one pilot site and develop the agent.

Task 6.3: PIXEL Information Hub

This task started at the beginning of this semester (M7). T6.3 is one crucial task within the WP6 context, as it will provide as outcome the main central point of storage and management of data at all levels.PIXEL Information Hub consists of several parts conceptually divided into components that push data toward the database (downstream), components involved in stored data retrieval and further processing (upstream) and components responsible for data persistence and storage. In addition, the system provides supporting services for configuring, managing and monitoring the PIXEL Information Hub.

During M7-M12 the activities performed in this task have been:

- Task kick-off, including planning of subtasks.
- 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)

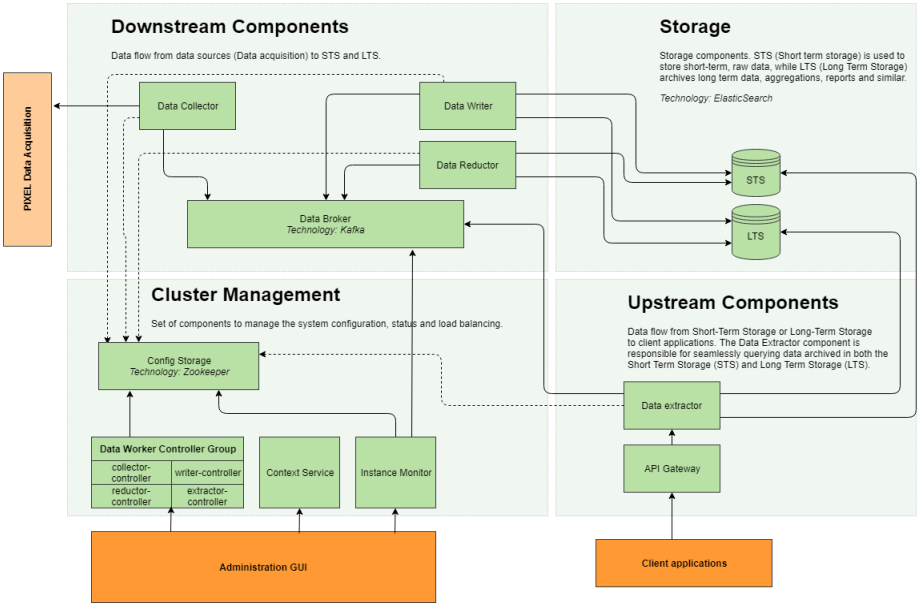

Figure 3. PIXEL Information Hub architecture

As a partial result, the architecture that the PIXEL IH will follow has been established, and several partners assigned to the development team are already advancing on the components. The design of this architecture has been led by XLAB (task leader) drawing from previous knowledge and an extensive experience on distributed systems and IoT.

Task 6.4: PIXEL Operational Tools

This task has started in this period, exactly on month M9.

The Operational Tools (OT) are mainly in charge of bringing closer to the user both the models and predictive algorithms developed in WP4. In this regard, several advances have been experienced during this reporting period (M7-M12). In the following list there is a summary of the actions conducted by the partners (mostly by the task leader, UPV) towards having a clear first software release:

- Establishment of a workplan. UPV divided T6.4 into sub-tasks and created a timeline schedule to commit all requirements and meet deadlines
- Designing an overall schema of components that will compose the total module: (i) Complex Event Processor (CEP), (ii) database, (iii) Model Engine, (iv) PA Engine, (v) Op. Tools API and (vi) Op. Tools UI.

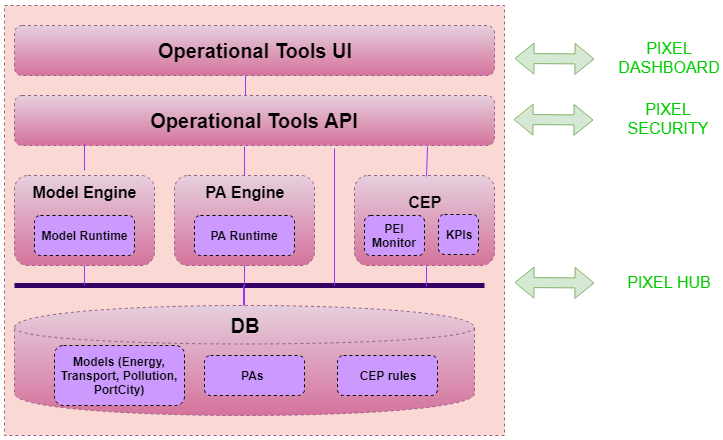

Figure 4. PIXEL Operational Tools schema

- 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. Specially it has been of interest the information exchange with the models and predictive algorithms (WP4-WP6).
- Selection of technologies for implementing all six sub-components
- Setting of test environment for developing the tools
- Development and integration of components (this is on going)
- Design of OT UI. This is a work that is tightly related with the final development of the user interface (OT UI) that will be, however, developed under the umbrella of task T6.5. In the image below there is the draft design for the user interface of this component:

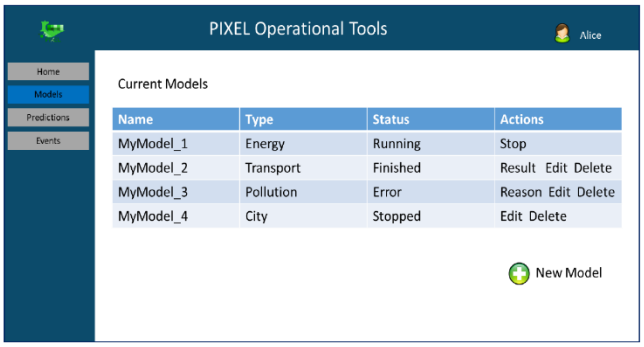

Figure 5. Draft design of PIXEL Operational Tools UI

Task 6.5: PIXEL Integrated Dashboard and Notification

This task has started in this period, exactly on month M9.

Task 6.5 aims at providing the visual environment to show in a single dashboard the different (e)KPIs identified. Moreover, this task must provide a configurable notification system to enable quick response of port operations staff. The dashboard layout will be configurable and the information/reporting modules will be widget-based, supporting the generalization -to other ports or even terminals with similar problems- objectives of the project. The widgets will be available on a PIXEL catalogue/marketplace This task will also develop an automatic report generation tool to support the generation of valuable information in ports for official reports. In the following list there is a summary of the actions conducted by the partners (mostly by the task leader, PRO) during this second reporting period (M7-M12) towards having a clear first software release:

- 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. Specially it has been of interest the specification of methodologies and technologies for feeding the dashboards. In this regard, partner PRO made an exhaustive literature review and altogether with XLAB selected sthe approach to be used. In Figure 6 is the summary.
- Selection of technologies for implementing all six sub-components
- Setting of test environment for developing the tools
- Development and integration of components (this is on going)

