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# D2.9 – Project Management Report v5

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Work Package	WP2		



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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 fifth PIXEL project management reporting. The present document provides the Project Management Report (PMR) for the sixth period of 6 months of the project. This report includes all the activities and advances performed from M31 to M36 of PIXEL. WP3, WP4 and WP6 were already closed before this period. The rest of WPs (WP2, WP5, WP7, WP8, WP9) are still active.

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

The document is structured in three blocks, providing the description of the work performed by the members of the consortium during the corresponding period (M31-M36). First block analyses the actions taken to accomplish the specific objectives listed in the DoA. Second block describes with more detail the main results and achievements per WP. The third block provides an overview of the impact achieved so far, including the different actions at industrial, scientific, academic and communication levels.

A summary of this period can be seen as follows: (i) advance of the deployment of pilots which is currently at its last stages, (ii) evaluating technically the PIXEL solution, modules and models (iii) focusing on the exploitation and innovation of the PIXEL results (iv) preparation of the operative roadmap towards the end of the project, (iv) clear advance on dissemination (despite the overall difficulty to physically attend to events), especially highlighting the scientific dissemination publications.

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# List of acronyms

Acronym	Explanation
AB	Advisory Board
СА	Consortium Agreement
COVID-19	Coronavirus pandemic 2019-2020 caused by virus SaRs-COV 2
CSA	Coordination and Support Action
DPO	Data Protection Officer
DX.Y	Deliverable n° 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
ІоТ	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
РО	Project Officer
ТоС	Table of Contents
DX.Y	Deliverable n° Y from work package X
WP	Work Package



# **1. About this document**

The idea behind this deliverable is to provide to the EC the report of the project status. After 36 months of execution (out of 41), all work packages have started, three have finished and many meetings have taken place. The scope of this document is to summarise the advances and results of the project within the period M31-M36.

# **1.1.Deliverable context**

Keywords	Description
Objectives	This deliverable does not serve particularly to any goal of the listed in the Grant Agreement. Nevertheless, this document plays a crucial role on the accomplishment of all the PIXEL objectives, indeed. Keeping track of current tasks, having an overview of the status of the project and planning the next steps for the forthcoming reporting period are the needed mechanisms to ensure that PIXEL remains towards its goals.
Exploitable results	This deliverable does not generate any exploitable result.
Work plan	The Project Management Report involves, actually, the activity from all the tasks in the project, as every one of them has been analysed and reported. However, this deliveable is framed in the WP2 structure and, particularly, it is assigned to T2.1, T2,2, T2.3 and T2.4.
Milestones	N/A
Deliverables	Similarly to the work plan, the Project Management Report involves all deliverables that have been submitted so far and some to still be completed. But, as it is mentioned several times throughout the document, this deliverable is especially tied to the advances on PIXEL pilots, the 2nd amendment of the Grant Agreement that has been approved in the period, the COVID-19 effects in the project and the extensive exploitation and dissemination actions towars the finalisation of the project.
Risks	<b><u>Risk N°2</u></b> – 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.
	<b><u>Risk N°3</u></b> - Coordination mechanisms, keeping track of the advance of the project, identifying deviations and planning corrective actions will enhance the capacity and good execution pace of the project, and they are depicted in this document.

# 1.2. Methodology used for elaborating the report

Drawing from the template established through D2.5, this report aims to mean an update of the latter. While D2.5 was the first report, D2.6 covered M7-M12, the Project Technical Report for mid-term review covered the period M13-M19, D2.7 summarised the M19-M24 execution and D2.8 reported about M25-M30, the present document depicts the advances and use of resources in the M31-M36 period of and it includes a summary of the immediate previous advances, the actual evolution of tasks and the results produced by all work packages.

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



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

# 2.1. Objectives

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

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

All the efforts carried out during this reporting period (M31-M36) are in the line of accomplishing these global objectives. At this point, the consortium has delivered all planned deliverables, in few cases with short, justified delays and with only two exceptions (D3.1 and D5.3) – which were properly informed -, ensuring maximum quality of work and alignment with GA's scope. Technical activity is in its very last stages, the enabling platform (several versions) was successfully installed in all ports. Pilots deployments are almost finished, while technical and business evaluation is on-going and dissemination and communication activities have been performed to maximise impact.

## 2.1.1. Research and innovation objectives

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

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

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

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



stakeholders must be connected and feeding the system. IoT and sensor networks from different stakeholders connected and interoperating. It provides methodology and tools for connecting isolated legacy systems such as SCADA/PLC based.

The results obtained related with this objective during the period M31-M36 of the project have been:

- Platform PIXEL installed 100% in all ports.
- Training material recorded available.

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

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

The results obtained after M31-M36 that put PIXEL one step closer to accomplish this objective have been:

- A Huge advances in the pilots: agents' integration, model integration, new visualizations.
- New sensors installed in all ports.
- A total of 8 models already running, visualised and providing results in the ports.

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

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

The results obtained after M31-M36 that put PIXEL one step closer to accomplish this objective have been:

- A Platform PIXEL installed 100% in all ports, including the ultimate version of the Dashboard of PIXEL and the most recent version of the Operational Tools.
- A total of 8 models already running, visualised and providing results in the ports.
- Minimum Valuable Product (MVP) tool of the COVID-19 pilot available.

#### **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 interrelated specifications of port processes regarding energy demand, port and city environmental management, hinterland multimodal transport in ports, and generic environmental pollution affecting port Interviews with external ports gathering feedback about potential environmental metrics adoption.

Recommendations' engine (almost finalised) with thresholds based on eKPI values.*s 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 M31-M36 of the project have been:

- Training material recorded available.
- First technical evaluations of modules and models in a standalone fashion.
- Recommendations' engine (almost finalised) with thresholds based on eKPI values.
- Manual of PEI adoption (operational and practical) *at its final stage*.

#### **Obj.5:** Develop predictive algorithms

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

The results obtained after M31-M36 that put PIXEL one step closer to accomplish this objective have been:

• A total of 8 models already running, visualised and providing results in the ports.

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

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

The results obtained after M31-M36 that put PIXEL one step closer to accomplish this objective have been

- Manual of PEI adoption (operational and practical) at its final stage.s
- Recommendations' engine (almost finalised) with thresholds based on eKPI values.

# 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 environmentaldamaging situations will be enabled from a dashboard which will inform port (or any other body in charge) about environmental indicators and possible decisions to make. The PEI and the metrics that compose it will play a fundamental role in the achievement of this objective. As a consequence, there will be available mitigation suggestion in the operation tool of the PEI and there will exist geospatial representation of the environmental impact.

The results obtained after M31-M36 that put PIXEL one step closer to accomplish this objective have been

- Interviews with external ports gathering feedback about potential environmental metrics adoption.
- Recommendations' engine (almost finalised) with thresholds based on eKPI values.



- Full report presenting the results of reviewing the content of the Environmental Sustainability Reports of the TEN-T
- Analysis of the results of the surveys in T5.4.
- Finalization of questionnaires to be used in the framework of T8.3 for the evaluation of indicators.
- Finalization of specific guidelines for each pilot site for business and economic assessment. The final KPIs to be measures have been identified, along with measurement units and relevant target values.
- •

# 2.2. Explanation of the carried work by WP

## **2.2.1. Work Package 1 – Ethics Requirements**

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

### 2.2.1.1. Summary of progress in previous periods

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

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

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

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

During the next management reporting periods (M7-M12, M13-M18, M19-M24), the activity on WP1 was diminished in terms of establishing procedures and documentation and was focused on continuous monitoring of ethical issues along the project execution. Having established the guidelines, the main tasks performed till M25-M30 were focused on:

- Generic documentation of the project (day-to-day documents exchange, etc.)
- Forms and questionnaires needed to conduct our work.
- Compliance with DMP and forwarding of new sources to register if applicable.
- Ensure ethics compliance in the communication with external agents (other projects, CSA, IMO, AB, AIVP, IAPH, other entities) and in the dissemination.
- PIXEL Ethics Mentor (see deliverable D1.4) supervised the main processes of information exchange and no remarkable issue has been detected by M36.
- All interviews to external people have been stored anonymously.
- No specific ethics concerns were raised about communication with Advisory Board.
- Formal permissions were provided for proceeding in susceptible dissemination actions.
- Ethical analysis of the content of Amendment #2.
- Ethical analysis of the data (and the whole tool) for conducting the new task T7.7.
- Generate documentation and follow procedures in the communication to bring a new member into the Advisory Board.



• One multi-instance installation of PIXEL – in a test environment that was called "demo" and that inherits the structure used till now (see D2.7) – is being used for development/testing purposes, where different functionalities may act over data from different sources from different ports under the same computing space. This was specially analysed by the EM as it may involve some GDPR issues such as privacy of data. However, no personal data has been exchanged beyond the explicit mention of the code of the port from where the data is arriving – e.g. GRSPK, PMBOD, GRPIR. No specific complain was done by the partners on this regard. This has been corroborated.

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

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

However, the extraordinary situation being lived due to the COVID-19 outbreak, its associated mobility restrictions and the new amendment request launched by the Consortium involved particular Ethics analysis (reported on the last deliverable D2.8).

### **2.2.1.2.** Summary of results after previous periods

- Formalization of the procedure for ethics compliance about Humans participation in the project
- Creation of a template for Ethical issue identification by any partner
- Creation of a Participant Information Sheet for Humans that participate in the project, compiling their related information
- Creation of an Informed consent form for Humans that participate in the project. This sheet will be distributed to be signed by the external participants of PIXEL.
- Detailed strategy and procedure for personal data (subject to pass Ethics control) protection
- Creation of an Informed Consent procedure for personal data processing
- Creation of a Certificate of consent per personal data to be processed. This sheet will be distributed to be signed by the corresponding responsible
- Creation of a template specific for pilot trials to specify information about the data to be processed, framed into the context of Ethics compliance.
- Appointment of a Data Protection Officer from within the project Consortium
- Deliverables D1.1, D1.2, D1.3, D1.4 and D1.5.
- Confirmation of appropriateness of procedures established by D1.1, D1.2, D1.3, D1.4 and D1.5
- Finished execution of WP3 under holistic ethical observation and analysis of future actions
- Preparation of documentation and surveillance of contacts and surveys by WP5, WP8 and WP9.
- Review of the contents of the amendment from the Ethic compliance perspective.
- Analysis of the Ethic implications of the project extension and the addition of the new task T7.7 for conducting a COVID-19 pilot.
- Analysis of possible GDPR and personal data concerns of the data to be handled in the new COVID-19 pilot.

### 2.2.1.3. Progress in M31-M36

During the management reporting period of interest (M31-M36), the activity on WP1 was diminished in terms of establishing procedures and documentation and was focused on continuous monitoring of ethical issues along the project execution.

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

• Generic documentation of the project (day-to-day documents exchange, etc.)



- E-mail exchange, communication via other channels as Slack chat, communication in teleconferences.
- Survey/questionnaire to TEN-T ports designed and delivered under task T5.4 to understand their adoption of environmental metrics. The questionnaire included to comply to Ethics established in PIXEL a introductory section detailing the data collection procedure, usage of the data and an Informed Consent to be provided by the surveyees before completing the questionnaire.
- Data about sensors, data sources, internal aspects of ports, data needed to complete the predictive algorithms, data needed to execute the models, data needed for PEI computation
  - Extensive communication with WP2 and the DMPs (for the D2.4 mainly).
- Communication with external agents (liaison with other projects, CSA, AB, IAPH, AIVP, conference organisers)
- External experts were contacted for "weighting and providing relevant inputs" about PEI's eKPIs. This collaboration was conducted under the Ethical framework specified in PIXEL, including proper forms and templates provisions that were asked to be fulfilled. No personal information has been collected (apart from the contact details for establishing communication). The results and information of their weighting values have been anonymised.
- Dissemination of PIXEL through all channels: website, social media, newsletter, pieces of news, scientific articles, presentation in (virtual) industrial events.
  - Addition of ethical considerations to all material preparations (included in the plans for preparing, tracking and monitoring dissemination events).

Till this moment no specific ethical concern has been detected from the aforementioned list.

All the exchanges of documentation have been done under optimal privacy conditions and the team does not consider any violation of privacy or personal data misuse have been produced. PIXEL Ethics Mentor (see deliverable D1.4) supervised processes of information exchange, survey preparation, mailing list of the project through the website and was also aware about the data set to be collected in further stages of the project. No personal data issues have been detected.

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

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

With regards to topics covered by D1.2, the PIXEL Information Hub and PIXEL ICT infrastructure have been developed and are being currently used for conducting the pilots. Regarding the platform, it runs in servers located at local networks in the port premises (virtual machines in own servers) where all data is being managed under a single-instance framework – meaning that all modules, handling information from different ports, are being run in different, mutually unreachable, computing locations. This means that no pilot port in PIXEL could ever have access to the data that is being collected and processed by in the other ports.

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

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

- Intervention of external agents (and people) to participate in PIXEL via the Proof of Concept (task T8.4) will also be analysed through the ethical perspective and the proper procedures will take place.
- Usage of the tool in the context of WP8 (T8.3) by people in ports not directly participating in PIXEL.
- Continuous work as in the points above.



### 2.2.1.4. Results after M31-M36

- Confirmation of appropriateness of procedures established by D1.1, D1.2, D1.3, D1.4 and D1.5.
- Analysis of Ethics implications in the platform running at pilots.
- Analysis of Ethics implications in the participation to surveys/methodologies/feedback from external people to the project.

#### 2.2.1.5. Deviations

So far no deviations have been detected.

#### **2.2.1.6.** Corrective actions

No corrective actions are required



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

Universitat Politècnica de Valencia (UPV) as Project Coordinator (PC) has been leading work package 2 (WP2), and the five tasks in which the WP is divided. As a project coordinator, UPV has carried out the majority of the activities within the task. The management work from month M1 to month M36 has been strongly affected by the telework, virtual-only meetings, application of amendment #2 changes and preparation towards the last months of execution of the project.

The COVID-19 restrictions have been affecting the partners during this whole reporting period. Communication between technical partners remained fluent even though the difficulties experienced due to ever-virtual work.

During the last semester, two Plenary Meetings were organised. The 6<sup>th</sup> Plenary (virtual) meeting was conducted on 24<sup>th</sup> and 25<sup>th</sup> November, focused on preparing the 2<sup>nd</sup> amendment of the Grant Agreement and solving technical issues. The 7<sup>th</sup> Plenary (virtual) meting was organised for 23<sup>rd</sup> and 24<sup>th</sup> February, focusing on the finalisation roadmap for pilots, evaluation rhythm and exploitation and dissemination outreach.

Apart from that, most remarkable actions in period M1-M36 have been: (i) to organise project meetings and coordinate the whole technical deployment, (ii) to continuously assess project risks and (iii) to oversight the data being integrated in the pilots for its Ethics and DMP-compliance analysis. The project consortium **has not** generated any deliverable in this period.

**WP2 has formally performed some changes** over its original workplan through **Amendment #2**: An extension of all tasks in WP2 (T2.1, T2.2, T2.3, T2.4 and T2.5), that now end at M41. The extension of the two tasks also means the re-scheduling of the due date of deliverable D2.4, which was planned for the month M36, and that now is expected by M41 (September 2021). Likewise, a new deliverable was created. Deliverable D2.9 (this document) was newly introduced in the workplan for settling an intermediate reporting point before the extended end of the project. The WP itself will be extended 5 months, till 30<sup>th</sup> of September 2021.

### 2.2.2.1. Summary of progress in previous periods

#### Progress by task

#### Task2.1: Work plan, coordination and document management

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

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



- Code-camp for software development and Agile Integration alignment, in Valencia, on 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> February 2020
- Virtual, 31<sup>st</sup> March 2<sup>nd</sup> April 2020, Plenary meeting (virtual, held via teleconferences)
- Virtual, 7<sup>th</sup>-8<sup>th</sup> July 2020, Plenary meeting (virtual, held via teleconferences)

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

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

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

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

Additionally, during the M19-M24 period one activity that was conducted was to create and appoint specific task forces to address issues of the project execution. 1. Agile methodology (by sprints) for development and integration. PRO leads this task force; 2. Assignation of technical experts to different pilots in order to establish a parallel tracking and execution of the deployments (one port – one pilot – one technical partner assigned); 3. Impact assessment and alignment with GA team, formed by CERTH and UPV.