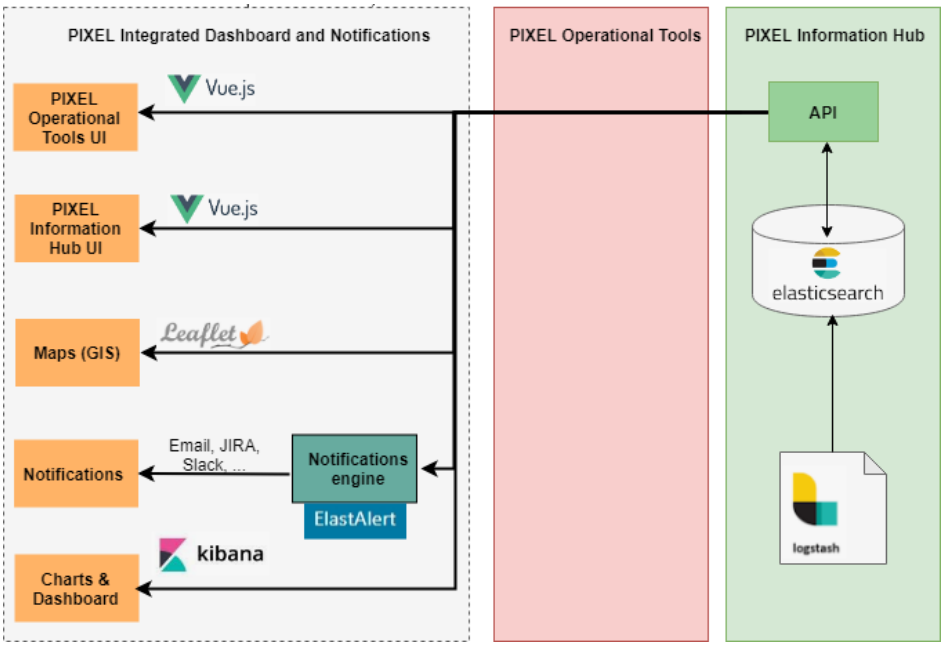

Figure 6. PIXEL Dashboard and notification schema

Task 6.6: PIXEL Security and Privacy

The task T6.6 covers several security aspects of the PIXEL project.

The first one is the IoT Security mechanism and guidelines. As for now, there is not a closed list of the IoT devices to be covered (current work under WP4 and WP6), the work on this task with regards to IoT security has been limited to define the main guidelines. This process has been led by the task leader: ORANGE. Those recommendations are part of the state of the art reported in the D6.1 architecture document. It's only high level rules that will be extended when real needs will be identified.

The second main activity carried out under task T6.6 in M7-M12 is the analysis and choice of security components for the PIXEL ICT infrastructure. For the first step, we have decided that the FIWARE IDM components (KeyRock, AuthZForce, Wilma) will cover the needs as it has been described and justified in the D6.1 architecture document. Those components are common FIWARE Generic Enablers. Also, some technological advances have been done in this regard: (i) to install FIWARE tools on a developer environment side to check their usage and identify the customization work that has to be done for PIXEL (Authentication and user management interface template) and (ii) to analyse the scope of security that will be included in the first release planned for end of May.

For the privacy aspect, there has not been a thorough work yet as the technical team assigned await for the result of the next delivery of WP4 and WP5 to identify the kind of data that will be manipulated on PIXEL to analyse then cybersecurity concerns. For user data management, we will rely on the FIWARE solution.

Till this moment (M12) we have identified solutions that allow us to cover generic aspects to guarantee security and privacy in PIXEL. However, this task is still to stir up, and both the task leader and technical coordination reckon that this will happen whenever the progress on the other work package (Wp4 and WP5) and the first implementation of the PIXEL solution within WP6 WP6 will be more advanced.

Table 8. WP6 Partner contribution summary table M7-M12

Partner	Contribution

P01 UPV	• Attendance to all WP6 specialized telcos
	• UPV leads task T6.4:
	  ○ Establishment of a workplan. UPV divided T6.4 into sub-tasks and created a timeline schedule to commit all requirements and meet deadlines
	  ○ Designing an overall schema of components
	  ○ Development of components
	• Writing sections of D6.1
	• D6.1 internal unofficial review after specific request from deliverable leader
	• Collaboration in the design of global PIXEL architecture

P02 PRO	• Attendance to all WP6 specialized telcos
	• PRO leads task T6.5:
	  ○ Designing an overall schema of components
	  ○ Development of components
	• PRO has lead D6.1:
	  ○ Provision of ToC
	  ○ Assignment of sections and provision of guidelines
	  ○ Set up of specific telcos for discussing the deliverable
	  ○ Writing of sections, integration and delivery of the document
	  ○ Leading the design of PIXEL global architecture
	• Leading the process of first software release for May 2019, as being the Technical Coordinator of PIXEL

P03 XLAB	• Attendance to all WP6 specialized telcos
	• In T6.1: Working on the general architecture of the PIXEL system, with focus on PIXEL Innovation HUB design. Assistance to WP6 planning and definition of development processes. Contribution to D6.1.
	• In T6.3 XLAB is the task leader.
	  ○ During the months M7-M9, XLAB took charge of the task kick-off.
	  ○ Planning of subtasks.

	○ Review of existing solutions. ○ Selection of suitable technologies, and stared testing subcomponents. ○ Propose final system composition for the Information Hub ○ Development of components • In T6.4: Provided initial ideas on the inclusion of models/predictive tools to WP6. • In T6.5, during the first months of this period, XLAB provided feedback on initial draft ideas • Propose solutions for PIXEL information hub UI under T6.5 umbrella • With regards to T6.6, XLAB provided feedback on initial draft ideas. Analysis of security-related needs of the PIXEL information hub, including Identity and API Management. • During the first part of the period, XLAB contributed to the creation of D6.1 by contributing to general architecture and Information Hub chapters. • Writing full sections of D6.1
P04 INSIEL	• Attendance to different WP6 specialized telcos • At the beginning of the period, INSIEL participated to the start of the PIXEL architecture and created the room to manage the activities in JIRA.to the launch of the task T6.1
P05 CATIE	• Assistance to WP6 telcos • Follow and keep updated of the draft architecture of PIXEL Platform. • Contribution to the discussion about model's implementation and link between WP4 and WP6. • Responsible of gathering real sample data coming from port and describing them in deliverable D6.1.
P06 ORANGE	• ORANGE is the WP leader of WP6, so following tasks have been done: ○ Organize periodic follow-up calls about WP6 ○ Choose a project management tool (JIRA and Slack) ○ Choose the development tools and frameworks (FIWARE- Labs) ○ Develop a detailed planning ○ Monitor the WP progress with the help of task leaders and deliverable leaders • Orange was involved in the WP6 management, in the writing of deliverable D6.1, in the developments of deliverable D6.3, and in some transversal discussions with WP4 about data structure, and with the port of Bordeaux about available data. • In task T6.1, ORANGE carried out the following activities: (i) filled the documents asked by the T6.1 task leader: partners interests, technological choices, (ii) started writing sections of the D6.1 document allocated to Orange, (iii) provided a general PIXEL presentation document. • In task T6.2, ORANGE carried out the following activites: (i) sent the detailed architecture of task T6.2 using FIWARE, (ii) created docker-based development environment for FIWARE, (iii) initiated Git repository in Orange gitlab instance, (iv) upskilled FIWARE APIs and NGSI datamodels, (v) provided details of PIXEL Data Acquisition Layer architecture. • In task T6.6, which ORANGE is leading: (i) • Provide an integration environment (FIWARE Labs) • Writing of sections in D6.1

P07 CREO	• Internal Review of D6.1
P13 GPMB	• Internal Review of D6.1

2.2.6.3. Results after M7-M12

The main results that we have obtained in this second period of the project (M7-M12) in the context of WP6 are the following:

- Finalised first version of the architecture
- Full list of components for each module is closed
- Development environment is setup and running
- Deliverables submitted successfully:
  - Deliverable *D6.1 – PIXEL Information system architecture and design v1*

2.2.6.4. Deviations

So far no deviations have been detected.

2.2.6.5. Corrective actions

Since there have not yet been any deviations, corrective actions have not been needed yet

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

This Work Package has not started yet. No previous activity has been undertaken apart from the finalisation of definition of use-cases and requirements (tasks included in WP3).

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 only two months during the current reporting period. In terms of tasks, the first one T8.1 is the only one currently running. However, the WP leader has set a very straightforward work pace and several advances have been done so far. In the following section they are explained.