During the previous period, some significative decisions/actions also took place:

- Spotting shared responsibilities and assigning lead partners on: (i) the development of NGSI agents in the context of pilots, (ii) development of visualisation interfaces over the Dashboard in the context of pilots.
- Establishing a new pilot validation methodology.
- Dividing the technological execution of the PEI in two clearly differentiated parts: agents and model.

Besides, during the M25-M30 period, an extensive work was conducted in this task towards the preparation of the Amendment #2 of the Grant Agreement of PIXEL. The modifications approved have come into play during the current period (M31-M36), as it is mentioned across this document.

#### Task 2.2.: Administrative and financial management

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

- Distribution of prefinancing was executed during the first month of the project.
- The first official periodic review took place during the M19-M24 period.
  - Preparation of the Project Technical Report for the mid-term review (M21):
  - Preparation, correction and supervision of the Financial Statements of the partners for the midterm justification
  - Preparation of the mid-term review session in Brussels



- Distribution of the interim payment was executed by the Coordinator during the last reporting period
- The project has generated one amendment. The main reasons were:
  - To redefine the participation with ORANGE and its three linked third parties: ORANGE Consulting (OrangeC), ORANGE applications for Business (OrangeB) and Association images & research, as from 1 September 2018.
  - To change the PMs assigned to some partners (MEDRI, IPEOPLE), according to their current management situation to best accomplish PIXEL objectives. A proper justification was provided.
- Fluent communication with the PO of the project has been held: Mr. Sergio Escriba (M1-M24); No change of PO has been experienced during this period.
- In order to fix some mistakes in delivery dates and responsibilities of some deliverables (e.g. D8.3), work has been carried out to be prepared to an eventual final Amendment that came into force later.
- Distribution of the mid-term financing after the results of the mid-term review. . By month M25-M26, the procedure was finalised and UPV proceed with the payment.
- Preparation of all documentation (operative and financial) for the Amendment #2 of the Grant Agreement, including several rounds of information exchange among partners and with the Project Officer.

#### Task 2.3: Advisory Board Management

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

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

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

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

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

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

• **Virtual meetings**: Teleconference calls will be properly scheduled to keep track of advances and to get feedback and other contribution from AB members. Planned dates for these meetings were:



- AB Welcome and Kick-Off collaboration February 2019 (done)
- 4th PIXEL Plenary Meeting November 2019 (done)
- $\circ$  3rd PIXEL Technical Meeting March 2020 (not done by M18)
- 3rd PIXEL Workshop November 2020 (not yet done)
- 6th Plenary Meeting March 2021 (not yet done)
- **Face-to-face meetings:** PIXEL plans to have two physical meetings with the Advisory Board, coinciding with Plenary/Technical Meetings of the project. Planned dates for these meetings are:
  - 2nd PIXEL Technical Meeting May 2019 (done with attendance of 4 AB members)
  - ?? PIXEL Plenary Meeting to be decided due to COVID-19 effects.

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

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

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

During the period M25-M30:

- Incorporation of a **new member to the Advisory Board** to replace the vacancy of AB member: David Bolduc. The person selected was **José Sánchez, from AIVP.**
- Plans for next actions and continuous work individually with AB members.

The resulting table is, then:

AB member	Organisation	Field of expertise
José Sánchez	AIVP	Port-city relation and SDG goals
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

Table 3. Advisory Board members by M36 of PIXEL

#### Task 2.4: Risk management and Quality Assurance

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

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



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

This task, same as the others in work package 2, will last for the whole period of the project. Thus, some actions were undertaken during its first 30 months.

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

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

Afterwards, the period M25-M30 was one of the most active one with regards to risk observation, assessment and (especially) mitigation. A lot of work was carried out in the risks' task (T2.4), but the most remarkable effects were associated with:

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

That generated a whole new set of risks with their associated mitigation measures.

#### Task 2.5: Data and ethical management, planning and assessment

PIXEL advance the following from M1 to M30 on T2.5:

- Identification of data subject to protection
- Elaboration of Data Management Plan (D2.2 and D1.5)
- Data Protection Officer appointed in PIXEL has been working with the participants of task T2.5 to supervise and create the needed documentation to enhance data protection strategies.
- Forwarded information about data management plan and data protection to WP3 (requirements) and WP6 (data processing).
- Establishment of a template to describe the data sources of all types to be included within the DMP observance.
- Elaboration of the second version of the Data Management Plan (D2.3), following the FAIR data management principles, describing (following the established template) the different data sources of interest and identifying next data sources.
- Identification of the next round of data to be included in DMP further versions. This is a continuous work that draws from the observation (by UPV, PRO and other relevant partners) of: (i) day-to-day advances of the project, (ii) technical scope and the different data sources that are being incorporated to the platform at each moment, (iv) the requirements, (v) the available data sets from the ports being integrated and used to generate and run the different technological tools of PIXEL, (vi) the market and state-of-the-art study and (vii) the global procedures on material generation in the project.
- Collection of details of the different (already known) data sets, advancing on its characterisation in order to fulfil the template for all identified data.
- Application of FAIR management principles during the execution of the pilots.

#### 2.2.2.2. Summary of results after previous periods

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

• Execution of the different administrative and financial activities as required by the project.



- Deployment of the different collaborative tools in order to manage the execution of the project.
- Submission of the deliverables in due date, delays have always been justified and agreed with the PO after analysing the corresponding rationale, e.g. delay of 15 days of D4.1, delay of 2 months of D5.3
- Quality control of the deliverables and results of the project.
- Application of a risk management mechanism.
- Detection and analysis of risks in the project due to the COVID-19 outbreak and associated restrictions.
- Identification, analysis and prospect of data privacy and protection for the different activities of the project. Formulation in deliverables D2.2 and D2.3.
- Establishment of the AB and start of the interaction with it obtaining advice and guidance for the project.
- Description of the new task T7.7, establishment of a workplan and introduction in the global timeplan
- Discussion, preparation and formalisation of list of topics to be included in the amendment #2 and official request to the EC.
- Preparation of justification and formal request to obtain a 5-monhts extension of the project.
- Inclusion of a new member in the Advisory Board in substitution of two leaving members.
- Submission of the report deliverable (D2.8) reflecting the reality of the project at this moment.
- Quality control of the deliverables and results of the project.
- Request of amendment #2 prepared and launched.
- Deliverables submitted successfully:
  - Deliverable D2.1 Project management and quality handbook
  - o Deliverable D2.2 Data Management Plan v1
  - Deliverable *D2.3 Data Management Plan v2*
  - Deliverable D2.5 Project Management Report v1
  - Deliverable D2.6 Project Management Report v2
  - Periodic Project Report (PPR) for the First official Periodic Review covering the execution of M1-M18 of the project
  - Deliverable D2.7 Project Management Report v3
  - 0 D2.8 Project Management Report v4
  - o (on-going) D2.9 Project Management Report v5 (this document).

### 2.2.2.3. Progress in M31-M36

#### Progress by task

#### Task2.1: Work plan, coordination and document management

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

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

#### Meetings



Like the previous period, as this period was also significantly affected by the situation caused by COVID-19, Instead of a face-to-face plenary meeting, the meetings needed to be conducted virtually.

The 6<sup>th</sup> Plenary (virtual) meeting was held on 24<sup>th</sup> and 25<sup>th</sup> November 2020. It took place via ISL teleconferences. The Project Coordinator prepared the meeting clearly indicating the partners that were explicitly needed in each session. The agenda was simplified to 2 days, without the need to establishing parallel tracks. After discussion by the partners, it was decided that all partners should be summoned in the same (virtual) place during the 2 days of the meeting so that the collaboration could be maximised. It consisted of clearly organised sessions, encompassing all active work packages with the special accent being on WP7 (as pilots have been the core work during this reporting period). The COVID-pilot (T7.7) had a special devoted session in the meeting.

The 7<sup>th</sup> **Plenary (virtual) meeting was held on 23<sup>th</sup> and 24<sup>th</sup> February 2021**. It took place via ISL teleconferences. The Project Coordinator prepared the meeting clearly indicating the partners that were explicitly needed in each session. The agenda was simplified to 2 days, without the need to establishing parallel tracks, similarly to the 6<sup>th</sup> Plenary meeting. This meeting was mainly centered on discussing the advance on pilots, including presentations (and short demos) showcased by the ports to the rest of the partners. In addition, the evaluation (WP8) was the second cornerstone of the meeting.

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

#### **Reporting and documentation**

With regards to the documentation, from M31 to M36 the common documentation repository was kept populated by all partners, while being created and maintained by UPV. Instructions for uploading, naming, placing and modifying the various document in the private server have also been followed by partners. Currently, more than 10 GB of original PIXEL documentation is already managed.

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

#### Work plan

Regarding the work plan, in the period M31-M36 the changes formalised through Amedment #2 have come into force. The new (approved) Gantt of the project is the following:



Table 4. New Gantt diagram approved in Amendment #2 of the GA

A summary of the changes provided by the new Amendment of the Grant Agreement is:

• **Project extension of 5 months**, which has been accompanied by the postponement of deliverables D2.4, D5.4, D7.2, D7.3, D8.3, D8.4, D8.5, D9.5 and D9.8, altogether with extending all pending tasks of WP2, WP5, WP7, WP8 and WP9, as it can be observed in the figure above.



- New task in WP7 T7.7: The pilot tarted (planning, initial works expecting the proposal to be accepted) by 1<sup>st</sup> October 2020 (M30). At this point (M36), the pilot is at its final stages, having already delivered a first functioning version of the expected tool (MVP).
- New deliverable in WP2 D2.9 (this document), to report on the activities performed during M31-M36.

Additionally, various WP leaders approached the PC with diverse requests/concerns about the project plan at different points, specially about cross-WP interactions, interdependencies and shared works that should be spotted under a clear task for the next months. WP2 risks are already managing these aspects.

#### Supervision proceduresg

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

A new supervision procedure has been devised and installed during M31-M36 period: The Project Coordinator meets once a week with the Technical Coordinator, who is gathering the deployment issues detected in all 4 ports. With that weekly periodicity, resources (personnel) are assigned to solve those issues dynamically and timely.

#### Task 2.2.: Administrative and financial management

In task T2.2 the administrative issues generated have been addressed, especially those related to applying the results of the Amendment #2 to the Grant Agreement. In the following paragraphs there are some details about the main activities in T2.2 during M31-M36 period:

- Application of Amendment #2 results: During the previous period (M25-M30) partners discussed different options and items to be included in the request, such as a project extension -duration decided in a PCC session- and the creation of a new task in WP7. The PC centralised the requests and proceeded to the submission to the EC. On M32, the amendment was approved by the EC and the Project Coordinator signed (on behalf of the Consortium) the accession to the new Grant Agreement. All the new formal documentation was uploaded to the internal repository of the project for the partners to consultation and continuous access.. The items that were finally approveed in the amendment were:
  - Changes requested by partners, including modifying structure of key personnel in Section 4, change of names and logos of partners.
  - Internal agreements taken place between partners with implications on PMs and budget.
  - Correction of some typos in the GA: in deliverable names, in task duration, in partners' participation, in the main text, etc.
  - o Duration of tasks and deliverables in WP7 and WP8 to keep consistence.
  - The introduction of a new task (T7.7) to conduct the COVID-19 pilot.
  - A 5-months project extension (new end date: 30<sup>th</sup> September 2021).
  - $\circ$  New deliverable in WP2 D2.9 (this document).
- Handover of one partner (former) P12-ASPM to P16-APT (Autorità Portuale di Trieste), that now has taken over all the actions of the port of Monfalcone withing PIXEL. This change has implicated a lot of work with regards to managerial changes in the Grant Agreement.
- **Planning towards the end of the project:** With only 5 months to complete the finalisation of the project, the Coordination team, altogether with the Technical Coordination and the Innovation Manager have been working in a whole strategy/roadmap for facing the last stages of the action:
  - In terms of operational management:
    - Prioritisation of issues.
    - Finalisation of ALL technical developments by the moment of the 4<sup>th</sup> Technical Meeting (8<sup>th</sup>-9<sup>th</sup> June 2021).



- Focus on evaluation: at least 3 months of models running in the ports to conduct proper business evaluation (T8.3).
- Exploitation: proper licensing, open source provision, ORDP and joint exploitation (potential creation of a foundation in exploration).
- In terms of financial management:
  - UPV is continuously reviewing the balances of "planned" vs "consumed" resources of the partners, warning them appropriately out of the results.
  - IFRs have been optimised.
  - The results of Amendment #2 are now fully operational and thus were properly communicated (individually) to all partners affected.

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

#### Task 2.3: Advisory Board Management

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

This period (M31-M36) has not been the most intensive with regards to the interaction with the Advisory Board. The period has still been characterised for its focus on internal management, advances on pilots, issues related to COVID-19 and primarily virtual dissemination opportunities. Considering the previous, the intervention of AB members in such internal nuances was not required.

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

- Re-schedule of meetings:
  - The next (and last) Plenary Meeting with the Advisory Board should have been conducted physically according to GA provisions. However, as it is not safe to travel and meet face-to-face yet, the last AB meeting will take place virtually. The Consortium has decided to co-locate the event with the next Technical Meeting of PIXEL, that will take place on 8<sup>th</sup>-9<sup>th</sup> June 2021 (M38).
  - This meeting will be focused on:
    - Showcasing results of PIXEL pilots and demonstration of the functioning models/tools (to be presented by the ports).
    - Obtaining feedback on: (i) adequacy of the solution and potential -minorimprovements and (ii) recommendations towards the few final months of the projects.
- Further actions related to the AB:
  - Invitation to the final (closure) event of PIXEL that will (most likely) take place on 16<sup>th</sup> September 2021.
  - Organisation of a workshop to show to the AB members the current status of PIXEL tools, models, visualization, etc. Huge advances have been done so the feedback to be received afterwards will be very useful to fine-tune PIXEL assets.
  - Potential joint participation on dissemination events.
  - However, the main day-to-day format of collaboration among AB members and the PIXEL consortium will be by attending to meetings or workshops (now, only virtually) and interaction through e-mails.



#### Task 2.4: Risk management and Quality Assurance

This task, same as the others in work package 2, will last for the whole period of the project. Thus, some actions were undertaken during the period M31-M36 of the project.

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

- d) Applying the changes formalised trough the Amendment #2.
- e) COVID-19 effects on pilots (difficulties installing sensors) and evaluation (accessibility, biased values, slow-pace of getting results...)
- f) the different delays taking place at various points of the project, producing cascading effects.
- g) Compliance with the overall work plan.
- h) Tracking the communication (and contribution) with external entities (e.g., AB members, interviewees, surveyees).

The most intensive activity in T2.4 has been to track and assess those risks and observe whether they have been materialised or not. Addigtionally, for those materialised, a series of mitigation actions have been put in place. A report on this activity can be found at section 4.

Additionally, a whole new set of risk have also been identified during M31-M36 period. Those risks have been analysed using the consolidated procedures agreed for PIXEL. Due to the current point of execution of the project, the most relevant risks identified are associated to WP2, WP7, WP8 and WP9, regarding the deployment of PIXEL in real ports and the impact that the different functionalities will have both for the ports and the society.

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

Regarding quality assurance, the process defined back in the first period for the quality review has been followed in all those deliverables that have been elaborated in M31-M36. Although this period has only coincided with one deliverable submission (D2.9 – this document), a series of deliverables are currently in the preparation phase, especially D5.4, D8.3 and D9.8, which are being passed through the usual quality assurance process (Internal Review plus Innovation Review, meeting certain timing).