2.2.8.1. Progress

Progress by task

Task 8.1: Evaluation Plan

Given the opportunity of the 3rd Plenary Meeting in Piraeus (early February 2019 – month M10) and despite not having started officially yet, during month M9 CERTH initiated the work on the formulation of the Evaluation Plan, by identifying relevant methods and criteria to be used for the evaluation and by structuring a first idea on the components of the PIXEL concept. Besides, a spreadsheet was created and uploaded to our common

repository (OnlyOffice) so that the ports can appoint their KPIs for validation and assessment of PIXEL. This action has been undertaken in order to take advantage of the intensive work on use-case definition and requirements gathering within the scope of other work packages (WP3 mostly).

Afterwards, all task leaders within WP8 were asked to establish a plan for executing their associated task. CERTH prepared and presented during the 3rd Plenary Meeting) a plan for tasks T8.1 and T8.3, whereas CATIE (for T8.2) and UPV (for T8.4) completed the exercise covering the full WP8 scope.

Regarding the Evaluation Plan, CERTH elaborated a template with which the Consortium will be able to map the impacts reflected in our proposal (Grant Agreement) with the current status of measurement in each one of the ports. The objective of this action is two-fold: (i) to set the ground for the future evaluation, being aware of which data is needed to calculate or to assess all values and (ii) to understand how many of the KPIs initially planned can already be evaluated and which ones need further actions. The latter will provide feedback about equipment to be purchased (always aligned with the plan in the GA and the budget), the operations to be conducted or even initiatives to be taken by the port authorities towards PIXEL sake.

This template has been based on the impacts set in the GA and in the feedback that has been received from other work packages till now (mostly from WP3, WP4 and WP5). Templates have been checked and fulfilled from the stakeholders (ports of PIXEL and SDAG in the FVG use case) and have been returned to CERTH to analyse. After this action, several specific meetings took place between CERTH and the corresponding stakeholders of each use-case to advance on the documents, on the KPIs and on the evaluation plan. Several technical partners also participated in the telcos, especially those who were during WP3 in charge of the use-case alignment in D3.3, D3.4, D4.1 and D3.2.

Furthermore, some technical work has also taken place regarding technical evaluation. CATIE prepared a very complete questionnaire with a list of all possible technical indicators that could be used for PIXEL Technical Impact assessment. It was sent to the technical partners involved in the form of a survey and was sent to the partners in order to select the most relevant aspects that will be addressed in the future evaluation.

A monthly pace for specific telcos has been established, so already 2 have taken place.

Table 9. WP8 Partner contribution summary table M7-M12

Partner	Contribution
P01 UPV	• Participation in specialised WP8 telcos • Elaboration of draft plan for task T8.4 • Review of D8.1 Gantt and ToC • Provision of initial content for sections on deliverable D8.1 • Answering T8.2's questionnaire about indicators for Technical evaluation
P02 PRO	• Participation in specialised WP8 telcos • Provision of initial content for sections on deliverable D8.1
P03 XLAB	• Attendance to different WP8 specialized telcos • Start drafting D8.1 content assigned to the partner
P04 CATIE	• Assistance to different WP8 telcos • Elaboration of draft plan for task T8.2 • Review of D8.1 Gantt and ToC • T8.1: First proposal about Technical Impact Assessment plan (CATIE is leading T8.2) • Creation of questionnaire for knowing partner's opinion
P06 ORANGE	• Contribute to the evaluation plan
P09 SDAG	• Fulfilling template for KPI measuring identification related to ASPM/SDAG use case

	• Attending specific telco with CERTH to advance on KPI identification
P10 THPA	• Fulfilling template for KPI measuring identification related to THPA use case • Attending specific telco with CERTH to advance on KPI identification
P11 PPA	• Fulfilling template for KPI measuring identification related to PPA use case • Attending specific telco with CERTH to advance on KPI identification
P12 ASPM	• Fulfilling template for KPI measuring identification related to ASPM/SDAG use case • Attending specific telco with CERTH to advance on KPI identification
P13 GPMB	• Fulfilling template for KPI measuring identification related to GPMB use case • Attending specific telco with CERTH to advance on KPI identification
P15 CERTH	• Coordinating work in relation to WP8, as CERTH is the leader of the WP. • Organisation of WP8 specific telcos • Creation of D8.1 ToC • Work in D8.1 (Evaluation Plan) • Elaboration of draft plan for task T8.1Elaboration of draft plan for task T8.3 • Creation of KPIs identification template and distribution to the ports for assessing the impacts that will be measured and evaluated • Organising specific telcos with stakeholders (ports of PIXEL) to analyse KPIs and potential evaluation strategies

2.2.8.2. Results

After the first 2 months of 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. Every sub-task has its corresponding plan and first approach to the actions to be carried out
- Deliverable D8.1 ToC and first contents
- First round of identification of KPI measurability and appropriateness for all use-cases

2.2.8.3. Deviations

So far no deviations have been detected

2.2.8.4. Corrective actions

No corrective actions have been required.

2.2.9. Work Package 9 – Exploitation, dissemination and communication

2.2.9.1. Summary of progress in previous periods

The first Management Reporting period coincided with the first “Dissemination reporting” period. On M6 the Consortium elaborated the first version of the Dissemination report of communication and dissemination actions taken place on the first six months of the project. This report was also submitted through D9.3. In D9.3, the initial version of the Dissemination Plan for the whole PIXEL project was depicted as well, where the Consortium defined the type, pace and goals of actions to be taken from M1 to M36 in this work package.

The first dissemination reporting period of the project was marked by the creation of initial content and definition of goals and scope rather than executing on-field actions. It was highly due to the fact of the moment of the project itself. In the month 6 of its execution, the main actions that had been carried out were mainly related with use-cases definition, requirements specification, market study and setup of the whole working environment. Only M6 was devoted to technical activities thus it was too early to have substantial content to be spread (from academic and business point of view). Only one paper was published about the conceptual basis that will be considered to develop our PEI. Additionally, few industrial activities were observed and attended in the first months, representing an advance of the events attendance that will be performed later during the project.

Progress by task:

Task 9.1: Communication and impact creation

This task was continuously performed during M1-M6. The main activities undertaken then were:

- A first release of the PIXEL public website
- Social networks accounts were created and slightly populated (Twitter, Facebook, LinkedIn, ResearchGate, YouTube)
- A first version of Communication Strategy was created through deliverable D9.3
- First version of supporting material for communication was created: poster, leaflet, the promotional video of PIXEL project and stickers for laptops

Task 9.2: Scientific dissemination

This task was continuously performed during M1-M6. The main activities undertaken then were:

- Creation of a plan and to establish a common framework for all partners to disseminate PIXEL advances. This was specified through deliverable D9.3
- Analysis of scientific dissemination channels, publication options, etc.
- Division of our three main fields towards which the dissemination must be addressed: PEI, IoT and Ports' business.
- Identification of a list of interesting events
- Publication of one paper relate to environmental index for assessing ports impact

Task 9.3: Industrial dissemination

Despite not having executed according to the work plan, some actions related to industrial dissemination were carried out. This was due to the creation of the first dissemination plan of the project, needed to conclude successfully deliverable D9.3. In this sense, the following actions were tackled:

- Clarification of the schedule of the expected PIXEL results produced by the tasks of the project
- Creation of an inventory of professional events and other modes of dissemination during PIXEL
- Refine the inventory of events defining the priority targets and customers (users of the port domain) and intermediaries (port associations, industrial associations)
- To list other small and medium-sized ports in their European countries with whom it would be easy to disseminate the results of the project.