#### Task 2.5: Data and ethical management, planning and assessment

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

- Identification of the next round of data to be included in DMP further versions. This is a continuous work that draws from the observation (by UPV, PRO and other relevant partners) of: (i) day-to-day advances of the project, (ii) technical scope and the different data sources that are being incorporated to the platform at each moment, (iii) the available data sets from the ports being integrated and used to generate and run the different technological tools of PIXEL, (iv) the results of the execution of the pilots, (v) potential personal data being gathered while executing the pilots, (vi) the market and state-of-the-art study and (vii) the global procedures on material generation in the project.
- Collection of details of the different (already known) data sets, advancing on its characterisation in order to fulfil the template for all identified data. Specifically, details are being fulfilled of the next sets:
  - Raw data from own sensors
  - Observational data from own web services
  - Observational data from external services
  - Data measurements from SmartSpot station (noise and light)
  - o Results generated from Predictive Algorithsm (traffic, energy, ETA/ETD)
  - o Results generated from model and PEI calculation



- $\circ$  Guidelines and recommendations related with the PEI adoption
- Historical data collection and processing for model training
- Pictures of PIXEL members presenting at events
- Pilot deployments in the four ports participating in PIXEL
- Task T7.7 documentation, UI and data generated

Table 5. WP2 Partner contribution summary table	
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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 D2.9	
	Advisory Board management:	
	• Arrangement of meetings and other agreements.	
	• Planning a roadmap till the end of the project.	
	• 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 warning about unbalanced resources consumption to corresponding partners.	
	• Facilitate communication within the consortium on administrative matters.	
	• Consolidate project's deliverables and reports and maintain Quality Assurance including submission to the EC.	
	• Leading the 6 <sup>th</sup> Plenary Meeting (virtual) in November 2020.	
	• Leading the 7 <sup>th</sup> Plenary Meeting (virtual) in February 2021.	
	• Organisation of different sessions for technical advance in both plenary meetings.	
	• Create, update and maintain the control and official documents, thus keeping track of the WP activity.	
	Organisation of bi-weekly Plenary Telcos,	
	• Lead the risk identification and mitigation process,	
	• Lead the finalisation of documentation preparation for amendment #2 and interacting with the Project Officer for its formalisation.	
P02 PRO	• Supporting Coordination in its majority of tasks from their position of Technical Coordinator	
	• Supporting Coordination specially in Risk detection, mitigation and taking actions	
	• Organisation of different sessions for technical advance in the virtual meeting in November 2020 and February 2021.	
	• Usual actions corresponding to a WP leader (WP7)	
	• As technical coordinator, meetings with project coordination to synchronize and align priorities.	
	• Oversight of proper technical advance of the project, acting as a technical leader in several occasions in different work packages	



P05 CATIE	• Attendance to all Plenary Telcos.
	• Attendance to PCC telcos.
	• As WP leader contributes to risk management and quality assurance.
P06 ORANGE	• Advisory board member and global follow-up (Task 2.3 and 2.4)
	• Supporting Coordination specially in Risk detection, mitigation and taking actions
	• Usual actions corresponding to a WP leader
	• Coordination of the administrative finalisation of WP6
P08 MEDRI	• Supporting Coordination specially in Risk detection, mitigation and taking actions
	• Usual actions corresponding to a WP leader (WP5)
	• Administrative and financial management include ongoing accounting administration, budgeting, measurement, and reporting activities. On a daily basis, a person is in charge of the following staff of the Faculty of Medicine: Assistant to the Administration and Finance Department, Human Resources Assistant, Accounting assistant to assist with document translation and other general services for the project.
	• Coordination tasks within the project team members, organizing team meetings. Follow up financial management-timesheets, time records, payroll lists. Preparation of periodical IFR, contributed in the periodical ITR.
	• Because of COVID 19, the project extension of 5 months has been approved, and budget modification and shifts among categories has been planned accordingly and sent to UPV for an Amendment2. But those proposals are not included in an Amendment2. Because of pandemia EU made flexible approach and approved the "Cases where an amendment is not necessary". MEDRI partner follows all the criteria of H2020, and all shifts among categories will be within the budget already approved. MEDRI will follow instructions provided by the coordinator UPV.

### 2.2.2.4. Results after M31-M36

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

- New Grant Agreement, including the modifications provided through Amendment #2.
- New PC-TC supervision procedure.
- New set of risks assigned to WP2, WP7, WP8 and WP9.
- Handover of partner P12 ASPM to new partner P16 APT.
- Deliverables in this WP successfully submitted:
  - o D2.9 Project Management Report v5

### 2.2.2.5. Deviations

No significant deviations have been produced in the execution of the work package beyond the application of the new provisions in the Amendment #2 of the Grant Agreement of the project.

### **2.2.2.6.** Corrective actions

No significant corrections have been applied in the execution of the work package beyond the application of the new provisions in the Amendment #2 of the Grant Agreement of the project.



## 2.2.3.Work Package 3 – Requirements and Use Cases

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

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

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

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

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

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



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

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

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

### **2.2.3.1.** Summary of progress in previous periods

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

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

#### Progress by task

#### Task 3.1: Market study with stakeholders

This task consisted of:

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

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

#### Task 3.2: Regulation, Policies and Recommendations

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

This task consisted of:

- Elaboration of a questionnaire distributed among the partners to gather the proper
- Rough identification of regulations applying to the use-cases and provision of information for deliverable D3.3
- Set of a roadmap of actions to perform with regards to legal regulation on ports affecting PIXEL
- All partners made an extensive effort of identifying and reporting their corresponding regulations in the areas of: Environment (waste, pollution), transportation legislation, safety and security legislation, GDPR, ISO certification and Quality control policies relevant to the project activities in the port pilot areas



- Description of the main European directives, legislation framework in specific port operation relevant areas
- Elaboration of a a comprehensive and detailed list of related compliances each port needs to cope with (according to its specific use case) and a definition of international and national regulatory bodies to be following to.

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

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

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

#### Task 3.4: Requirements specification

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

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

### **2.2.3.1.** Summary of results after previous periods

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

• First approach to the use-cases manual



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



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

WP4 started on month M4 and finished by the end of the M19-M24 management reporting period. The first three tasks (T4.1, T4.2 and T4.3) were finished by M18 and all management and execution details were provided in the Periodic Technical Report submitted before the mid-term review that took place on January 2020 (M21). During the last reporting period, the task T4.4 was finished successfully and the associated deliverable (D4.4) was submitted to the EC by April 2020.

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

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

### **2.2.4.1.** Summary of progress in previous periods

#### Progress by task

#### T4.1 – Port and City Environmental Management Models

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

This task had three distinct but interdependent goals:

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

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

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

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

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

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

#### **T4.2 – Energy Demand Models**

This task focused on modelling the port's energy demand and production to provide information about the energy use. Three main axes have been investigated in this task: 1) quantify the energy consumption corresponding to a specific port activities scenario, 2) how to predict the local photovoltaic electricity production for a given period and 3) how to estimate the resulting electricity net balance between electricity consumption



and production in the port area. This task has closely interacted with a) task 4.1 in order to have a common definition and modelling approach for port activities and b) task 4.5 in order to development predictive algorithm for energy production with a photovoltaic (PV) system.

The following activities were conducted to achieve those objectives:

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

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

#### <u>T4.3 – Hinterland multimodal transport Models</u>

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

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

Code was developed for these two models. The provided results help to understand if a different traffic management has a positive impact on congestions and are useful for an effective decision support tool plan a temporary stop at SDAG inland port. These models have been fully developed and were considered ready to be integrated in PIXEL Operational Tools.

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

#### <u>T4.4 – Environmental Pollution Models</u>

Main goals of the Task 4.4 were the creation of noise and air dispersion models that could be used by pilot ports to assess their contribution to the environmental pollution levels. In order to successfully finish those tasks, two



different approaches were used. For noise modelling, a commercial software Predictor-LimA Software Suite, developed by Brüel & Kjær, was used. As for air pollution, it was decided to use the American Meteorological Society (AMS) and the United States Environmental Protection Agency (EPA) Regulatory Model – AERMOD.

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

Regarding noise pollution, the following activities were carried out:

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

And for the air pollution modelling:

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

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

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

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

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

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

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

#### <u>T4.5 – Predictive Algorithms</u>

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

First part of Task 4.5 (taking place in the period M7-M18) was thus dedicated to the identification of predictive tasks, according to the PIXEL Requirements analysis, Use cases and scenarios manual, as well as the needs of PIXEL Models and developments in bigger ports. All the technical details were provided via deliverable D4.3. During the period M19-M24, this task was the main focus of the WP4, as it is the only one remaining active. This task advanced and finalised the different predictive algorithms that were identified and explored during the period M7-M18. Different sub-tasks were identified based on the existing documentation regarding requirements and use-cases as well as based on the review of the state-of-the-art in the literature, existing trends and examples from the maritime industry, our AI expertise and available internal and external data.



The algorithms identified and developed were:

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

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

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

### 2.2.4.2. Summary of results after previous periods

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

- Models have been developed and were set ready for integration within the PIXEL platform (WP6) and use/test in real condition (WP7)
  - Port Activity Scenario Model: Modelling of the supply chain and port's activities and enable to build activity scenarios that are used to identify energy sources, emissions of pollutants and estimate the flow of cargoes entering or leaving the port.
    - Definition and development of the model of the Port Activities Scenario.
    - Definition of the data models to be used in the Port Activities Scenario.
    - Definition of the flexibility and transferability of the model: definition of the restrictions of the model of the Port Activities Scenario and of the restrictions' correlation with the data availability.
    - Definition of the system and training requirements of the model of the Port Activities Scenario.
  - Energy Demand Model: Enable quantification of energy consumption of cargo transition.



- Definition and development of the energy demand model and associated data models.
- Test of the model with GPMB
- Definition of the system and training requirements of the model
- Hinterland multimodal model: Decision support tool to optimize the re-routing of trucks.
  - Definition and development of the transport model: two sub models.
  - Definition of the system and training requirements of the model
- Air and noise dispersion models: Simulate the air and noise pollutant dispersion caused by various activities and operations inside the port.
  - Adaptation of AERMOD interface to use the model in PIXEL.
  - Use of a noise model based on Thessaloniki data.
  - Definition of the system and training requirements of the model
- Water and soil pollution models:
  - Water and soil pollution modelling identification.
  - Water and oil pollution modelling description of integration, use, data needed and technological requirements for a port wishing to implement them.
  - Water pollution modelling utilisation for the THPA port case (using bathymetry data).
- Predictive algorithms have been fully identified, described, **developed and published in GitHub**. The following results have been already obtained:
  - ETA using vessel calls (protected)
  - AIS data (protected)
  - $\circ$   $\,$  Traffic prediction algorithms for PPA, THPA and ASPM  $\,$
  - o PV installation prediction
- The work done in WP4 has been presented in 4 research conferences (8th International Conference on Maritime Technology, Maritime Transport Conference, OCEANS 2019 conference)
- Three deliverables have been submitted successfully:
  - Deliverable D4.1 PIXEL Models v1
  - Deliverable D4.2 PIXEL Models v2
  - Deliverable D4.3 Predictive Algorithms v1
  - Re-submission of D4.1 PIXEL Models
  - Re-submission of D4.2 PIXEL Models v2
  - Deliverable D4.4 Predictive Algorithms v2

#### 2.2.4.3. Work in M31-M36

There was no real activity of WP4 to report on this reporting period (M31-M36) as it was officially finalised in M24. However, there have been some remnant cross-WP collaborations that have taken place during this period:

- The members of WP4 have continued to be ensuring the usability of their results. They have been asked about functionalities and technical nuances of WP4 models in order to reach the project goals.
- For the deployment of the pilots (T7.1 and the rest of WP7 tasks), it has been needed a punctual exchange of information to understand and fine-tune the transition between standalone execution of the models (WP4) and an integrated seamless flow in the PIXEL framework in the port (WP7). It is expected that this information exchange will last till the end of the WP7.

#### 2.2.4.1. Deviations

No deviations in this period.



### **2.2.4.1.** Corrective actions

No corrective actions were necessary.

### 2.2.5.Work Package 5 – Port Environmental Index Development

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

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

The beginning of the period of interest in this reporting (M31-M36) was mainly focused on finalising task T5.4 (Practices for PEI practice and adoption), especially on documenting the PEI fit in ports as well as conducting a series of questionnaires to gather external information. That has brought task T5.4 to its end and the team then focused on testing the PEI in real deployments, ensuring proper execution of T7.5 PEI transversal trial, and also in formalising the Guidelines for improvement of environment and society.

Apart from that, the period M31-M36 WP5 has been focused on:

- Continuous intensive work on the translation of the procedures for obtaining eKPIs from raw data from ports to the T7.5 team for the NGSI agents preparation.
- Surveying a set of representative TEN-T ports (and other) to gain insight of current adoption practices in the ports of environmental measuring tools
- Documenting PEI procedures and a manual for PEI adoption by external ports.
- Devising a set of recommendations to the ports (towards improving environment and society) based on the result values of PEI execution.

**WP5 has formally performed some changes** over its original workplan through **Amendment #2**: An extension of all the currently active tasks in WP5 (T5.4 and T5.5), that now end at M33 and M37 correspondingly. The extension of the two tasks also means the re-scheduling of the due date of deliverable D5.4, which was planned for the month M32, and that now is expected by M37 (May-2021). The WP itself will be extended 5 months, till 31<sup>st</sup> of May 2021.

### 2.2.5.1. Summary of progress in previous periods

#### Progress by task

#### Task 5.1: Methodology definition

This task consisted of:

- a general description of the workflow to be used and methodological approach for obtaining the PEI;
- literature review of the current methodological approaches for the identification of environmental aspects of port operations;
- analysis of the existing approaches for addressing and defining the significant environmental aspects of port operations;
- conclusion on best approach for setting system boundaries: build three different indexes: an environmental index for the ships, a separate one for terminals and a third one for the port authorities;
- discussion on different methodological approaches related to different types of cargo;


- discussion on different methodological approaches to select the indicators (environmental key performance indicators eKPI) for PEI construction and weighing.
- Choice of the methodology and depiction of full explanation via deliverable D5.1 (M12).

This task was considered concluded in M7.

# Task 5.2: KPI Definition

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

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

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

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

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

## Task 5.3: PEI development

This task had a duration of 15 months, starting in M7 and ending in M24. However, due to certain justified delays, some pending activities were pending. Specifically, the completion of D5.3 and the finalisation of all calculation details for the index were tackled during months M25 and M26.

This task included a further narrowing and analysis of the eKPIs to be used in the PEI calculation based on the different IoT data sources that have been identified in this task.

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

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

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

The task T5.3, which was supposed to be finalised by M24 (end of this management reporting period) was the more intensively tackled by the WP5 team during M19-M24 period. The results were properly introduced in the deliverable D5.3. In the last reporting period it was made clear that this deliverable would be formally submitted by M26, due to the deviations indicated below.

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

• Creation of a waste inventory



- Short summary and recommendations on the PEI calculation methods were provided and a pseudocode for the calculation
- Indicators for all the sub-indices, together with relevant measurement units and calculation methods
- Work on how to link the PAS output with the estimation of the emissions in the atmosphere due do the port activity (link between PAS and PEI) and how to use AIS module within PIXEL to generate inputs for the PEI.
- Determining methods for estimating eKPIs from directs measurements or proxy data
- Discovery of suitable IoT sensors for feeding certain data needed in PEI
- Data analysis for PEI within the mathematical toolbox choice.
- Development of a running version of PEI calculation in Java
- Start of integration of PEI visualization into the global PIXEL dashboard
- Full integration of PEI visualization into the global PIXEL dashboard
- Development of all NGSI agents to convert raw data into eKPIs
- Application of all the calculations designed to real scenarios (one pilot per port in PIXEL)
- Test and validation of the algorithms designed
- Test and validation through time with real data- of the mathematical methods selected

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

This task was not affected by the COVID-19 associated changes in the Grant Agreement.

## Task 5.4: Best practices for PEI adoption

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

- Methodological approach for the task and the PEI adoption needs
- Analysis of the results of the TEN-T ports Environmental Sustainability reports' content
- TEN-T ports' questionnaire design
- Initial work on envisioning metrics for assessing port environmental performance by ports
- Tentative structure of the adoption and practices and implementation problems
- Initial identification of the benchmarking possibilities and strategies
- Questionnaire for online interviews and identification of contact persons with ports and related agents in order to gain information about PEI adoption and other planned feedbacks
- Creation of the questionnaire for TEN-T ports.
- Import of the questionnaire to a specialised web platform for conducting the survey,
- Web research for appropriate contacts in the TEN-T ports for the survey,
- Elaboration of a draft report presenting the results of reviewing the content of the Environmental Sustainability Reports of the TEN-T.
- Preparation of the survey results analysis tool.

## Task 5.5: Guidelines for improvement of environment and society

This task started in month M23. Till M30, the following activities were conducted:

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



- The guidelines for "deploying and using the PEI by a port staff member" were completed.
- Some recommendations of the usage of T5.3 product (PEI software and functionality) was devised till this period.