Task 9.4: Exploitation and Business Plan

This task was continuously performed during M1-M6. The main activities undertaken then were:

- Creation of an early stage exploitation plan and guidelines for IPR management
- Identification of a list of tasks and deliverables of innovation interest, that will need Innovation Review

2.2.9.2. Summary of results after previous periods

- First website of the project: https://pixel-ports.eu

- Social media accounts of PIXEL in: Twitter, Facebook, LinkedIn and ResearchGate
- PIXEL official YouTube channel
- A first promotional video of the project
- A presentation video for PIXEL from Project Coordinator, to establish a common basis for all partners to generate multimedia content for our channel
- Supporting material for dissemination: Leaflet, poster and sticker designs.
- Official PIXEL slogan and pitch
- First version of exploitation plan for PIXEL
- Deliverables successfully submitted in period M1-M6:
    - Deliverable *D9.1 – Virtual Presence*
    - Deliverable *D9.2 - Supporting material for communication (leaflet, poster and video)*
    - Deliverable *D9.3 – Dissemination Plan*
    - Deliverable *D9.6 – Exploitation Plan*

2.2.9.3. Progress in M7-M12

This period M7-M12 has been very busy for the Dissemination and Communication team.

Several dissemination events have been attended by partners, in which PIXEL have been spread. Besides, our logo has been changed thus all our profiles have been updated accordingly, generating consistent material to set the ground for good position of the brand PIXEL. Furthermore, scientific dissemination has been highly enhanced via the writing of several proposals for paper publications. Our targets are, in this moment, international fairs and congresses (with associated press releases and magazines) in which PIXEL may be present to increase its impact.

One of the most important milestones in this work package during M7-M12 has been the change of leadership of task T9.1. Due to a risk of breach of GA for underperformance (details in section 2.2.2.3), the Consortium decided, via PCC session and voting, to change the leadership of task T9.1. Our presence in social networks and the quality, accuracy and update periodicity of our website were detected as shortcomings of the project by month M8 and an official procedure was launched. In this regard, everything was solved satisfactorily for all parts but, for what concerns to WP9, the task T9.1 is now lead (since M9) by partner UPV instead of partner IPEOPLE. This decision was taken based on two reasons: (i) UPV had already lead several processes of T9.1 on behalf of IPEOPLE (wordpress design, first webpage design, first communication plan guidelines, posts in social media channels, availability to credentials of social media accounts, etc.) and (ii) UPV is WP9 leader and centralizing the management of Virtual Presence with Scientific Dissemination and the whole WP supervision seemed the best option for the partners. This change has not meant any decrease of scope, objectives nor impact goals of the project. Actually, this change has derived into several improvements in dissemination and communication.

As a matter of fact, the Virtual Presence of the project has been considerably enhanced creating and enriching both our social media accounts and our website. Furthermore, leady by UPV, all the PIXEL Consortium has worked together in establishing a common baseline and message to transmit through all our channels, that will be re-visited periodically as the project will be advancing. At the same time, several multimedia content such as presentation videos, dissemination supporting material (rollup, images for social media content, pitch, slogan, presentation ideas, common material for explaining PIXEL) has been created to enhance the future PIXEL impact and extent.

Looking at the summary/report (section 3.1) on Virtual Presence, and taking into account the moment of the project, the performance can be catalogued as successful, creating a good image among different communities and continuously generating content in several spaces.

Finally, one of the most important activities in this regard has been the interaction and joint work with the CSA DocksTheFuture and the other EC-funded projects (Ports of the Future Projects Network). Several bilateral telcos have taken place between PIXEL and COREALIS and PortForward and all required actions from the

CSA have been duly performed. Actually, the dual event organised in Trieste in M12 by the CSA was attended by several PIXEL partners (ASPM, UPV, XLAB, SDAG).

Dissemination and Communication plan and monitoring strategy:

During this period (M7-M12) a new (updated) plan for dissemination and communication has been created, shared and agreed among the partners. Drawing from the plan outlined in deliverable D9.3 and in the Grant Agreement, the WP9 leader (UPV) launched a process to create a new Dissemination Plan. This was motivated by the aforementioned change of leadership in Communication and Virtual Presence responsibility and with the aim to harmonise in one accessible place all the information related to Dissemination and Communication. Thus, a holistic tracking tool (editable spreadsheet) was created including several tabs covering different aspects. This tool is detailed in section 3 of this document (3.1.1). This plan is uploaded to our common document repository and all partners have rights to edit the document under the supervision of WP leader.

It should be stressed that the dissemination activities have been continuous and that the plan of such activities will evolve throughout the lifetime of the project. The evolution will be caused both by the growth of internal knowledge (e.g. discovery of new target group, like conferences, research cluster or as a result of the Open Call); as well as changes in the ecosystem of research in which PIXEL project will grow. The project partners have been working together in areas related with IoT interoperability and technological solution for ports for several years before the start of the project, so some "dissemination background" is being leveraged in these first year of the project, as well as solid relationship among particular entities which will, hopefully, make the communication and exploitation activities more fluent.

At this moment, all partners are well aware of the status of dissemination and communication by conducting these actions: (i) follow PIXEL social accounts in all available channels, (ii) checking periodically the website and providing comments through the on-purpose tool, (iii) having access to the dissemination planning and monitoring tools, providing ideas and realizing their expected attendance to events, actions execution, etc. and (iv) attending to periodic telcos in which a summary of past actions and future points is overviewed.

Progress by task:

Task 9.1: Communication and impact creation

In the second management reporting period (M7-M12), the activity within this task can be considered as intensive, as all channels have been active and increasing their activity and several additional actions (supporting material, website, etc.) have been tackled to foster PIXEL virtual presence and image in both the academic and industrial community. A summary of the actions undertaken in the context of T9.1 from M7 to M12 is described in the next few paragraphs:

Creation of a new version of project website: https://pixel-ports.eu

- UPV lead the design and implementation process.
- The original design was shared among partners and a discussion started. Feedback came from almost all partners to reach a final layout satisfying all views
- One specific telco was set to share with the partners (i) the main contents and (ii) the web-map of the site. The design was based on the content and flavour of other H2020 projects and maintained the essence of PIXEL website that had been running till the release of the new version.
- The new version of website has created including the following:
    - The homepage (PIXEL tab) showcasing the project vision, embedding the promotional video and mentioning the ports involved in our project
    - A "Project" tab, in which the visitor can read all main items of PIXEL: (i) overview, (ii) PIXEL concept, (iii) objectives, (iv) impact, (v) members of our Consortium and (vi) members of our Advisory Board. A sidebar has been included with the updated Timeline of latest tweets published in the official PIXEL Twitter account.
    - A specific tab describing our four use-cases, with a brief summary of all pilots to be covered in PIXEL accompanied with explanatory pictures

  - "Publications" tab, in which we have created an up-to-date list with all publications of PIXEL: (i) deliverables, (ii) research papers, (iii) conferences and (iv) marketing material (poster, leaflet, rollup, etc.). All assets include link to direct download of associated documentation. This tab and its raw content will be updated every time a new public document is generated by PIXEL Consortium.
  - In the "Events" there is a list continuously updated with: (i) the latest news related to PIXEL, (ii) events attended and (iii) future events in which PIXEL will be present. Furthermore, a calendar tool has been embedded to check when is PIXEL attending / has attended to scientific/industrial/liaison dissemination events. Moreover, additional information (pictures, details of participation, location, outcomes, etc.) are available when clicking in a specific event.
  - Links to the Port of the Future Network tab, including a short description, logo and link to the other cluster projects: (i) COREALIS, (ii) PortForward, (iii) the CSA itself, DocksTheFuture.
  - Reference and link to our Social Networks (Facebook, Twitter, YouTube, RG).
  - At the bottom of the homepage, administrative data of the project, a reference of the funding from the EC and a subscription box for receiving PIXEL newsletter are already running.
  - Clear, updated and compliant sheets about "Terms of service, Privacy and Cookies policy" to ensure data protection along all the website
  - The website has been created with Wordpress framework.
  - All corporative colours, images and tone are respected and aligned with style guidelines.
- A plan for the contents, periodicity of updates, guidelines on its use and KPIs to assess its usefulness
- A specific document has been created to track all requests for change and suggestions from partners. This document is continuously monitored by UPV and changes are translated periodically to the public version of the website.