# 2.2.5.2. Summary of results after previous periods

The main results obtained till M36 of the project in the context of WP5 are the following:

- The general methodological framework for PEI development and computation has been devised.
- The significant environmental aspects of port operations have been identified and mapped to the PIXEL pilot ports.
- The eKPIs of environmental aspects of port operation have been assessed and proposed.
- The IoT data sources for eKPIs retrieval and computation have been analysed and solutions have been proposed.
- The statistical toolbox for PEI computation has been addressed and several statistical methods for data imputation, normalization, weighing and aggregation have been put forward.
- Different approaches for assessing uncertainty and sensitivity analyses related to the PEI algorithm have been proposed.
- Different ways of PEI visualization in the PIXEL dashboard have been proposed including advanced features for data analysis and visualization.
- Port waste inventories have been considered and analysed.
- A final list of eKPIs has been agreed upon.
- Development of code and generation of a usable program in Java for current PEI calculation
- Surveys to TEN-T ports conducted.
- Draft report presenting the results of reviewing the content of the Environmental Sustainability Reports of the TEN-T
- Answers from ports and other involved agents to the survey issued in the last reporting period
- Packaging of all T5.3 results to enhance and apply the calculation in task T7.5
- The creation of the results analysis tool is at an advanced stage.
- Different dissemination results were created, including scientific papers, presentations at relevant conferences and posters.
  - 2 papers (Environmental monitoring and assessment, TRA2020 respectively) and were presented in 2 researchg conferences (Recent scientific achievements of the Teaching institute of public health, GreenerSites Final Conference)
  - o Two poster presentations in the Eighth International Conference on Marine Technology
  - Two scientific papers (one on noise pollution and one on air pollution) were finished in this period and are planned for submission early in the next reporting period
- Deliverables submitted successfully:
  - Deliverable D5.1 Environmental Aspects and Mapping to Pilots
  - Deliverable D5.2 PEI Definition and Algorithms v2.
  - Deliverable D5.3 PEI Definition and Algorithms v3.

# **2.2.5.3. Progress in M31-M36**

**Progress per task** 

## Task 5.4: Best practices for PEI adoption



This task finalised during this reporting period. Concretely, T5.4 came to an end by M33 (January 2021), with the closure of the survey related to PEI adoption and the processing of the results.

During the first three months of this period (M31-M33), the activities in T5.4 were extensive, putting in practice all the plans and preparations performed in previous stages. CERTH led the team towards successful interpretation of the results from the fulfilment of the surveys by external ports/agents in TEN-T network. The feedback provided has served to better understand the global adoption of environmental monitoring metrics by ports and this has also feed the execution of the PEI pilot trials in PIXEL (T7.5). The cross-fertilisation between T5.4 and T7.5 has allowed the Consortium to guarantee that PEI (as a tool) complies with the expectations expressed by external ports within this task. In addition, some interviews have already been conducted to finalise the task (whereas other are still pending).

A questionnaire survey which started in July202 was finalized and results from participating ports were collected. The results are analysed and incorporated in the currently developing Deliverable 5.4 "PEI Manual for adoption in ports and guidelines for environment and society". Relevant discussions were held with task leader (CERTH) and MEDRI has done all the work related to the Deliverable 5.4, which also encompasses this task

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

- Closure of the TEN-T survey (gathering a total of 15 answers from external ports)
- Analysing the results of the Environmental metrics adoption survey
- Elaboration of a full report presenting the results of reviewing the content of the Environmental Sustainability Reports of the TEN-T.
- Conduction of some interviews with external ports alongside the survey to gather more specific feedback according to the objectives of the task.
- Inclusion of all the previous in the deliverable D5.4, which is (at the end of this period) at a final stage of completion.
- Conduction of a experts-oriented survey for establishing weights for PEI calculation based on Budget Allocation Method.

## Task 5.5: Guidelines for improvement of environment and society

The period M31-M36 has constituted the core timeframe for the execution of this task. As planned, this task has been hugely influenced by the results of T5.3 and T5.4. Very useful recommendations for the usage of T5.3 product (PEI software and functionality) have been during this period, already extracting relevant conclusions. In addition, manuals of the use of the tool (and how to properly tackle its adoption) have also been elaborated in the context of T5.5. However, the work is not yet final.

A research and collection of practices for minimising a port's environmental impact was made, which were used for developing a set of guidelines for minimizing a port's PEI in D5.4.

The main work of this task has been carried out during this reporting period (M31-M36):

- Settling and documenting "normalization method" and "ranking comparison", "aggregation" and "weighting" for integrating those mathematical tools into the PEI algorithm.
- Elaboration of a PEI manual and guidelines for adoption, compiling all the work done in the WP in the form of a simple (15-pager) reference document to decide and proceed on adopting PEI by an external port (this document is at its final stages).
- Literature review on best practices for minimising a port's environmental impact & the internalisation of ports external costs in order to be used for developing a set of guidelines for minimizing a port's PEI.
- Creation of input data for the recommendations engine for PEI minimizing which is being incorporated to the PEI tool in the task T7.5
- Selection of the thresholds for triggering recommendations in the technical PEI tool based on eKPI values.



This task will be finishing just one month after the closure of this period, in M37. According to the task members, the objectives will be met by then, and the results will be depicted via deliverable D5.4.

Partner	Contribution
P01 UPV	• Contribution to the writing of deliverable D5.4, in particular to the Manual of PEI adoption, on its technical part.
	• Design of a recommendations engine that is being incorporated within the PEI tool.
	• Creation of a template for selecting thresholds to trigger recommendations and guidelines to ports for minimising environmental impact drawing from PEI execution values.
	• Settlement of normalization (to a reference port), aggregation and weighting methods.
	• Conduction of a experts-oriented survey for establishing weights for PEI calculation based on Budget Allocation Method.
	• Supporting T5.4 and T5.5 leader from organisational perspective.
P02 PRO	• Feedback for PEI representation in PIXEL platform.
	• Configurations of dashboards framework to support PEI representation.
P05 CATIE	• Supporting the decision-making process for settling "normalization method" and "ranking comparison", "aggregation" and "weighting" for integrating those mathematical tools into the PEI algorithm.
	• Assisting UPV for introducing emission factors in the PAS output and using PAS results by the PEI model.
P06 ORANGE	• Participate in the task and deliverable 5.4 (Best practices for PEI adoption)
P07 CREO	<ul> <li>In the context of task T5.4:</li> <li>Questionnaire survey shared/discussed with our direct port contacts.</li> </ul>
P08 MEDRI	Organisation of WP5 meetings (virtual)
	• Usual tasks of WP coordinator (organisation of work, coordination, supervision)
	• Relevant discussions were held with task leader (CERTH) and MEDRI has done all the work related to the Deliverable 5.4, which also encompasses this task.
	• Selection of the thresholds for triggering recommendations in the technical PEI tool based on eKPI values.
	• Collaboration with UPV for translating recommendations and reference values into the technical tool.
	• Collaboration in the writing of D5.4: guidelines for PEI adoption.
	• Similar to the Task 5.4, relevant discussions with task leader (CERTH) were held. MEDRI significantly contributed to the recommendations on measures to improve the ports' environmental performance and, thus, PEI score. All the results of the work done in the task was described in the Deliverable 5.4.
	• Also, some work was done considering the calculations of emissions (inside the PAS model) when using biofuels instead of fossil fuels.
P16 APT P12 ASPM (changed in Amendment	• As APT is a new partner in PIXEL, a lot of efforts have been spent in analysing the current state of the art of WP5, evaluating how to continue the activities started by PP12 – ASPM.

 Table 6. WP5 Partner contribution summary table



	• APT contributed in WP5 development collecting data from port system/community and investigating in data sources availability as well as commenting the best practices/guidelines for improvement of environment in ports.
	• APT supervise the furniture of the noise and light sensor commissioned by ASPM and its installation activity in the port of Monfalcone premises.
	• APT shared the data of the noise and light sensor in the port of Monfalcone premises with the Pixel platform.
P15 CERTH	• Work on Task T5.4 – Finalization of the TEN-T ports' questionnaire survey for D5.4 (PEI Manual for adoption in ports and guidelines for environment and society) by collecting some additional answers and analysis of the results in order to be incorporated to the report. Work on the D5.4 report.
	• Work on the Task 5.5 – Literature review on best practices for minimising a port's environmental impact & the internalisation of ports external costs in order to be used for developing a set of guidelines for minimizing a port's PEI.
	• Preparatory actions together with MEDRI for creating the input data for the recommendations engine for PEI minimizing which will be incorporated to the PEI tool
	• Finalisation of deliverable D5.4 and submission for internal review.
	• Completion of the search for best practices for PEI minimization and preparation of the data file, together with MEDRI, for importing data into the recommendation engine of PEI.
	• Initial preparations for the PEI workshop presentation in June.

# 2.2.5.4. Results after M31-M36

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

- Full report presenting the results of reviewing the content of the Environmental Sustainability Reports of the TEN-T
- Analysis of the results of the surveys in T5.4.
- Manual of PEI adoption (operational and practical) at its final stage.s
- Interviews with external ports gathering feedback about potential environmental metrics adoption.
- Recommendations' engine (almost finalised) with thresholds based on eKPI values.

# 2.2.5.5. Deviations

No deviations detected during this period. The last deliverable of the WP5 – D5.4 – is planned to be submitted on time by the end of the next month (first in the next reporting period), M37 – May 2021.

# 2.2.5.6. Corrective actions

No corrective actions were needed during this period.



# **2.2.6.Work Package 6 – Enabling ICT infrastructure framework**

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

Particularly, this WP was planned last a total of 22 months; having started on M4 and finishing on M26. In this regard, this work package was already closed during the previous reporting period.

For what remains active, joint WP6/WP7 bi-weekly telcos "Agile development and integration" are still being conducted (although everything is now WP7-focused) to ensure proper fine-tuning of the integration of the modules towards conduction of the pilots. More concretely, those teleconferences are oriented to bug-fixing and improvement of the modules after issues detected during the pilots execution, redounding – normally- on the delivery of successive versions of the modules. For instance, during the execution of the COVID-pilot (T7.7), one Dashboard widget must be deployed and integrated within the Dashboard module; this has required some WP6 partners to ensure the proper compliance of all the structure and data flow by delivering a new version of the Dashboard module.

# **2.2.6.1.** Summary of progress in previous periods

#### **Progress by task**

## Task 6.1: PIXEL information system design and architecture

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

- Initialization of architecture definition plan, development tools and guidelines for conceiving the PIXEL ICT.
- Conduction of several meetings to initialize a working framework for the whole work package
- Definition of the WP execution plan, internal milestones and the methodology to be followed. Every sub-task has its corresponding plan and first approach to the technologies to be used.
- Establishment of the RA (Reference Architecture) for PIXEL, contemplating all technical constraints and needs of all the tasks comprised in WP6.
- Clarification of the technological choices for implementing each one of the modules after analysing the requirements set through deliverable D3.2 and D3.4.
  - A thorough definition of each one of the modules (including state of the art), architecture diagrams, explanation and examples of the architecture and different technological choices made can be consulted in D6.1 and D6.2.
- Clear establishment of the relation between modules and tasks in order to clearly delimitate the responsibilities within the work package and create a collaborative framework for development.
- Creation and writing of the deliverable D6.1
- Refinement of all modules explanation (and more detail provided) altogether with an architecture finetuning via deliverable D6.2.
- Creation and writing of D6.2.
- Specific check on requirements.

This task was considered finished and closed by month M18.

## Task 6.2: PIXEL Data Acquisition

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

• Definition of the main components that form part of the module and validation with all partners.



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

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

## Task 6.3: PIXEL Information Hub

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

- Review of existing solutions and selection of suitable technologies, and started testing subcomponents.
- Proposition of the final system composition
- Analyse the relation with other modules in PIXEL ICT infrastructure and establishment of interaction diagrams (depicted in deliverable D6.1)
- Establishment of the internal architecture of the IH module.
- Testing DAL integration with existing data sources
- OT integration first phase as agreed at the plenary in Greece.
- Preparation of M18 review demonstrators
- Alignment of data structures
- Review of OT integration patterns
- Development of methods for storage of complex data structures
- Development, fine-tuning and finishing of the necessary custom models and integration of the alreadyexisting solutions to have the framework of the IH as a whole:



- o OpenJDK
- o Elasticsearch
- PIXEL DataCollector (southbounds connection)
- o PIXEL Archiving System Core
- API for the northbound collection (info to be retrieved by the models executed via the Operational Tools)

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

# Task 6.4: PIXEL Operational Tools

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

- Establishment of a work plan, including a timeline schedule to commit all requirements on time.
- Designing an overall schema of components that will compose the complete module: (i) Event Processing, (ii) Database, (iii) Model and PA Engine, (iv) API gateway, (v) publication submodule, and (vi) user interface.
- Definition of subcomponents clearly: with their relations with other components, interaction with other modules of PIXEL architecture, their technological function and flow of actions and use.
- Analysis and discussion about the interfacing with other parts of the PIXEL platform.
- Selection of technologies for implementing all sub-components.
- Setting up of a test environment for developing the tools
- Development and integration of components. This activity is still ongoing as task T6.4 lasts for M26. In fact, it requires models (which were even released in M18) and predictive algorithms (not even finished according to the project time plan) to be ready to start integrating them. Before that, work has been done with testing models.
- Design and implementation of a user interface. This is a work tightly related with the PIXEL Dashboard (task T6.5). Code has been implemented from scratch with similar technology as the dashboard to facilitate the integration (VUE, JavaScript).
- Development of the new version of the Operational Tools software (OTv2)
- Specification of the files to be used for (i) identification and creation of a model in the OT (GetInfo.json) and for (ii) the instantiation of a model (running the model; Instance.json).
- Development of the connectors with models module in order to put in communication the model developed within WP4 and the OT.
- Specification and materialisation of the southbound interaction in order to let the models retrieve data from the IH and the northbound interaction in order to let the Dashboard access to the results of the models so that can be visually represented.
- Support dockerization of WP4 results models.
- Running of the Operational Tools with all needed connectors in the "development environment" in FILABS.
- Integration of the component with the rest of modules of the platform
- Development of the new version of the Operational Tools software (OTv2)
- Integration of other PIXEL modules, specially the Operational Tools. The newest version of the Operational Tools has been integrated in the UI of the platform.
- Deployment of the implemented version of OT v2 in FILABs

The task T6.4 finalised in M26, during the previous reporting period (M25-M30) According to the partners, this task was considered close after the submission of D6.4 and D6.5.



## Task 6.5: PIXEL Integrated Dashboard and Notification

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

- Designing an overall schema of components that will compose the total module: (i) PIXEL Information Hub UI, (ii) PIXEL Operational Tools UI, (iii) Maps (GIS), (iv) Notifications and (v) Charts and Dashboard.
- Analysis and discussion about the interfacing with other parts of the PIXEL platform.
- Selection of technologies for implementing all six sub-components
- Setting of test environment for developing the tools
- Development and integration of components, mainly the following:
  - Dynamic creation of visualizations
  - o Alerts module
  - Map engine to spot data sources
  - Overall navigation
  - Integration of other PIXEL modules, specially the Operational Tools
- Creation of the visualizations needed for the working demo in the mid-term review
- Development of an automatic report generation tool to support the generation of valuable information in ports for official reports
- Creation of the configurable widget framework and its application to the demo environment.
- Develop, integrate and continuously run in the "development environment" of the second (and definitive) version of the Dashboard/global UI wrapper and the inclusion over it of several requested features:
  - Development of an automatic report generation tool to support the generation of valuable information in ports for official reports.
  - Development of various widgets to cover functionalities that will be used in the pilots in the different tasks of WP7.
  - Development of the Alerts and Notifications functionality using ElastAlert.
  - Creating and materialising the links with T6.6 by embedding the user profiling and authentication via the Dashboard

The task T6.5 finalised in M26, during the previous reporting period (M25-M30). According to the partners, this task must be considered close after the submission of D6.4 and D6.5

## Task 6.6: PIXEL Security and Privacy

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

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



- Customisation of the existing FIWARE enablers for PIXEL security (whole WP6 duration)
- To fine-tune the scope of security that is included in the different releases of the platform.
- API Gateway solution was analysed, tested and included in the FILABS "development environment".
- Trace an end-to-end coverage of the security, ensuring that for already integrated framework (in GPMB), the security modules are usable, useful and used.
- Integration of the security with the new versions of other PIXEL modules (OT v2, Dashboard v2, different NGSI agents developed).

The task T6.5 finalised in M26, during the previous reporting period (M25-M30). According to the partners, this task must be considered close after the submission of D6.4 and D6.5.

# **2.2.6.1.** Summary of results after previous periods

This WP was closed in M26. The results obtained can be listed as the following:

- Definition of the WP execution plan, internal milestones and the methodology to be followed.
- Definition of every sub-task of the corresponding plan and first approach to the technologies to be used.
- State of the art and technology selection.
- Links with WP3, WP4, and WP5 regarding requirements.
- Finalized first and second (final) version of the architecture.
- Full list of components for each module closed.
- Development environment is setup and running.
- DAL agents orchestrator developed and integrated.
- Operational Tools v2 (OTv2).
- Dashboard and global UI v2.
- Information Hub connected and integrated in the "development environment".
- Northbound and southbound APIs completed and tested between all modules.
- A series of NGSI agents for ports (specially for GPMB).
- An NGSI Agent Python library and documentation to help other partners to developed NGSI Agent.
- FIWARE security modules completely customised and integrated in the development environment.
- PIXEL platform developed for an initial release.
- DAL agents orchestrator developed and integrated
- Finalisation, dockerisation and integration of Operational Tools v2 (OTv2)
- Finalisation, dockerisation and integration of Dashboard and global UI v2
- A series of NGSI agents for ports (all the ports). Decision to complete this in the next WP.
- FIWARE security modules completely customised and integrated in the development environment
- Documentation of all code (done through D6.4 and D6.5).
- The following deliverables were submitted successfully:
  - Deliverable D6.1 PIXEL Information system architecture and design v1
  - Deliverable D6.3 PIXEL data acquisition, information hub and data representation v1
  - o Deliverable D6.2 PIXEL Information system architecture and design v2
  - Deliverable D6.4 PIXEL Data Acquisition, Information Hub and data representation v2
  - Deliverable D6.5 APIs and documentation for software extension



# 2.2.6.2. Work in M31-M36

While the purpose of developing agents in T6.2 was merely to validate the component and corroborate its interfaces, the development of on-purpose agents to run the pilots has been allocated to specific tasks in WP7. This continuation has been being executed during the M31-M36 period. In particular, this work has been translated into WP7, which also involves the agents development and integration as one of the main enablers to run the pilots. The division has been done as follows:

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

While the task T6.5 completed all its objectives and is covering fully its description, an additional activity was opened. Besides the visualisation framework including the widgets structure, notifications and all the required traits, some partners (mainly PRO) started to develop specific visualisation widgets to cover and represent the results of specific models in certain ports of PIXEL, which is currently and on-going activity falling under the scope of different tasks in WP7. This (the development of specific visualizations) is an action expected to be occurring till the end of WP7 (M38 – June 2021). However, neither the PEI nor the COVID pilot UI will be visualised through widgets, therefore the last consideration does not apply.

# 2.2.6.3. Deviations

No deviation detected in this period.

# 2.2.6.4. Corrective actions

No corrective action detected in this period.

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

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

WP7 lasted (initially) from M14 to month M33 and constitutes one of the most important WPs for the project. After the approval of Amendment #2 of the Grant Agreement (see purple table below), the WP will last till month M38 (June 2021). As it has been indicated many times, PIXEL is use-case driven, so a good plan, execution and validation of the pilots will mark the future of the PIXEL tools and research lines.

At management level, WP7 is being a complicated work package as it includes the integration of developments made in other work packages and the realization of 4 pilots. The delay of other WPs, altogether with COVID-19 effects, affected WP7. On the one hand, the activity in ports was clearly diminished, even paralysed, which has had huge influence in thge delay of equipment installation, the availability of the personnel and the difficulty to access to certain agents within the port. On the other hand, many deployment issues are arising, due (mainly) to the heterogeneity of cases, network configuration and topologies, restrictions and other fine-tune aspects that are hugely different from one port to another. All technical teams have needed to devote more time than planned for dealing with such issues.

For those reasons, a close and fluent communication between WP7 and the rest of the work packages is being crucial.

On a broader scope, the current scenario of the WP in this reporting period (M31-M36) is considered "**behind the schedule but with clear deadlines that will be met**". It has been mainly characterised by a general unrest that has sometimes forced the team to adopt a wait-and-see strategy. For coping with the many integration and deployment issues that have occurregd, the PC and TC have put in place a mechanism that reviews the issues in deployment on a weekly basis and dynamically assign resources (partners, personnel, postponing teleconferences, etc.) to ensure a more agile pace of integration, for complying with WP7 and WP8 deadlines. This dynamic allocation has -sometimes- caused further delays in WP8 and WP9, but it is considered necessary at this time, as finalising the pilots is the #1 priority of the project partners till **mid June 2021**.

As an overview, during the M31-M36 period a lot of work has been done in the pilots related with data acquisition, model installation/execution and data visualization. The main effort during this period has been related to the implementation of the agents that are the components of the architecture in charge of data ingestion. Some agents connect directly to sensors or data sources to obtain real-time data, while others connect to ftp to retrieve data. In some special cases, forms have been developed for data ingestion, such as the use of forms for defining the Pas Model input data. Regarding the models, most of the models have been dockerized and integrated into the platform. The visualisations of the models have been implemented and still need to be validated with real data and to be accepted by the end users. The PEI model that has to be run on the four ports has been integrated on the PPA port. The integration of the PEI Model on the other ports is in an advanced stage.

During this period the new COVID pilot has been almost finalised and will be integrated in the next release of the pilots. This pilot was not planned at the beginning of the project, but due to the fact the importance of the current situation the consortium made an effort to develop this model to help the port community in order to monitor the capacity of the different areas to ensure the security distance between port staff

**WP7 has formally performed some changes** over its original workplan through **Amendment #2**: An extension of all tasks in WP7 (T7.1, T7.2, T7.3, T7.4, T7.5 and T7.6), that now end at M38 (June 2021). The extension of all the tasks also means the re-scheduling of the due date of deliverables D7.2 and D7.3, which were planned for the month M33 (January 2021), and that now are expected by M38 (June 2021). The WP itself has been extended 5 months, till 30<sup>th</sup> of June 2021.



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

For the introduction of T7.7, the scope of three (already planned) pilot tasks have been diminished as follows:

- Air pollution model integration and usage of ARPA open data (T7.3): The air pollution model will not be real-time integrated in the Monfalcone pilot. The approach will be similar than the noise modelling for the Greek ports: running AERMOD offline, exporting results and then just monitoring available environmental data in Monfalcone.

- Gathering, processing, exploitation and visualization of data coming from the PMIS (national owned) system (T7.3). Difficulties have been experienced to obtain all permissions and authorizations to access the PMIS of the port (property of the National Government). The COVID pilot will help this task alleviate its dependency of this data. Efforts will be focused on the COVID use-case and the PMIS integration will take place (if arrived on time) at a later stage of the project.

- Accepting short periodicity for the PEI applied to terminals and Port Authority-related data (T7.5). One of the most constraining issues for PEI deployment in Monfalcone is the need of manually fulfilling certain data associated to the port authority (e.g. energy consumption, waste, wastewater, etc.). According to D5.3, these data must be typed by the port with "as soon as possible", which would require too extensive amount of communications between port agents and departments. Relaxing these requirements will allow ASPM and other partners to be focused on the useful COVID use-case.

This modification of scope does not alter the ambition of the work package at all. This change has been approved through amendment #2.

# **2.2.7.1.** Summary of progress in previous periods

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

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

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

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

#### **Progress by task**

#### Task 7.1: Integration of PIXEL components

This Task started in M13 and will end in M38. Till M30, the phase corresponding to the integration and testing of the software components developed in PIXEL was covered. The following activities took place:

- Definition of the integration strategy and its depiction via deliverable D7.1
- Creation (in TestLink) of the test cases for evaluating the integration.
- Definition of the models (out of WP4) that will be integrated; by when and by whom.
- Selection of a microservices strategy to be used for integrating all models as containers under a common mechanism.
- A proof of concept demo has been defined using the developed components and interfaces
- This demo was shown in the mid-term review in January 2020 (M21).



- Integration of GPMB data, T7.2 model and WP4 outputs from a supervision point of view in order to present a working demo in the mid-term review in Brussels.
- PAS outputs fine-tuning and the conversion into an actionable UI for ports
- Revision and clarification of pilot scenarios and expected impacts (KPIs) in alignment with the technical implementations (interaction with WP8).
- Definition of a new Pilots Validation methodology that will allow the WP7 leader, technical coordinator and PC coordinator to keep track ok
- Specification (in detail) of all the NGSI agents to be developed under all the tasks in WP7, including port-specific use cases, PEI pilots (in all 4 ports) and the cross-port use-case.
- Distribution of tasks among technical partners to ensure coverage to: (i) WP6 modules responsibles interaction in WP7, (ii) maximisation of skills leverage, (iii) speeding the integration with the aim of start evaluating the pilots as soon as possible.
- A proof of concept "infrastructure" has been created (called "demo") in which any model, data source and functionality might be run with testing purposes. Additionally, it is planned to use this installation for "improvements" of the global PIXEL framework requested/designed during the course of WP7.

## Task 7.2: Energy Management trial: Port of Bordeaux

This task started in M16 and will end in M38. During the first half of the project (till M24), only three months of this task had taken place. In that short time, just some actions were performed:

- A first work of identification of software and hardware that have to be integrated for the GPMB pilot execution, resulting in a to-do list for the integration that was included in the deliverable D7.1
- A first set of integration tests were identified and defined in the TestLink web tools
- Identification of the end-points of the data sources to be integrated
- Identification of how to integrate weather station data and data coming from electrical sensors already installed inside the port but not already connected.
- Start of the work for integrating PAS model execution and outputs to feed the energy demand model with live data.
- Data gathering, selection of data models, planification of NGSI agents development
- Development of NGSI agents
  - Vessel calls (from VIGIEsip)
  - PV output prediction
  - Tide level sensor
  - Data from supply chains of GPMB
  - VIGIEsip integration
  - Waste, wastewater and air pollution data for PEI
- Final clarification of the equipment needed to run PIXEL, collection of the equipment and start the phase of putting it in place
- Designing and starting software and hardware integration
- Collaboration with WP4 partners in order to prepare the software and operational mechanisms to achieve having the models running.
- Setting up the needed equipment to run the pilots. As per technical decision, the computing equipment has been divided in two virtual machines. Since the beginning of the period, the equipment (Linux servers) has been made usable. Technical partners more involved in this task (ORANGE and CATIE) have been granted with VPN credentials and SSH access to proceed with PIXEL installation.
- PIXEL modules installation.
- Designing and starting software and hardware integration



• Bi-weekly tracking of the models and agents deployment following the new pilots validation methodology.

# Task 7.3: Intermodal Transport trial: Port of Monfalcone

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

- Establishment of the basis on how to manage the execution to achieve the scope of the task, including a work plan and assignment of duties to the different partners involved.
- A first work of identification of software and hardware that have to be integrated for the ASPM/SDAG pilot execution, resulting in a to-do list for the integration that was included in the deliverable D7.1
- A first set of integration tests were identified and defined in the TestLink web tools.
- Data gathering, selection of data models, planification of NGSI agents development.
- Development of NGSI agents
  - Vessel calls (from the website of ASPM)
  - Certain SILI data needed for running models
  - Data from the videocameras of (already installed in) Monfalcone
- Final clarification of the equipment needed to run PIXEL, collection of the equipment and start the phase of putting it in place.
- Designing and starting software and hardware integration
- Collaboration with WP4 partners in order to prepare the software and operational mechanisms to achieve having the models running.
- Setting up the needed equipment to run the pilots. As per technical decision, the computing equipment has been divided in two virtual machines. Since the beginning of the period, the equipment (Linux servers) has been made usable. Technical partners more involved in this task (ORANGE, INSIEL and UPV) have been granted with VPN credentials and SSH access to proceed with PIXEL installation.
- PIXEL modules installation.
- Designing and starting software and hardware integration
- Bi-weekly tracking of the models and agents deployment following the new pilots validation methodology.

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

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

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



- Final clarification of the equipment needed to run PIXEL, collection of the equipment and start the phase of putting it in place.
- Designing and starting software and hardware integration
- Collaboration with WP4 partners in order to prepare the software and operational mechanisms to achieve having the models running
- Setting up the needed equipment to run the pilots. As per technical decision, the computing equipment has been divided in two virtual machines. Since the beginning of the period, the equipment (Linux servers) has been made usable. Technical partners more involved in this task (UPV, PRO and PEOPLE) have been granted with VPN credentials and SSH access to proceed with PIXEL installation.
- PIXEL modules installation.
- Designing and starting software and hardware integration
- Bi-weekly tracking of the models and agents deployment following the new pilots validation methodology.

# Task 7.5: Transversal trial: Port Environmental Index development

The Transversal Trial Port Environmental Index (PEI) development started in M14 and will end in M38 (according to the updated Grant Agreement), so five months were executed till the end of the last reporting period.

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

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

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

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

Other activities performed in the task so far (M30) were:

- Experiences from the noise modelling done in previous periods were used to determine the optimal positions for the placement of noise sensors in the pilot ports
- During the Plenary meeting in Thessaloniki sensor purchasing by the ports has been addressed and recommendations have been provided.
- The next NGSI agents have been developed during this reporting period for the PEI execution:
  - All agents for THPA.
- The PEI methodology for calculation of the PEI index was finalized for Port of Thessaloniki where we expanded the methodology for Port Authorities and Terminals (in addition to the ships, as in the previous period).
- Full execution of PEI in THPA year 2019, validation of results.
- Demo of the tool of the pilot to all partners using the validated (finalised) example execution in THPA.

## Task 7.6: Inter-pilot integration and collaboration

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



During M19-M30, as the developments are highly dependent on the results of the rest of the tasks in the WP, not many materialisations have been performed. The points that have been working on are:

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

# 2.2.7.2. Summary of results after previous periods

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

- Definition of the validation approach to validate the platform integration and pilots.
- Definition of test plans, test cases and the initial execution plan.
- Clear planification by sprints following agile methodology has been set, put in place and is being followed by technical partners in charge of the integration.
- An integrated working demo functioning that was shown during the mid-term review
- Assignation of technical experts to different pilots in order to establish a parallel tracking and execution of the deployments (one port one pilot one technical partner assigned)
- Development of NGSI agents of the different pilots: T7.2, T7.3, T7.4 and T7.5 have developed several NGSI agents that are already integrated in a "development environment" that will be later translated to the on-premises servers.
- Certain remote servers and on-premise infrastructure prepared for the integration.
- A new Pilot validation methodology
- Huge advances in the pilots: agents' integration, model integration, new visualizations.
- Platform PIXEL installed 100% in one port and more than 50% in the others.
- New sensors being installed and integrated for PIXEL.
- Creation of a new task T7.7 (result related with WP2) that will be reported in the next period.
- Complete version of ship index calculation.
- Deliverables submitted successfully:
  - Deliverable D7.1 Integration Report V1

# 2.2.7.3. Progress in M31-M36

#### Progress by task

## Task 7.1: Integration of PIXEL components

Task T7.1 has been executed during the whole period, being one of the most crucial activities of the project in this moment. In this period (M31-M36), this task has been pursuing the achievement of the following objectives:

- 1. Minimising the time-to-production of all software components.
- 2. Smooth execution of the pilots vis-á-vis technology availability.
- 3. Ensuring a proper communication with WP8.
- 4. Conduct enough reviews, validations and confirmations before considering a pilot "closed".

For achieving so, T7.1 (whigh has been one of the most intensive of the project in this period) has overseen:

- Tracking of the evolution of all subsequent tasks using the new pilots validation methodology.
- Specification (in detail) of all the visualisations (widgets) to be developed and integrated for end-to-end validating and WP8-evaluating all models in all pilots.



- Training/tutorial session to technical partners on how to leverage the Dashboard visualization framework (visualization configurator and widgets creation) for developing the visualisaton in a more distributed, parallel, organised way.
- Analysis of arising issues and proper distribution of tasks among technical partners to ensure coverage to: (i) maximise skills leverage, (ii) speed the integration with the aim of start evaluating the pilots as soon as possible.
- Creation of a new "DevOps"-related methodology for uploading new versions of the code of the models, visualizators, agents, etc. and to organise (in a coherent way) the successive deliveries of the platform (documenting the changes and updates done after each commit).