Advance on the creation of communication material:

- Official rollup of the project was created:
  - XLAB, as Innovation Manager, suggested a new design and took charge of the leading role in the process
  - The original design was shared among partners and a discussion started. Feedback came from almost all partners to reach a final layout satisfying all views.
  - The rollup was delivered and has become one of the essential communication assets of the project. This element has been communicated through all social networks and has been used in different dissemination events.
- Design of a T-shirt for promotion and communication. XLAB and UPV collaborated to create a front and back design of unisex short-sleeve shirt. The rationale of this action is two-fold: (i) for internal dissemination purpose, to create synergy with stakeholders and fostering PIXEL image via posting pictures, etc., (ii) to have interesting material to provide whenever interesting opportunities come (such as Advisory Board meetings, industrial events, etc.
- During this period 3 new videos have been posted to our YouTube account.
  - Our Project Coordinator (Prof. Carlos Palau) recorded one lecture-kind session explaining PIXEL objectives, keystones and advances beyond the state of the art. This video has been created to be more oriented to scientific community rather than industrial or broader community (the first promotional video was created towards these goals).
  - Partner SDAG decided to create a video explaining the ASPM/SDAG use-case and communicating the potential benefits of adopting PIXEL.
  - UPV recorded an additional video on the field explaining more day-to-day advances and objectives of the project, describing UPV's role within the project.

During a specific WP9 teleconference, to which most partners attended, the Consortium decided to stop using Facebook account for PIXEL communication (remove the account) due to: (i) target audience does not fit with

EC project aims, (ii) few followers than in other accounts, (iii) unnecessary burden (we are already being active in YouTube, Twitter, Website, LinkedIn and Researchgate). Therefore, from now on PIXEL Facebook account won't be used anymore thus its use won't be reported neither. This point was consulted with the Project Officer and it was approved.

Task 9.2: Scientific dissemination

The scientific dissemination (task T9.2) has been taking place since the very beginning of the project. It is an important task within the project, considering that PIXEL is a Research and Innovation Action and we are expecting to obtain outstanding academic outcomes out of it.

During this period, between months M7-M12, we have focused on: (i) detecting interesting opportunities for presenting PIXEL to the scientific community and academia, (ii) analysing internally the advances of the project and map them with current status and fora, (iii) applying for presenting PIXEL technical components/advances to different means of publication and (iv) writing papers or articles to be published/present in events. Here below it is the list of the main actions undertaken in this task during this semester:

- Elaboration of papers (short and long format, for conference and for journal in different cases):
    - Green Port Congress: a paper was presented to spread PIXEL in this congress at the end of 2019. Resolution is pending.
    - Maritime Transport Conference (ongoing): A paper focused on modelling is being prepared by partners relating PIXEL advances on WP4 and WP6. This paper will be sent in M13.
    - Transport Research Arena 2020 (TRA 2020): Two conference track papers are being prepared by partners relating PIXEL advances on (i) PEI methodology and (ii) ICT infrastructure. These papers will be sent in M13.
- ORANGE presented PIXEL in a Scientific Dissemination Event: FIWARE Global Summit in Malaga on late November 2018 (M7)
- MEDRI presented PIXEL in several lectures at the University of Rijeka, Croatia. Prof. Igor Kegalj and Prof Luka Traven transmitted to the students the concepts and objectives of the project and how it addresses environmental impact by ports.
    - Spread of the information about PIXEL project within the Course: Marine Ecology at Rijeka on November 2018
    - Annual Faculty of Medicine Celebration Days 2018 on December 10-15. 2018 at Rijeka

On the other hand, several academic actions are envisioned, some of them even started at this point of the project. At least 2 PhDs are already confirmed to verse about certain parts of PIXEL on behalf of UPV and other 2 PhDs are already running under the programme of Medical Faculty of University of Rijeka (partner MEDRI) and will be directed by Prof. Luka Traven (PIXEL WP5 leader).

Task 9.3: Industrial dissemination

The industrial dissemination efforts under the Task 9.3 - during the period M7-M12 - were mainly used to build the industrial dissemination strategy in collaboration with the Innovation manager (T9.4) and the WP9 leader.

This inventory of the 2019 and 2020 industrial events (symposium, congress, conferences, etc.) was also continuously updated during this period - discussing /exchanging / emailing with potential participating / attending PIXEL's partners. The mandatory aspects and resources to be committed by each partner to disseminate PIXEL's results participating to the conference and/or the exhibition events were remaindered to all partners. Questionnaires have been sent twice to the PIXEL's partners to confirm their interest to participate to the industrial events in 2019 and beginning of 2020.

Then – within the Innovation Task manager and WP 9 manager - we have developed the dissemination strategy describing the procedure and steps to be followed. The principle of this dissemination strategy was to correlate the timeline of PIXEL's developments to the industrial events timeline to efficiency promote PIXEL's results and to create good business and scientific opportunities. Based on the target groups defined in the previous period (M1-M7), we have designed a method (defining assessment criteria and levels of priority) to prioritize/select the industrial events for attendance. Then a procedure to follow for the event preparation was collectively designed/developed with the WP9 leaders.

This development of the Industrial development strategy has focused on the events prioritization and the tracking process:

- Events detection.
- Events selection for attendance.
- Events preparation:
    - Confirmation of interest.
    - Framework of the participation.
    - Groundwork preparation (draft).
    - Groundwork review and completion.
    - Groundwork finalization.
    - Marketing campaign.
    - Monitoring and Wrap-up of the event.
    - Event outcomes.

It is composed by eleven (x11) steps: The events detection and selection (the previous method); The partner interest confirmation; The frame work of the participation, The groundwork preparation; The groundwork review and completion; The groundwork finalization; The marketing campaign; The monitoring and wrap-up of the event; The marketing event outcomes.

The T9.3's actions in progress are to apply the procedure, discussing individually with PIXEL's attendants to industrial events. This methodology will be part of the next T9.3 deliverable.

Task 9.4: Exploitation and Business Plan

Exploitation:

Activities related to Exploitation have also been continued by the Consortium. Lead by our Innovation Manager, the live tool created for this purpose has been populated and the steps towards the next Exploitation report (D9.6) are being taken.

A summary of activities on this task is that PIXEL Consortium has invest efforts in establishing a very solid Exploitation plan considering all the sub-parts that compose a business-level myriad of components (Canvas, Exploitable results, Intelectual Property Background, market audience, expected results, etc.).

Furthermore, despite task T3.1 finalised 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 has been further assessed in M7-M12 through task T9.4. Results on these activities will be delivered within its associated documents.

Table 10. WP9 Partner contribution summary table

Partner	Contribution

P01 UPV	• Organisation and attendance to periodic WP9 telcos
	• Assumption of task T9.1 leadership
	• 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
	• Design, creation, deployment and hosting of the new website: https://pixel-ports.eu/
	• Creation of the new Dissemination Plan

	• Creation and delivery of planning, monitoring and brainstorming tool for communication and dissemination means
	• Assistance to CREO for the elaboration of the Industrial Dissemination procedure
	• Participation in the creation of the official Rollup of the project
	• Conduction of all the relation and interaction with CSA DocksTheFuture and other EC funded projects:
	  ○ Attendance to periodic telcos
	  ○ Creating common dissemination action
	  ○ Creating common material
	  ○ Establishing a calendar for cross-dissemination action
	• Attendance to events for liaison with other projects:
	  ○ CSA-organised workshop with experts (COREALIS, PortForward present)
	  ○ CSA DocksTheFuture Mid-Term Conference
	• Presentation of PIXEL at the event: TEN-T Atlantic Corridor Working Group meeting on M11 at Lisbon.
	• Update (periodic and asynchronous) of social media accounts and communication channels (Twitter, LinkedIn)
	• Providing suggestions/requests/recommendations for the website
	• Supporting XLAB in obtaining a slogan and pitch for PIXEL
	• Participation in the connection with COREALIS and PortForward by conducting specific teleconferences to boost liaison and collaboration
	• Creation of a presentation video for PIXEL from Project Coordinator, to establish a common basis for all partners to generate multimedia content for our channel
	• Creation of a video explaining PIXEL coordination, UPV's role in the project, objectives and spotting the viewer on PIXEL leitmotiv in a friendly manner
	• Preparation of a plan for:
	  ○ Video creation, deadlines and script for initial recordings.
	  ○ Newsletter composition and planning
	  ○ Virtual Presence publications
	  ○ Communication material creation and delivery
	• UPV was present in a Scientific Dissemination Event: FIWARE Global Summit in Malaga on late November 2018

P02 PRO	• Attendance to periodic WP9 telcos • Assistance to CREO for the elaboration of the Industrial Dissemination procedure • Participation in the creation of the official Rollup of the project • Providing suggestions/requests/recommendations for the website • Supporting XLAB in obtaining a slogan and pitch for PIXEL • Assistance to the creation of communication material (rollup, images for social networks) • In task T9.3, discovery of interesting events to observe • In exploitation, advance with Exploitation strategy definition, identification of PIXEL products and assistance to XLAB in all aspects related to ports' business insights. • Continuous market assessment participation, continuing T3.1's work through T9.4

P03 XLAB	• Conduction of Innovation and Exploitation specific monthly telcos • Attendance to all specific WP9 telcos • In T9.1: (i) new roll-up structure and design and (ii) recommendations for dissemination and communication management. Contributions to social media interactions, new website and marketing materials. Presence at CSA DocksTheFuture Trieste, 3-4 April • In T9.4, which XLAB is leader, the partner has worked on: (i) key aspects of PEI exploitation, (ii) definition of the PIXEL equilibrium triangle and (iii) PIXEL pitch. Final PIXEL Pitch presentation at Presence at CSA DocksTheFuture Trieste, 3-4 April. • Submission of abstract to pitch at Living Bits and Things, Bled, Slovenia. Discuss the appropriate industrial dissemination. • Contributions to website and social channels • Core message discussions • Attendance to events for liaison with other projects: o CSA-organised workshop with experts (COREALIS, PortForward present) o CSA DocksTheFuture Mid-Term Conference • Providing suggestions/requests/recommendations for the website • Lead the process for obtaining a pitch and a slogan for PIXEL • Through the Innovation Manager, lead connection with COREALIS and PortForward by conducting specific teleconferences to boost liaison an collaboration • Continuous market assessment leadership, continuing T3.1's work through T9.4
P04 INSIEL	• Attendance to every WP9 specific telco and every Innovation-Exploitation telco • Contributed to the new PIXEL image (logo, website, slogan,..) • Participation in the creation of the official Rollup of the project • Providing suggestions/requests/recommendations for the website
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 our own social medias. • Participation in the creation of the official Rollup of the project • Providing suggestions/requests/recommendations for the website
P06 ORANGE	• Attendance to some WP9 specific telcos • Participation in the creation of the official Rollup of the project • ORANGE presented PIXEL in a Scientific Dissemination Event: FIWARE Global Summit in Malaga on late November 2018
P07 CREO	• Attendance to every WP9 specific telco and every Innovation-Exploitation telco • Development of the Industrial dissemination strategy • Design and continuous observance of Industrial Events tracking process • Development of questionnaire to PIXEL partners (to evaluate the participation of PIXEL partners to selected industrial events)
P08 MEDRI	• Attendance to several WP9 specialized telcos: communication/dissemination and exploitation/innovation • Participation in the creation of the official Rollup of the project

	• Providing suggestions/requests/recommendations for the website
	• MEDRI was very active on Communication:
	  ○ Sub-page of PIXEL project in Croatian language (https://pixelmedri.jimdofree.com/)
	  ○ Set up PIXEL project team site at partner's website (https://spp.uniri.hr/ss_medri/katedre/465/djelatnici/pixel/_layouts/15/start.aspx#/)
	• MEDRI was very active on event participation and scientific dissemination in months M7-M12 of the project:
	  ○ Spread of the information about PIXEL project within the Course: Marine Ecology at Rijeka on November 2018
	  ○ Annual Faculty of Medicine Celebration Days 2018 on December 10-15. 2018 at Rijeka.

P09 SDAG	• Attendance to every WP9 specific telco and every Innovation-Exploitation telco • SDAG analysed the content of project communication tools and deliverables trying to give useful comments in order to improve the result. • SDAG is continuing to update its social medias (Facebook, Twitter, LinkedIn and Company Website) trying also to include PIXEL project news and relevant information to improve the project dissemination. • SDAG also contributed to the Article that was published thanks to the Port of Monfalcone in December 2018 in a local newspaper (VGE Venezia Giulia Economica). • Finally, SDAG made the first partner description video in December/January that was published on the youtube project channel. The video is about 3 minutes, and the Project Manager Cinzia Ninzatti explained who SDAG is and which is its role in PIXEL project. • SDAG has conducted analysis of all project communication tools when asked. • Participation of the MidTermConference of CSA DocksTheFuture on April at Trieste • Participation of the Workshop with experts organised by the CSA DocksTheFuture on April at Trieste
P10 THPA	• Supporting material for the communication of the project was distributed • Internal mail for the promotion of the project was sent to all ThPA SA personnel, for the upvoting of the project in all social networks.
P11 PPA	• Attendance to some WP9 specific telcos • Contributed in the identification of relevant industrial events for PIXEL
P12 ASPM	• Attendance to every WP9 specific telco and every Innovation-Exploitation telco • Participation of the MidTermConference of CSA DocksTheFuture on April at Trieste • Participation of the Workshop with experts organised by the CSA DocksTheFuture on April at Trieste • ASPM has analysed the contents of the communication tools, in particular website, and the deliverable provided by the LP, trying to provide useful feedbacks to improve the contents. • ASPM contacted some of the organizers of the exhibition that the company will attend in 2019 to arrange some speech related to PIXEL's results and activities. ASPM wrote an article published inside the local press and related websites: "VGE Venezia Giulia Economica" regarding PIXEL project and scope • Participation in the creation of the official Rollup of the project • Providing suggestions/requests/recommendations for the website

P13 GPMB	• Attendance to several WP9 specialized telcos: communication/dissemination and exploitation/innovation • Presentation of PIXEL at the event: TEN-T Atlantic Corridor Working Group meeting on M11 at Lisbon. • Participation in the creation of the official Rollup of the project
P14 IPEOPLE	• Attendance to every WP9 specific telco and every Innovation-Exploitation telco • Assignment of a new specialised team for WP9 • Social Media updates and minor changes in the Web site till month M10, when this responsibility was shifted to UPV. • Participation in the creation of the official Rollup of the project • Providing suggestions/requests/recommendations for the website • Continuous market assessment participation, continuing T3.1's work through T9.4
P15 CERTH	• Attendance to specific WP9 telcos • Contribution to the project's scientific dissemination with the identification of relevant conferences for presenting the PIXEL results (T9.2) • Review of the new website and suggestions for improvement • In task T9.3, discovery of interesting events to observe • In exploitation, advance with Exploitation strategy definition, identification of PIXEL products and assistance to XLAB in all aspects related to ports' business insights. • Continuous market assessment participation, continuing T3.1's work through T9.4

2.2.9.4. Results after M7-M12

The main results that we have obtained in this second period of the project (M7-M12) in the context of WP9 are the following:

- New website of the project: https://pixel-ports.eu
- 3 introductory and explanatory videos of the project by various partners
- New (updated) dissemination plan
- Dissemination and Communication planning, monitoring and brainstorming tool available
- Industrial events tracking and outcomes gathering created and shared
- New supporting material for dissemination: rollup and images for social networks
- Liaison with other projects and CSA established and being enhanced

2.2.9.5. Deviations

First version of the web was designed and depicted in the deliverable D9.1, with screenshots and their corresponding explanations. Current version of the website published in the url: https://pixel-ports.eu does not coincide with the first version delivered. This is a consequence of the review of design and functionality of the website after an iterative process of enhancement of Virtual Presence that is always on-going.