# Task 7.2: Energy Management trial: Port of Bordeaux

Task T7.2 has been being executed the whole 6-months period M31-M36. The main activities conducted during this period have been (in parallel, mutually feeding and interacting with WP6 partners):

- Data gathering, selection of data models, planification of NGSI agents development
  - Installation of additional sensors (purchased within PIXEL) and integration in the infrastructure. This activity will be ongoing during the next reporting period as well.
  - Incorporation of new data sources gathered with the purpose of covering PIXEL use-cases.
- Development of NGSI agents
- PIXEL modules fine-tuning, orchestration and utilisation.
- Finalising hardware and software integration
- End-to-end checks for the modules integrated.
- Training/tutorial session to technical partners on how to fulfil the PAS forms (ultimate version already finalised and installed in all pots) for defining the supply chains of the port in order to properly run and execute the PAS model in every port.

The following advances have been experienced in the period M31-M36 are the following – note: this reporting format has been extracted from the new pilots validation methodology:

- PIXEL installation level: 100%
- NGSI agents developed: 8
- NGSI agents fully (end-to-end) integrated: 3
- Dockerised models integrated: 4
- Models' completion level reached:
  - PAS modelling: PAS forms fulfilled validation completed, visual.
  - Vessel calls prediction: agents finalised, model integration finalised, agreements closed, visualisation finalised, end-to-end at final stage.
  - Prediction of renewable energy production: agents finalised, model almost finalised, agreements closed, visualisation ongoing, end-to-end pending.
  - ETA prediction with AIS agents done, model done, agreements closed, visualisation ongoing, end-to-end pending.
  - Energy demand prediction: agents finalised, model integrated, agreements closed, visualisation finalised, end-to-end at final stage.

#### Task 7.3: Intermodal Transport trial: Port of Monfalcone

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

- Data gathering, selection of data models, planification of NGSI agents development
  - Installation of additional sensors (purchased within PIXEL) and integration in the infrastructure. This activity will be ongoing during the next reporting period as well.



- Incorporation of new data sources gathered with the purpose of covering PIXEL use-cases.
- Development of NGSI agents
- PIXEL modules fine-tuning, orchestration and utilisation.
- Finalising hardware and software integration
- End-to-end checks for the modules integrated

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

- PIXEL installation level: 100%
- NGSI agents developed: 5
- NGSI agents fully (end-to-end) integrated: 5
- Dockerised models integrated: 3 (COVID pilot, Hinterland multimodal model, PAS)
- Models completion level reached:
  - Traffic prediction: agents finalised, model integrated, agreements closed, visualisation finalised, end-to-end pending.
  - PAS modelling: agents finalised, model integrated, agreements closed, visualisation ongoing, end-to-end pending, PAS forms fulfilled.
  - Hinterland multimodal: agents finalised, model integrated, agreements closed, visualisation closed, end-to-end finalised.

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

Task T7.4 has been being executed the whole 6-months period M31-M36. The main activities conducted during this period have been (in parallel, mutually feeding and interacting with WP6 partners):

- Data gathering, selection of data models, planification of NGSI agents development
  - Installation of additional sensors (purchased within PIXEL) and integration in the infrastructure. This activity will be ongoing during the next reporting period as well.
  - Incorporation of new data sources gathered with the purpose of covering PIXEL use-cases.
- Development of NGSI agents
- PIXEL modules fine-tuning, orchestration and utilisation.
- Finalising hardware and software integration
- End-to-end checks for the modules integrated.

The following advances have been experienced in the period M31-M36 are the following – note: this reporting format has been extracted from the new pilots validation methodology:

- PIXEL installation level: THPA 100%, PPA 100%
- NGSI agents developed: 8 THPA, 7 PPA
- NGSI agents fully (end-to-end) integrated: 4 THPA, 3 PPA
- Dockerised models integrated: 2 THPA, 1 PPA
- Models completion level reached:
  - $\circ$  THPA Air pollution: integration on-going, visualisation ready, agreements closed, end-toend pending.
  - THPA Noise pollution: integration done, visualisation ready, agreements closed, end-to-end pending.
  - THPA Traffic predictions: agents finalised, model dockerised not integrated yet, agreements closed, visualisation ready, end-to-end pending.



- THPA PAS modelling: PAS forms pending, agents done, model dockerised not integrated yet, agreements closed, visualisation done, end-to-end pending.
- $\circ$  PPA Air pollution: integration ongoing, visualisation ready, agreements closed
- PPA Noise pollution: integration ongoing, visualisation ready, agreements closed
- PPA Traffic predictions: agents done, model integrated, agreements closed, visualisation ready, end-to-end pending.
- PPA PAS modelling: PAS forms pending, agents ongoing, model dockerised not integrated yet, agreements closed, visualisation closed, end-to-end pending.

## Task 7.5: Transversal trial: Port Environmental Index development

The task T7.5 in M31-M36 was continuously advanced building upon the results provided by deliverable D5.3 and the execution and finalisation of the tool applied to the Port of Thessaloniki (year 2019). As it has been commented in previous sections, the development of NGSI agents for the PEI pilots has been placed in this task.

According to previous agreements (Plenary Meeting in July 2020), it was. planned for ports to deploy the PEI after the work done in D5.3, which was also finished during this period. The agreed approach consisted in starting by developing all the agents and deploying the PEI in one port (THPA) and then taking advantage of the code generated, documentation and lessons learned to tackle the rest of pilots in a serialised fashion: THPA->ASPM->GPMB->PPA.

Therefore, that is what T7.5 have been focused during this M31-M36 period. The current status (achieved after this period of work is):

- Port of Monfalcone: Several agents developed (4 out of 6 needed). PEI visualization (UI) integrated in the platform. PEI model will be tested and validated by mid May.
- Port of Bordeaux: Several agents developed (2 out of 7 needed). PEI visualization (UI) integrated in the platform. PEI model will be tested and validated by end of May.
- Port of Piraeus: Several agents developed (3 out of 6 needed). PEI visualization (UI) integrated in the platform. PEI model will be tested and validated by mid June.

In addition, the "backend of the PEI" – PEI as a model has been improved during the current reporting period (M31-M36), refining the mathematical methods being used, adding certain options and including functionalities such as external database consultation, recommendations engine (coming from T5.5), improvement of some graphics and others.

## Task 7.6: Inter-pilot integration and collaboration

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

- Analyse the data sources that will be available in the different pilots to define which possible new models can be applied to existing pilots that were not initially planned
- Identify new models/combination of existing models. So far, the integrations expected (considered enough to cover task's scope are):
  - Traffic model to other ports
  - Potential adaptation of the energy demand model to other ports within PIXEL
  - COVID-19 pilot integrated in PIXEL and tested in other ports beyond Monfalcone
  - PAS energy modelling results with regards to air emissions, to be benefitted by the rest of the pilots (not only the port of Bordeaux)
- Review potential synergies among models under integration.



## Task 7.7: COVID-19 pilot for the Port of Monfalcone

T7.7 has had the majority of its execution in this period. This means that the last reporting period (M25-M30), this task had not started yet (introduced by amendment #2) and in the next reporting period (M37-M41), it will only be executed during 2 months, that will be mainly focused in finalisation of details and documentation.

Therefore, the work done in this period in the COVID-19 pilot can be summarised as follows:

- Decide DB and technology, prepare a server to run the MVP.
- Definition of the PAS output format, development of PAS forms, fulfilment of PAS forms, fine-tuning of PAS code to include staff and distancing (new).
- Development of NGSI agent and integration of vessel calls
- Visualisation UI for the results of the model.

Table	7	C	antribution	of months and	WD7	1/21	1/26
<i>uvie</i>	/.	Summury	contribution	of parmers	VVII /	WIJI	-11130

Partner	Contribution
P01 UPV	• Attendance to all WP7 bi-weekly conferences.
	• Develop NGSI agents in tasks T7.4 and T7.5
	• Develop visualisation interfaces in tasks T7.4 and T7.5
	• Finalisation of the installation of PIXEL (v2) in THPA premises
	• Integration of HOPU sensors (SmartSpot) station data into PIXEL platform.
	• Devise and participation on TC-PC agile review mechanisms
	Extensive work on enhancing PEI backend and frontend tools
	• Coordination and prominent technical development of the pilot COVID-19 for Monfalcone (T7.7).
	• Participation in T7.6 proposing potential cross-pilots and preparing the technical achievement.
P02 PRO	• Lead WP7 bi-weekly conferences and WP6-WP7 control sessions under Agile Development management.
	• Work package leadership: coordination of activities in pilots, reporting, support and control of deadlines.
	• Definition of integration methodology and application.
	• End-to-end integration of all active pilots + development + demo scenarios.
	• Creation of the temporal development platform for testing purposes.
	• Prepare the virtual meetings – WP7 session (pilot template and organize/lead the session)
	• Coordinate the different bugs / issues of the platform during this period
	• Refinement of user experience of the platform.
	• Framework conversion of dashboards tool for a better scale-up.
	• Task 7.1: Task leadership. Integration work between elements is ongoing and coordinated by PRO.
	• Task 7.2: Support to GPMB pilot: deployment, integration, security and hotfixes. Update and support on PAS Forms.
	• Task 7.3: Support to Port of Monfalcone pilot: deployment, integration, security and hotfixes.
	• Task 7.4: Support to Port of THPA and PPA pilots: deployment, integration, security and hotfixes. Development, integration and refinement on NGSI Agents for these pilots.



	• Task 7.6: support to inter-pilot use cases.
	• Participation of the Covid Use-Case: architectural approach.
P03 XLAB	Attendance to all WP7 bi-weekly conferences
	• Attendance to joint WP6-WP7 control sessions under Agile Development management
	• Continuous support to pilot deployments concentrated on issues related to Information Hub integrations with Operational Tools, Data Acquisition Layer and Predictive Algorithms. Further work on the refinement of navigational status, ETA and turnaround time prediction models resulting in better performance.
	• Support to INSIEL for the integration of road traffic data.
	• Support to ThPA/UPV to deploy road traffic PA.
	• Support to GPMB/Orange for integration of ETD PA and deployment of the IH.
P04 INSIEL	• Attendance to all WP7 bi-weekly teleconferences.
	• In the period M31-M33 has been test the intermodal model with some components of PIXEL infrastructure installed on Insiel premise. In the meantime Orange and Insiel continued to install the new version of the platform, due to some upgrade of some components on the Insiel infrastructure, in order to start to test all platform components integrated with Monfalcone Port model.
	• In the period M34-M36 has been solved some issues on PIXEL platform in cooperation with Orange and XLAB in order to make running the intermodal model within the PIXEL platform using all components of the platform.
	• INSIEL integrated Monfalcone model agents to PIXEL platform.
	• INSIEL continued with the development of all agents for the data flow between DAL, models and IH, within the platform . Moreover the development of the agent for PEI is started.
	• Participation in all meetings of T7.7 – COVID pilot, and devising of the relation of the new tool for the Port of Monfalcone with the hinterland multimodal model.
P05 CATIE	• Attendance to WP7 telcos.
	• Task 7.1: CATIE follows the integration plan in GPMB and test and validation of models as leader of WP4; Many works has been done to integrate PAS model in the PIXEL platform. Participation in identification of integration issues and support for solving them. Test of dashboard and of the Operational Tools. Close work with UPV and PRO. PAS mode has been successfully integrated into GPMB's PIXEL instance.
	• Adaption of the PAS model for its integration in the PIXEL architecture.
	• PAS model fully tested and able to be run through the PIXEL platform.
	• Leading of task T7.2: CATIE has organized the work within partners. CATIE in collaboration with GPMB and ORANGE work on software and hardware integration for the energy management use-case. Mainly all data sources have been integrated. PIXEL platform has been deployed in GPMB. Coordination of integration actions.
	Participation of the Covid Use-Case:
	<ul> <li>Modification and adaptation of PAS model to integrate density and number of workers.</li> </ul>
	<ul> <li>A new version of PAS model has been delivered and the MVP of the covid use- case has been validated</li> </ul>
	<ul> <li>Test of visualisation of raw data and PAS results.</li> </ul>
P06 ORANGE	Attendance to all WP7 telcos
	<ul> <li>Support of the DAL orchestrator.</li> </ul>



	• Support partners in developing their own agents for all WP7 pilots.					
	• Support use of the pyngsi framework.					
	• Investigate end-to-end data flows on the PIXEL platform on GPMB premises.					
	• Following all pilots integration and NGSI Agent creation.					
	• Dockerize all NGSI Agents for GPMB.					
	• Write JSON schemas describing FIWARE datamodels use on GPMB Pilots.					
	• Deploy a new platform for demo and integration in ORANGE infrastructure.					
	• Participate actively in GPMB pilot execution (T7.2).					
	• Support to model validation.					
	Support deployment of platform on all pilots					
	Support platform configuration on FRBOD					
	• Help INSIEL to manage their platform.					
	• Add evolution on PyNGSI to support MQTT.					
	Prepare the integration of HOPU (sensor noise and light) data.					
	Make evolution of VesselCall Agent for PEI data.					
P08 MEDRI	Attendance to all WP7 teleconferences					
	• Usual work as task leader (task T7.5). Additionally, the following activities we carried					
	out in the context of the PEI pilots during the M31-M36 period::					
	• The data was provided by the Port of Thessaloniki containing the information					
	on gas and electricity consumption as well as for the waste and wastewater. After careful consideration of the provided data some issues related to waste					
	and wastewater data raised so they were being solved. Previously developed					
	methodology was adapted in order to make it possible to calculate the eKPIs					
	for port authorities and terminals for the Port of Thessaloniki. Preparation work for the Port of Monfalcone PEI was done as well					
	$\circ$ Continuing from the previous reporting period, the work was continued on the					
	implementation of the PEI in the pilot ports. During this time period weekly					
	teleconferences were held with UPV, ports and technical partner working on					
	each port. As the work in the Port of Thessaloniki was mostly finished during the provides reporting period, most of the effort in this reporting period was					
	done on the implementation of the PEI in the remaining three ports (mostly					
	Bordeaux and Monfalcone).					
P09 SDAG	• SDAG contributed for the implementation of the task by providing feedback on the					
	related activities lead by PRODEVELOP and helping the Port of Monfalcone with the					
	implementation of the PEI.					
	• Furthermore, SDAG contributed to activities related to the new introduced Covid Pilot.					
	• SDAG also participated in some TelCos WP7 related and in all Covid Pilot telcos, working for integrating parking areas of SDAG related to COVID restrictions in					
	Monfalcone.					
	• Contribute for all tasks and activities for the implementation of the new Covid Pilot and					
	give support for the writing of the scheduled deliverable giving its experience and competence as an interport.					
P10 THPA	<ul> <li>Attendance to all WP7 – pilots + integration teleconferences</li> </ul>					
	• ThPA installed and deployed successfully the sensors required, for the scope of the					
	project. Relative communications took place, among the technical partners and					
	suppliers, in order to customise the sensors. representatives of the team attended the					
	1 tirst PIXEL webinar, as part of the project's communication activities. Moreover, waste					



	<ul> <li>and energy data for 2020, was collected/translated, verified and sent through the API, to technical partners of the Consortium.</li> <li>T7.4: For the recording of progress of the pilot implementation and better communication among partners, weekly telcos were scheduled, between PEOPLE and THPA. Remaining datasets were aggregated and evaluated.</li> <li>In addition, ThPA team of the project, made all relevant preparations and communications, for the ThPA presentation of the pilot progress in the Plenary meeting, that was held on the 24-25<sup>th</sup> November and the next one, held at mid of February 2021. Furthermore, after the PEI demonstration meeting with MEDRI and UPV, relevant meetings were held among the involved ThPA departments, for the evaluation of results.</li> </ul>
P11 PPA	<ul> <li>Attended to all WP7 – pilots + integration teleconferences</li> <li>Within the PPA pilot task (T7.4):         <ul> <li>Exchange communication between PEOPLE and Marinetraffic on the vessel calls data, pollution-weather sensors and sound meter software.</li> <li>Support of sensors vendor to PPA staff on software issues.</li> <li>Installation of pollution-weather sensors and sound meter software on PPA laptops</li> <li>Activation of the Microsoft Azzure cloud servers for installing the PIXEL software.</li> <li>Drawing up the pilot activity work plan.</li> <li>Drawing up of the pilot activity work plan and collaboration with the relevant subcontractors for the pilot activities arrangements to connect to the PIXEL platform</li> <li>Finalize the Internet connectivity of all sensors to the appropriate PIXEL software.</li> <li>Customize cloud servers and install PIXEL software modules.</li> </ul> </li> </ul>
P16 APT	Attendance to all WP7 teleconferences
P12 ASPM (changed in Amendment)	<ul> <li>APT contributed to WP7 providing feedback on the activities lead by PRODEVELOP and MEDRI, helping with the implementation of the intermodal trial for the port of Monfalcone and transversal trial for the PEI.</li> <li>APT organized various meeting along with INSIEL and Technical partners in order to evaluate the installation of an environmental sensor in the port of Monfalcone premises</li> </ul>
	<ul> <li>APT continued analysing data coming from ships arrival forms, trying to find specific information useful for the PEI development such as wastes and emissions data. These activities ended with a new internal procedure to record wastes from ships (data contained in MARPOL Annex A.5 via PMIS). Besides, these activities ended with a new internal procedure to record the tonnage of good carried by ships inside the online sailing list that feeds PIXEL.</li> </ul>
	• APT also participated various internal and external Telcos together with INSIEL SDAG, CATIE etc. regarding the integration of the Pixel Hub and COVID pilot and its implementation and also regarding PAS model, visualizations and fine-tuning of the functioning of the tool. This included testing and using the MVP (v1) of the tool, that was already made available by the technical partners of task T7.7.
P13 GPMB	• Attendance to all WP7 teleconferences