2.2.9.6. Corrective actions

Change of leadership in task T9.1 has been the only administrative action performed in WP9.

3. Impact

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

The dissemination report will be sent through deliverable D9.4, with due date on month M18 (November 2019). 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

As described in Deliverable D9.3 dissemination activities aim to establish critical mass and long-term commitment from different selected target groups. Therefore, results from various project activities are already being disseminated to the widest possible, though precisely selected, communities through a number of focused activities.

The new (updated) dissemination plan has considered a continuous activity since the start of the project, but with flexibility and possibility of evolving during the lifetime of the project, is considered as crucial by the PIXEL Consortium as it will help our 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.

Creation of tools of communication and virtual presence through our document: “Events, dissemination and communication strategy and monitoring” (explained at the beginning of this chapter). This monitoring and planning tool contains a list of specific sheet with different purposes:

- *Events* tab: In this space all events attended and to attend by PIXEL are listed. Its structure is very intuitive and a colour code is attached to easily understand the status of each event. In this sheet the Consortium adds: (i) events detected since the GA elaboration, (ii) interesting events detected in the first version of dissemination plan through D9.3 and (iii) events that arise and are worth to include and observe. Moreover, some monitoring tools are also enabled, such as a partner responsible per event, the outcomes of it, comments of the status, whether it has been also conducted, etc.
- *Website* tab: A space for the partners to provide comments, suggestions and correct mistakes of the web.
- *News & press releases*: A tab where the partners can access and include relevant news/press releases related to PIXEL. UPV (as Virtual Presence manager) access this tab periodically and translate its content to the website.
- *Publication* tab: A monitoring tool of the papers/publications of the project. Details are included.
- *YouTube* tab: A planning and monitoring tool for video creation and releases along the whole project. UPV altogether with other partners created a plan which was validated, now all partnes consult this tab to check their forthcoming activities.
- *Social media strategy* tab: Common useful messages and assets to consider for social media channels; such as: hashtags, main leitmotiv, tone, what to avoid, what to include, analytics tools, etc. This is part both for planning and for monitoring.
- *Continuous communication materia*l tab: In this sheet the WP leader and the Innovation Manager which kind of content is being created and posted in social media, website, etc.
- *Dissemination material* tab: Update of poster, rollup and video is planned for M18. Besides, the creation of certain additional material (t-shirts, stickers, business cards, etc.) is registered, monitored and approved thanks to this tab.
- *Timeline*: A timeline for posting. This tab is fed by the others and it condense, per week, which content is expected to be posted to comply with the Dissemination and communication plan.
- *Brainstorming* tab: In this space all partners can include ideas related to dissemination and communication.

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:

- CID ALICE - New Global Routes: OBOR at Athens, Greece (http://pixel-ports.eu/wp-content/uploads/2019/03/Conf_Nov_2018_Alice_Agenda.pdf):
  - Ignacio Lacalle (UPV) presented PIXEL in the context of the role of IoT and environmental impact mitigation in the future Europe-Asian and silk road markets. This event was also leveraged to establish synergies with the rest of the projects of the cluster (Ports of the Future Network), as representatives from COREALIS. DocksTheFuture and PortForward were present as well.
  - 6th November 2018 (M7)
- FIWARE Global Summit at Malaga, Spain (http://pixel-ports.eu/?page_id=588):
  - Marc Despland (ORANGE) presented PIXEL in a Scientific event context. ORANGE gave an overview of the PIXEL approach, focusing on how IoT can help small ports in the data acquisition, processing and extraction of value.
  - 27th-28th November 2018 (M7)
- Annual Faculty of Medicine Celebration Days (https://pixelmedri.jimdofree.com/%C5%A1irenje-vidljivosti-projekta/)
  - Prof. Luka Traven (MEDRI) explained PIXEL to a broad audience at the University of Rijeka. This presentation is framed into Scientific dissemination and it was mainly focused on the environmental impact measuring provided by PIXEL.
  - 10th-15th December 2018 (M8)
- TENT-T Atlantic Corridor Working Group (http://pixel-ports.eu/?tribe_events=tent-t-atlantic-corridor-working-group):
  - Working Group meeting on ports and multimodal terminals – Atlantic Core network Corridor. Michel LE VAN KIEM (GPMB) presented the energy transition strategy of GPMB in which the LNG dredge and the PIXEL project have an important role, whereas Ignacio Lacalle (UPV) presented PIXEL focussed on alternative fuels and green energies strategies illustrated with LNG dredge and IoT.
  - March 7, 2019 (M11)
- CSA DocksTheFuture Workshop with experts and MidTerm Conference (http://pixel-ports.eu/?tribe_events=docksthefuture-workshop-with-experts):
  - The main goal of the workshop was twofold. To validate the selected projects and initiatives of interest, on the one hand, and to present/add further projects and initiatives not considered on the other hand.
  - Many different port experts participated during this workshop with presentations and comments about the concept of the Port of the Future (PoF) and current ongoing related projects.
  - From the PIXEL Consortium Joao (XLAB) gave a short presentation about the vision of PoF according to PIXEL and how are we mostl contributing. Flavio (XLAB) also made a short presentation about data analytics and the potential for ports in order to gather operational and strategical insights.
  - Other PIXEL participants in the session were Dejan (XLAB), Stefano (ASPM) and Benjamin (UPV)
  - 3rd and 4th April 2019 (M12)
- IEEE 5th World Forum IoT (http://pixel-ports.eu/?tribe_events=ieee-5th-world-forum-on-internet-of-things):
  - IEEE 5th World Forum on Internet of Things presented a technical program about the latest in innovative and original research, and advances in technology across the IoT landscape,

including results from trial and demonstration projects. One of the remarked works is our project, PIXEL. Particularly, addressing ports needs through data spaces and IoT technology will be the core items that Prof. Palau will present on behalf of PIXEL

- 15th to 18th April 2019 (M12)
- In this event PIXEL presented one paper: “"Enabling Industrial Data Space Architecture for Seaport Scenario" **that will be published** in the magazine IEEE Xplore.

- Creation of the official rollup of the project:

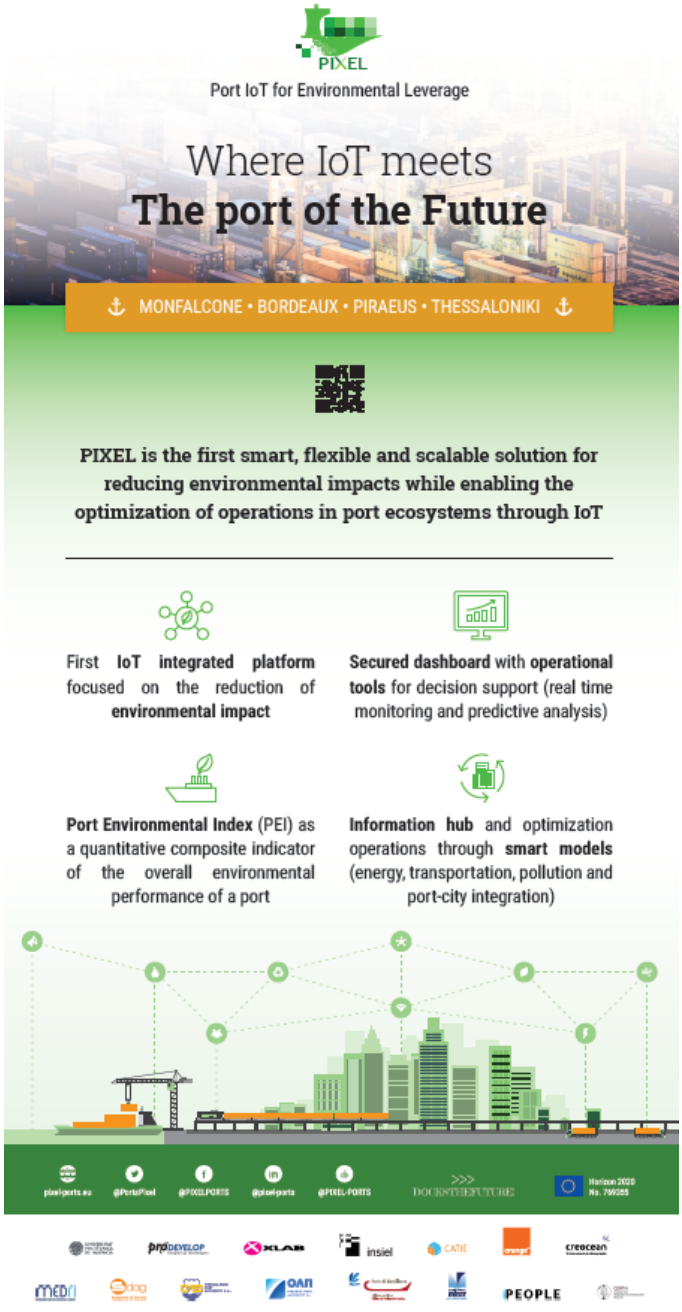

Figure 7. Official rollup of PIXEL

3.1.3. Liaison with other projects

D9.3 considered in the communication action the liaison with different project, and a preliminary plan was drafted, however as the relationship with CSA DocksTheFuture and the rest of the projects of the Port of the Future Network is ongoing, the consortium has already taken some liaison actions. These actions have not been arbitrary but responding to a specific strategy (D9.3) in order to take maximum profit of the actions and to focus on answering the question with whom the PIXEL project needs to engage, when, where, and on which basis. Driven by this underlying plan, this section draws current status of the projects external liaisons:

- CSA DocksTheFuture (*Grant agreement ID: 770064*): PIXEL has been present in all teleconferences and update sessions called by the CSA. UPV as Project Coordinator and XLAB as Innovation Manager have attended all meetings and provided the requested information on time and format. Furthermore, PIXEL has leveraged this arena to bring some interesting thoughts about the concept of the Port of the Future, the forthcoming trends and the current situation of small and medium ports in Europe. Additionally, PIXEL attended the dual event organised by the CSA at Trieste on early April. Both the Workshop with Experts and the Midterm Conference were attended by 3 PIXEL partners (UPV, XLAB and SDAG) bringing 6 attendees. UPV presented PIXEL and our vision of the Port of The Future and trends on the conference and Joao Costa presented short pitch of PIXEL on the workshop with events. Interesting outcomes have been extracted for both sessions and our project was involved in the most important action that the Ports of the Future network has undertaken till now.
- During this period (M7-M12) the liaison between PIXEL and the other two RIAs of the Ports of the Future Network has been enhanced. Firstly, all three projects met together (through their Coordinators) physically at Athens, in the Alice CID ETP OBOR event. Secondly, and as the main action performed, a bilateral telcos were set and conducted with both projects satisfactorily. Further synergies and contacts are envisioned:
- INTER-IoT (*Grant agreement ID: 770064*): This project has ended during M7-M12 PIXEL period. The first comment about the liaison with INTER-IoT is that 3 partners have worked in both projects, thus a lot of synergy and work pace has been transferred from one to the other. Secondly, PIXEL adopts several technical ideas from INTER-IoT, such as interoperability, semantic considerations and a use-case in a port. For this reason, in the final review of the former, the partners of INTER-IoT decided to include PIXEL as a future research direction of the works done during the project.
- PEEPOS (*2013-FR-92010-S (TEN-T Programme 2007-0213)*): This project is an initiative very connected with PIXEL. PEEPOS aims at defining an operational plan for ports to improve energy efficiency and industrial ecology. Furthermore, it was (and its continuation will be) deployed at one of the PIXEL's pilot locations (Gironde estuary) and was carried out by one of the PIXEL consortium members (GPMB). This relation has been enhanced during this period due to the industrial event: TENT-T Atlantic Corridor Working Group. In this event GPMB presented the new evolution of PEEPOS, including PIXEL as a technical spark for achieving greater environmental objectives. Furthermore, in the same event UPV presented PIXEL and several cross-references were made.

4. Deliverables and milestones

4.1. Deliverables

Table 11. 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
D2.5	D10	Project Management Report v1	2	UPV	Report	PU	31/10/2018	Yes	31/10/2018	None
D2.6	D11	Project Management Report v1	2	UPV	Report	PU	30/04/2019	Yes	30/04/2019	None
D3.1	D14	Stakeholders and market analysis report	3	IPEOPLE	Report	PU	31/10/2018	Yes	12/02/2019	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
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	11/02/2019	None
D4.3	D20	Predictive Algorithms v1	4	XLAB	Other	PU	30/04/2019	Yes	30/04/2019	None
D5.1	D22	Environmental factors and mapping to pilots	5	MEDRI	Report	PU	30/04/2019	Yes	30/04/2019	None
D6.1	D26	PIXEL Information system architecture and design v1	6	PRO	Report	PU	30/04/2019	Yes	30/04/2019	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
D9.6	D44	Draft Exploitation Plan	9	XLAB	Report	CO	31/10/2018	Yes	31/10/2018	None

* Deliverables submitted at the same time than D2.6

4.2. 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.

5. Explanation on the Use of Resources

5.1. Use of resources

In the period M7-M12 there have not been any significant deviations in tasks, objectives or scheduled activities. However, some technical partners (UPV, CERTH, PRO, XLAB, CREO) are currently under minimum deviations (less than 20%) in the use of resources that will be corrected during following periods. Prior to the first Periodic Review (plan for M18) these partners will catch up with the allocation schedule and will be aligned with the effort to be devoted for the first half of the project. These deviations are caused, mainly, by:

- The kickoff date of the project (1st May) close to vacation period introduced some delay in hiring processes.

- Despite experiencing a good advance up to now, the project started with usual slow-start, in which most partners strove to harmonise and set the optimum pace of collaborative work. The Consortium consider this alignment was, however, quickly achieved and the results are the quality and quantity of work exerted by this moment (M12).
- The project started with some problems in hiring people and some attention had to be placed to the different regulations for hiring people within the different countries within the consortium.
- Changes in management of three of the four ports involved in the project that will lead to request of extra subcontracting in the project amendment.
- ICT effort is being carried out stepwise, so some tasks are dependent to others. Partners are allocating resources as the tasks need them, thus in the following months the allocation of manpower will increase specially for technical papers.

A special case worth to remark is the partner MEDRI. According to the amendment, MEDRI increased significantly its total PM to be justified due to several reasons that were accepted by Coordination and EC. To comply with the updated plan, MEDRI proceed to appoint specialized staff for managerial tasks and started a hiring process to cope with the technical tasks. MEDRI is a public University and hiring procedures are quite bureaucratic and can take longer than expected. By the middle of this period (M7-M12) two specialized technical people was fully appointed and started to work in PIXEL but this has caused a shortcoming in the allocation of PMs from a justification point of view. Regardless, MEDRI will catch up with allocation plan step by step and the justification will be well reasoned for the first Periodical Review.