	T7.5 : Green Marine exchange						
	• T7.1: Sensor station for Noise and Light (installation and issues)						
	• T7.2: Energy description of Bassens terminal, WASTE information gather (Ship and terminal)						
	• Installation of SmartSpot station (noise and light)						
P14 IPEOPLE	Attendance to all WP7 teleconferences						
	• Leading task T7.4 carrying out usual management activities						
	• Technical work in task T7.4:						
	• Organized and conducted Telcos with ThPA and PPA regarding Task 7.4						
	<ul> <li>Providing support to ThPA and PPA in numerous issues.</li> </ul>						
	<ul> <li>Developing NGSI Agents for ThPA (cont. from prev. period)</li> </ul>						
	• Following the sensors procurement and installation for ThPA and PPA						
	• Overseeing sensor installation						
	• Overseeing sensor data availability						
	Organized and conducted Telcos with ThPA and PPA regarding Task 7.5.						
	• Participation in PAS configuration for the COVID pilot – T7.7.						
P15 CERTH	Attendance to several WP7 teleconferences						
	• Interaction betweegn WP7 and WP8.						
	• Participation in teleconferences relevant to the COVID Pilot.						
	• Harmonization of work between WP7&WP8.						
	• Coordination of the support needed on behalf of technical partners to the Ports' representatives, in order for the later to fulfill their obligations and to be in the position to prepare themselves for the evaluation.						
	• Participation in teleconferences relevant to the COVID Pilot.						
	• Preparations for the evaluation of the COVID pilot.						

# 2.2.7.4. Results after M31-M36

- A new TC-PC methodology for solving deployment issues in a more agile way
- Huge advances in the pilots: agents' integration, model integration, new visualizations.
- Platform PIXEL installed 100% in all ports
- A total of 8 models already running, visualised and providing results in the ports.
- Minimum Valuable Product (MVP) tool of the COVID-19 pilot available.
- Training material recorded available.

# 2.2.7.5. Deviations

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

WP2 risk management is continuously tracking the evolution and applying proper corrective measures.

# **2.2.7.6.** Corrective actions

The PC and TC have put in place a mechanism that reviews the issues in deployment on a weekly basis and dynamically assign resources (partners, personnel, postponing teleconferences, etc.) to ensure a more agile pace of integration, for complying with WP7 and WP8 deadlines.

Further than the previous, no corrective actions have been put in place during this reporting period.



# 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 and was supposed to be finalising by the end of this reporting period (M36). However, it has been extended (see below Amendment #2). Hence, it has been running for 26. In terms of tasks, all tasks have been initiated by M36 and only T8.1 was already finalised on M16.

The most prominent aspect of the WP8 execution is the dependency with the results of two previous work packages: WP6 and T7.1 (especially for the technical assessment in T8.2) and the completion of the pilots in WP7 (especially in regard to the business assessment in T8.3). These dependencies are already being materialised in delays in the execution of WP8, that were tried to be compensated (risk materialised and managed) by extending the work package 5 months. The risk assessment task in WP2 carefully analyses this evolution and puts in place any possible mitigation measure. The WP8 tasks are being normally executed, having prepared all means for the evaluation to take place as soon as the pilots will be running and generating results.

During the last semester work (M31-M36) in the framework of WP8 was related to the preparation actions for the evaluation of the PIXEL Platform and use cases. Based on the initial time plan, the deployment of the PIXEL Platform is finalised (installed in all ports) and pilots are in its final stage of completion (to be finished before M38). Due to various reasons, related mainly to technical challenges and to the COVID-19 related restrictions, the expected pace of finalisation of pilots was slowed, so the work was focused on being absolutely poised to start the evaluation as soon as the circumstances would allow it. Apart from the previous, the work during M31-M36 has been focused on technically evaluating (under standalone fashion) the modules and models of PIXEL (T8.2), preparing the content for evaluating the business cases (T8.3) and advancing towards proof of concept of the tools in external ports (T8.4).

**WP8 has formally performed some changes** over its original workplan through **Amendment #2**: An extension of all the currently active tasks in WP8 (T8.2, T8.3 and T8.4), that now end at M41 (new final date of the project). The extension of the three tasks also means the re-scheduling of the due date of deliverables D8.3, D8.4 and D8.5, which were planned for the month M36, and that now are expected by M41 (Sept2021). The WP itself has been extended 5 months, till 30<sup>th</sup> of September 2021.

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

# **2.2.8.1.** Summary of progress in previous periods

## Progress by task

## Task 8.1: Evaluation Plan

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

• Design of the plan of the technical impact assessment. It was decided to use evaluation models based on the Square assessment framework.



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

This task was successfully finalised in M16.

## Task 8.2: Technical Impact Assessment

Task T8.2 started in month M15, therefore by the end of the past reporting period (M30), fifteen months of the task were executed. The activities conducted till that point were:

- Definition, discussion and agreement on the task time planning and the ToC (Table of Content) for the deliverable (D8.2).
- Creation of a first version of the questionnaires for TAM3 and AIMQ questions.
- Creation and sharing of a collaborative document for D8.2.
- Writing of a first draft for a majority of sections.
- Measurement of some technical impact assessment characteristics in order to derive KPIs for the different modules.
- The four pilot sites fine-tuned and finalised the description of their final pilot case and the measures that will be finally implemented with regards to technical impact assessment. This finalisation has included a review and update of the KPIs that will be included in the evaluation methodology.
- Finally, one of the main actions in the task was the writing of the deliverable D8.2 with the most updated information about the business impact assessment.
- Preparation of the tool for the technical evaluation
- Analysis and review of requirements in D3.2, both functional, non-functional and pilot-specific in order to streamline their assessment.
- Participation in the discussions of WP6 integration in WP7, the different advances in the pilots. Helping in the issues occurred.

## Task 8.3: Business & economic impact assessment

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

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



- Preparation of the ToC of deliverable D8.4.
- Definition of evaluation procedures to be carried out whenever the ports will have deployed their pilots.
- Gathering information from ports: a comprehensive list of the activities performed by all PIXEL ports was carried out.
- Update and/or verification of the KPIs included in D8.1, including the design of customized indicators to finely measure the impacts in each user story.

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

Task 8.4 is devoted to two primary goals: (i) Identify future research directions and (ii) implement Proof-of-Concept pilot tests in external ports.

This task officially started during the previous reporting period (M25-M30), more concretely on M25.. However, the task leader (UPV), prepared in the previous months (M19-M24) a clear plan with the different actions to be performed (technically, temporally and with regards to assignation). This plan was made available to the partners and was discussed and agreed in Plenary meetings.

The works conducted during the 5 months previous to the current reporting period were:

- For the first sub-task, and aligned with the proposed plan in deliverable D8.1, the team carried out the identification of main and specific research topics according to the available literature. The timeframe is being split into past trends (1980-2015), recent ones (2015-2020) and future forecast, where PIXEL results will apply. Some links were also established with the DSS tool developed by the CSA DocksTheFuture.
- For the second sub-task, alignment with WP9 was established to provide a homogeneous PIXEL offer and identified some potential candidate ports to make initial contacts. Two ports (Valencia, Trieste) already showed interest and provided initial feedback, which was used to start a FAQ document. Some work has also been carried out to align the methodology described in deliverable D8.1 with the CSA Transferability Analysis tool.

# 2.2.8.2. Summary of results after previous periods

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

- Formulation of the Evaluation Methodology to be implemented for the:
  - o Technical Impact Assessment of the PIXEL Platform in each use case
  - o Business and economic impact assessment of the ICT solution implemented in each use case
  - Proof of concept and future R&D potential of PIXEL.
- Progress in evaluating part of the module characteristics.
- A set of guidelines for the Business and Economic Assessment guidelines for each PIXEL port
- Table of Content and first advances on deliverables D8.3 and D8.4.
- Deliverables submitted successfully:
  - Deliverable D8.1 Evaluation Plan
  - Deliverable *D8.2 Technical Evaluation v1.0*

# 2.2.8.3. Progress in M31-M36

#### **Progress by task**

## Task 8.2: Technical Impact Assessment

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

During this reporting period, T8.2 has been mainly waiting for the integration of work done in the framework of WP7, particularly in the advances of every pilot framed in T7.2, T7.3, T7.4 and T7.5.



In the meantime, some additional tasks have been performed:

- As soon as a functionality is totally ready (OK message must be received from WP7 leader and Technical Coordinator), CATIE is being provided a link (URL) that includes a UI with the needed instructions for conducting the technical assessment. This done mainly for the real implementation in a pilot, but it is also planned to validate functionalities over the "development environment".
- The Table of Contents (ToC) for the D8.3 have been produced and distributed among partners.
- Section 3 of the Report is ongoing and irrelevant to the full deployment of the platform.
- Start of evaluation of certain modules and tools in a standalone mode (PEI, PAS, energy demand, COVID-pilot). On going actions with the previous and other models.
- CATIE produced a questionnaire which is to be filled in by the participating ports.

Task T8.2 will be continued during the next (and last) reporting period.

#### Task 8.3: Business & economic impact assessment

T8.3 has been running during the whole period M31-M36. The progress can be summarised as follows:

- The final guidelines for the business and economic evaluation have been agreed among CERTH and the representatives of the four ports, with the technical partners, also having participated in the discussion. These guidelines include the final KPIs to be measure and the corresponding targets to be achieved. Information on measurement units is also included. These guidelines will be part of the D8.4.
- The formulation of D8.4 is ongoing and will be soon distributed among partners for discussion and input provision. Data collection for the measurement of the KPIs cannot start at this point.
- The partners have agreed to start the distribution of the questionnaires to the relevant parties in order to start collecting data for the qualitative KPIs.
- KPIs for the evaluation of the COVID pilot have also been identified.

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

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

The ToC of the D8.5 has been prepared and finalized. Actions are taken to fill in as many parts as possible at this point. In regards to the Proof of Concept related to participating ports, the partners are taking the necessary steps. Following, in regards to the Proof of Concept involving external to the project ports, several contacts have been made to involved ports. Potential participating ports include the Port of Trelleborg (Sweden), the Port of Valencia and one more port. Finally, a third goal related to this task the methodology and includes re-work with TA for each 'pre-product' and definition of a common methodology.

Partner	Contribution							
P01 UPV	Attendance to all WP8 monthly teleconferences							
	• T8.2: Assessing technically the PEI tool in a standalone mode							
	• Performing several contacts with external ports towards PoC in T8.4							
	Assistance for the business evaluation of the COVID-pilot tool.							
	• Leading T8.4:							
	• Finalising ToC of D8.5.							
	• Finalising the literature research and envisioning of future research lines							
	• Alignment with KERs in T9.4							
	• Established links with the CSA DtF Transferability Analysis.							
P02 PRO	• Attendance to all WP8 monthly teleconferences							

#### Table 8. WP8 Partner contribution summary table M31-M36



	• Integration of technical assessment tools in the platform.
	• T8.2: Help preparing the scenarios for the technical assessment.
P03 XLAB	Attendance to all WP8 monthly teleconferences
	• In the frame of T8.2 XLAB has supported the integration and deployment of WP6 results (Information Hub) and WP4 results (predictive models) for pilots, so to create a comprehensive testbed for the technical impact assessment.
	• In this period, XLAB prepared the technical framework for the technical impact assessment of the PIXEL IH and Predictive Algorithms, as contribution to D8.3.
P04 INSIEL	• In the context of T8.2 and T8.3, INSIEL worked in cooperation with Monfalcone Port and SDAG on technical and business impact assessment, analysed current indicators to evaluate PIXEL solution impact on Italian pilot.
P05 CATIE	Attendance to all WP8 telcos.
	• As the T82. Leader, CATIE has worked on D8.3 and informed WP8 what is expected for the round 2 of technical evaluation. Follow-up of evaluation and risk identification for evaluation.
	• Questionnaire to evaluate what happened in ports before PIXEL has been sent.
	Work on technical assessment has been done.
P07 CREO	Evaluation of PEI module and deployment
	• Writing of D8.3: Section 3 PEI deployment in port.
	Check PEI last technical points of PEI deployment.
	• Prepare the evaluation methodology for the PEI module by port users.
P08 MEDRI	Attendance to all WP8 monthly telcos
	• During this period, all the teleconferences linked with the task were attended and preparation has been done for future work, mostly related to the deliverable D8.3.
P09 SDAG	Attendance to all WP8 monthly telcos
	• SDAG contributed for the implementation of the task by providing feedback on the related activities lead by CERTH, gave comments and contributions about documents/information asked by CERTH.
	• SDAG also participated in all the TelCos WP8 related.
	• T8.3/4 Business and economic impact assessment – SDAG continued to give feedbacks, support and information needed for all the tasks and for all the deliverables. Furthermore, also providing comments about documents and information that the task leader needs.
	• SDAG together with Insiel and the Port of Triest, contributed to revising the documents and KPIs.
P10 THPA	Attendance to several WP8 telcos
	• Meetings with the project's subcontractor, assisting in WP8 tasks
	• The relevant outcomes were the ThPA contribution in regard to Task 8.3 Business and Economic Impact Assessment of the PIXEL Use Cases, which was delivered to WP8 leader, as well as the Questionnaire for the assessment of the impacts of the measures implemented in the framework of the PIXEL Project. Finally, the revision of Green Marine Indicators for Port Authorities in "Environmental Leadership" and "Community Impacts".
P11 PPA	Attendance to all WP8 telcos
	• Provided contribution for D8.3.



	• Participation in the biweekly WP8 teleconferences, teleconferences with PEOPLE and marine traffic on the vessel call data. Teleconferences with PEOPLE on 23/9/2020 on the pilot methodology-implementation and the biweekly plenary telcos.
P16 APT P12 ASPM (changed in Amendment	<ul> <li>Attendance to all WP8 telcos</li> <li>APT provided feedbacks and information to CERTH in order to fulfil the activities related to the implementation of T8.3. Questionnaires has been filled in both for the Ports of Trieste and Monfalcone.g</li> <li>The same questionnaire has been shared with port operators asking to contribute in PIXEL activities</li> <li>APT revised the KPIs list previously defined by ASPM after discussions with PIXEL project partners and APT departments, considering the different role of APT over</li> </ul>
P14 IPEOPLE	<ul> <li>ASPM in the port of Monfalcone.</li> <li>Attendance to all WP8 monthly telcos.</li> </ul>
	• Organized and participated in T8.4 meeting about PAS.
P15 CERTH	• Overall coordination of WP8 in general and of Task 8.3 in particular, which is related to the business and economic assessment of the PIXEL use cases.
	• Organization of monthly progress teleconferences (scheduling, agenda, minutes preparation).
	• Bilateral calls, when necessary, with Ports' representatives in order to finalize the evaluation strategy to be implemented towards the coming months.
	• Finalization of specific guidelines for each pilot site in regards to the business and economic assessment. The final KPIs to be measures have been identified, along with measurement units and relevant target values.
	• Finalization of questionnaires to be used in the framework of Task 8.3 for the qualitative evaluation of indicators.
	• Preparation of the template for the relevant report; D8.4. The above information will comprise part of this report.
	• Work on D8.5 – Finalization of the search for review papers and other sources of information for the three periods (until 2015, 2015-2020, 2020-) and work on the preparation of the report.

# 2.2.8.4. Results after M31-M36

The main results that obtained during the M31-M36 period of the project in WP8 are the following:

- Table of Content and first advances on deliverables D8.5
- Advances on deliverables D8.3 and D8.4
- First technical evaluations of modules and models in a standalone fashion.
- Finalization of questionnaires to be used in the framework of T8.3 for the evaluation of indicators.
- Finalization of specific guidelines for each pilot site for business and economic assessment. The final KPIs to be measures have been identified, along with measurement units and relevant target values.

# 2.2.8.5. Deviations

No deviations detected further that the repeatedly mentioned affectation from WP7 delays on finalising the pilots. Risks (see Section 4) are being tracked specially with regards to WP8.

# **2.2.8.6.** Corrective actions

No corrective action performed during this period.



# 2.2.9.Work Package 9 – Exploitation, dissemination and communication

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

This period, same as the previous one, has been anomalous compared to first two years of the project. It has been strongly marked by the effect of the COVID-19 outbreak, which drastically changed a huge part of the dissemination structure as it had been known till that moment.

Although vaccination is advancing in most Europe countries, travelling and attending to physical events is not safe yet (and not allowed/recommended by the majority of governments). Therefore, the dissemination events (in general) are still being conducted virtually.

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

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

In particular, especial emphasis has been put on two actions: (i) enhancing the PIXEL presence in industrial conferences, targeting a number of events to be attended (presenting PIXEL) before the end of the project, including technical demonstrations and workshops-booths and (ii) advancing towards the exploitation of PIXEL, working on the Key Exploitable Results and devising the possible options to exploit PIXEL products.

**WP9 has formally performed some changes** over its original workplan through **Amendment #2**: An extension of all tasks in WP9 (T9.1, T9.2, T9.3 and T9.4), that now end at M41 (new final date of the project). The extension of the four tasks also means the re-scheduling of the due date of deliverables D9.5 and D9.8, which were planned for the month M36, and that now are expected by M41 (Sept2021). The WP itself has been extended 5 months, till 30<sup>th</sup> of September 2021.

# **2.2.9.1.** Summary of progress in previous periods

## **Progress by task:**

## Task 9.1: Communication and impact creation

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

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



- PIXEL official leaflet: 2 versions were created (M1 and M18).
- PIXEL stickers were designed, printed and are part of the dissemination kit of PIXEL from M6.
- Newsletter: following a plan of one issue each 5 months, 2 newsletters have been generated and submitted to the mailing list of subscribers.
- Continuous update of the website each time a new deliverable was submitted, a new event was attended or any other dissemination and technical related activities have been going on in the project.
- Continuous update of social media channels following the same strategy and timely pace than for previous reporting periods.
- Creation and submission of the newsletter #2
- Definition of content for the newsletter #3
- Preparation of the script and plan for the next (and last) commercial video to be delivered during the next reporting period.
- Generation of new videos and upload to the YouTube channel.

#### Task 9.2: Scientific dissemination

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

The activity and planning were conducted jointly to adjust the events to attend and the papers to be submitted to fairs and congresses. For tracking and planning scientific publications (equal than for other dissemination activities) an Excel sheet-based tool has been used during all the M1-M30 period (also for M31-M36 and it will be used as well till the end of the project). The publication results are summarised in the following table:

	Presented	Accepted	Success rate	Published	IoT/ICT (presented)	Environment (presented)	Logistics (presented)	Global (presented)
Proceedings	11	9	81,80%	5	7	3	1	3
Journals	8	8	100%	8	2	6	0	0

Table 9. Publication results/statistics by M30

- Additional actions were conducted in the period M1-M30 in this task:
  - A set of KPIs for Scientific dissemination were drafted and finally converted into a more specific table within the reporting period.
  - Press releases: Several press releases have been made so far related to PIXEL advances
  - Lectures at the University.
  - PhDs started: for now, 4 PhD programs have started by people working directly in the project.
  - o Continuous monitoring of publication opportunities
  - Design of a new methodology for scientific publications, accompanied by an Excel file available via the online repository to all the partners:
  - Regarding the technical collaboration with other projects, PIXEL has reinforced its provision to the DataPorts project (NGSI agents and DAL).
  - Contribution to open-source initiatives:
    - FIWARE Data Model request was made
    - Updated to GitHub some models and alogrithms, agents and other contributions.
    - Different use from external organisation of PIXEL code/projects made public
    - PyPl pyngsi framework library
    - Contact with FIWARE to propose new data models (e.g. tide sensor).



### Task 9.3: Industrial dissemination

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

During the period M1-M30 the activities conducted in this regard were:

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

#### Task 9.4: Exploitation and Business Plan

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

The tasks conducted during M1-M30 to be aligned with the previous were:

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



- Strategy for the ROI at PIXEL
- Update IPR and exploitable results, and further product definition
- Identification and description of main innovations
- Further definition of assets of PIXEL, and complementary analysis with those of COREALIS and PortForward in the context of an exploitation-based liaison
- Preparation and discussion to approval and release of value proposition validation questionnaires for PIXEL ports but algso for ports and stakeholders at DocksTheFuture, CORIALIS and PortForward
- Analysis of ROI and plan of ROI assessment at PIXEL
- Early draft of the commercial offer
- Analysis of value proposition validation questionnaires for PIXEL ports but also for ports and stakeholders at DocksTheFuture, COREALIS and PortForward
- Progress on the ROI definition based on PIXEL ports WP7 deployments
- Refinement of PIXEL's 4-tiered commercial offer
- Coordination of content on KER description feeding communication
- Pitch canvas description and first draft of 2nd PIXEL video storyline
- 1-to-1 IPR management meetings

# **2.2.9.2.** Summary of results after previous periods

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

- Effective communication materials (2 leaflets, 2 posters and several videos). Access to all of them are available through our PIXEL website.
- PIXEL website active and continuously updated with all recent information, including events, publications, marketing material and deliverables as they are being released (public ones). The website is GDPR compliant. Metrics monitoring tools are available to evaluate the impact.
- PIXEL social network active with periodic updates on our PIXEL events. Twitter and website are linked to increase the impact. Metric monitoring tools are available to evaluate the impact
- Effective dissemination plan in terms of scientific and industrial dissemination. Methodology for identification and tracking of events (how, who, when, preparation and outcomes)
- Business and Exploitation Plan and New (updated in M24) dissemination plan
- Newsletters #1 and #2
- PEI value proposition
- Initial RoI calculation and RoI calculation tool
- Formal contacts and certain commitments with IAPH, ESPO and IMO organizations.
- New complete webinars plan.
- 5 new videos uploaded to Youtube channel.
- Presentations at industrial events and articles published.
- Article about PIXEL, its innovation and utility for Port-City interface in the AIVP website.
- Initial design of PIXEL's 4-tiered commercial offer.
- A total of 19 videos uploaded to the YouTube channel.
- Deliverables submitted successfully:
  - Deliverable D9.1 Virtual Presence
  - Deliverable D9.2 Communication support
  - Deliverable D9.3 Dissemination Plan
  - Deliverable D9.4 Report on Dissemination and Update of the Dissemination Plan v1


- Deliverable D9.6 Draft Exploitation Plan (CO)
- Deliverable D9.7 Business and Exploitation Plan v1 (CO)

## 2.2.9.3. Progress in M31-M36

#### **Progress by task:**

#### Task 9.1: Communication and impact creation

The following activities were performed within task T9.1 in the period M31-M36:

- Continuous update of the website each time a new deliverable was submitted, a new event was attended or any other dissemination and technical related activities have been going on in the project.
- Continuous update of social media channels following the same strategy and timely pace than for previous reporting periods.
- Continuous creation of dissemination material such as images for representation, pitches.
- Generation of new videos and upload to the YouTube channel:
  - o Video extracted from ORANGE's presentation in the "Salon de la Recherche"
  - Video extracted from UPV's presentation in the CSA DocksTheFuture's closure event presentation.
  - A video explaining the technical workflow of the PIXEL solution, created by the Technical Coordinator and focusing on the technological modules of the platform, how they operate among them and the data and process flow.
  - The Data Acquisition Layer module in PIXEL: visualisation and functioning
  - o The Information Hub module in PIXEL: visualisation and functioning
  - The Security module in PIXEL: visualisation and functioning
  - The recording of webinar #1 of PIXEL
  - The recording of webinar #2 of PIXEL
  - Video extracted from CERTH's presentation in the HUAWEI's Digital Innovation conference.
- Advance on the creation of the new (and final) promotional video of PIXEL. Animations completed, integration of videos provided by PIXEL partners ready, currently at final stages of edition.
- Conduction of the First PIXEL webinar on January 2021. The Project Coordinator and the Technical Coordinator presented PIXEL advances, while PEOPLE guided the session that counted with relevant audience.
- Conduction of the Second PIXEL webinar, hosted by UPV, guided by PEOPLE and presented (mainly) by CATIE, focusing on the usage of the Port Activity Scenario in the context of maritime ports. The audience was also deemed as very good, realising the technical orientation of the session.

#### Task 9.2: Scientific dissemination

The following activities were performed within task T9.2 in the period M31-M36:

- Continuous monitoring of publication opportunities
- Following and tracking the scientific dissemination activities by using the new methodology described during the previous reporting period.
- Contribution to open-source initiatives:
  - Updated to GitHub some PIXEL modules, agents and other contributions.
  - Different use from external individuals/organisation of PIXEL code/projects made public
  - Properly tagging all PIXEL code projects (in internal Git server) for the posterior upload (at the end of the project) to open repositories (as open source contributions for the community).



- Contact with SmartDataModels for potential publication of PIXEL ontologies as public resources.
- Scientific publications Nothing was published in this period, although huge work was conducted on the preparation of submission of several articles. See item below.
- Preparation and submission of scientific contributions:
  - "Leveraging IoT and prediction techniques to monitor COVID-19 restrictions in port terminals". This paper gathers the advances, design and proposal of the COVID-19 pilot in PIXEL. It has already been accepted to be presented in a congress and will be published after a presentation will be conducted.
  - "Monitoring the environmental impact of TEN-T ports operations current status and commonly used performance indicators". This paper is the result of processing the different surveys fulfilled by TEN-T ports about the adoption of environmental metrics (WP5 work). It is under review stage.
  - "The advantage of a Green Smart Port of the Future". This paper has been elaborated by the collaboration of all PIXEL partners. It hast tried to summarise all the advanced posed by PIXEL, scripted around the most important exploitable products (PEI, PAS, PIXEL as a whole solution and ETA/ETD predictive algorithms). It has already been accepted and will be published after presenting the work in the congress.
  - "Port Digitalization through an Activities Scenario Model as a First Step for a Digital Twin of Port". This article for the conference IPIC 2021 explains the potential role of the PAS product of PIXEL as a logistics node simulator in the Physical Internet domain. Abstract accepted and full paper elaboration ongoing.
  - "Functioning prototype of IoT and composite indicators for smart port environmental monitoring". This short paper reflects the proposal for conducting a technological demonstration in the conference MEDITCOM2021. It will be about the PEI tool deployment.
  - "Scale-model showcase to monitor environmental impact in ports using IoT and low-resource equipment". This short paper reflects the proposal for conducting a technological demonstration in the conference MEDITCOM2021. It will be about deploying a scale-model demo.
  - Another paper is being prepared about the smart networking and IoT connection technologies for Smart Ports. This paper will be the result of a shared work of PIXEL with other research projects. This will be reported more clearly in the final report of the project.

#### Task 9.3: Industrial dissemination

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

- Continuous tracking of industrial events. Due to the COVID-19 effects, few conferences are taking place physically (only a couple of interest of PIXEL at this point). In addition, travelling and attending events is still not safe. The task leader (CREO) altogether with the WP leader (UPV) are carefully monitoring these facts and proceeding with proper actions.
- Participation at Le Salon de la Recherche (ORANGE event)
- Participation at Huawei Industrial Digital Transformation Conference
- Participation at Annual Faculty of Medicine Celebration days 2020
- Presentation at the closure event of CSA DocksTheFuture January 2021.
- Presentation at the closure event of COREALIS April 2021.
- Results of the "Relevant entities of the port sector" task force:
  - Participation in the BlueInvest awards
  - Publication of PIXEL in the TRIMIS portal of the EC:
  - Telcos organised and conducted with CSA-related entities.
  - Working on follow-up documents to enhance relation with those organisations.



- Devise of definitive plan of the webinars. The WP9 team has decided to reinforce the relevance of this activity, considering that it may well be the main "industrial dissemination" forum that will be available for the project members during the next months. The changes on the plan have been the following:
  - Definitive dates arranged.
  - Selection of internal partner speakers
  - o Pre-selection of potential external speakers
  - Obtention of results from the first two webinars (already conducted)
  - $\circ$  Fine-tuning of organisation for the webinars from the lessons learned so far.

#### Task 9.4: Exploitation and Business Plan

The following activities were performed within task T9.4 in the period M31-M36:

- Interviews with PIXEL partners regarding the sustainability of PIXEL exploitation
- Template for KER videos
- Defining and describing KERs of PIXEL
- Division of PIXEL KERS into 4 big blocks: PAS, PEI, Big Data Engine, Maritime Analytics.
- Description of the Key Exploitable Results, for the preparation of specific subpages
- PIXEL port configurations and cost structure for the ROI assessment
- IPR management and synchronisation with product definition
- Development (complete) of the commercial offer and pricing model
- Analysis of PIXEL exploitation after the project: individual exploitation, non-profit foundation, etc.
- Deployment and follow-up of marketing campaigns for joint actions
- Strategy for KER submission and impact creation
- Interviews with PIXEL ports regarding the sustainability of PIXEL exploitation
- Finalise the pitch canvas and Llava matrix of the project.
- First steps for the design of the new business-focused website.

#### Table 10. WP9 Partner contribution summary table in period M31-M36

Partner	Contribution
P01 UPV	• Organization of all WP9 telcos and session in both physical and virtual meetings
	Attendance to all Innovation telcos
	• Usual tasks of Community Manager, as responsible of all social channels:
	<ul> <li>Posting of various content</li> </ul>
	• Periodic update of profile
	• Re-share content of other projects and relevant news/events
	• Analysis of trends on communication by other projects/entities in the sector
	• Continuous update and hosting of the new website: <u>https://pixel-ports.eu/</u>
	• Assistance to CREO in the Industrial dissemination tracking and monitoring
	• Conduction of all the relation and interaction with CSA DocksTheFuture and other EC funded projects:
	• Presentation in the last, closure event of the CSA.
	• Presentation in the last, closure event of COREALIS.
	• Update (periodic and asynchronous) of social media accounts and communication channels (Twitter, LinkedIn)



	•	Providing suggestions/requests/recommendations for the website
	•	Supporting XLAB in the innovation and exploitation management tasks
	•	Strong collaboration in T9.4, specially in the tasks related to communication with COREALIS, PortForward and the CSA
	•	Active participation within the task force of "Relation with relevant agencies/entities in the port sector" that is being led by CERTH
	•	Upload to YouTube channel the different videos developed by the partners
	•	Lead the conception of the new promotional video of PIXEL.
	•	Writing of three papers and collaboration on the writing of another two.
	•	Active participation in the analysis of PIXEL KERs, commercial offer and other innovation/exploitation-related activities
	•	Participation in the BlueInvest awards submission
P02 PRO	•	Attendance to all WP9 telcos
	•	Attendance to all Innovation telcos
	•	Post several tweets in Prodevelop's account.
	•	Preparation of the 1 <sup>st</sup> webinar.
	•	Contributions to scientific dissemination.
	•	Attendance to sector-specific conferences and dissemination.
	•	Collaboration in the edition of the (last) commercial video to be delivered during the next reporting period
P03 XLAB	•	Storyline and script contributions to the new project video
	•	Contributions to social media, website and newsletter
	•	Description of the Key Exploitable Results, for the preparation of specific subpages
	•	Preparing the guidelines for the KER videos
	•	Prepare the information hub video.
	•	Contributions to the new project video
	•	Template for KER videos
	•	KER Information Hub video Contributions to social media, website and newsletter
	•	Description of the Key Exploitable Results, for the preparation of specific subpages UMT2021 coordination and contributions to other impact-focused publications
	•	Pitch materials contributions
	•	Deployment and follow-up of marketing campaigns for joint actions
	•	Coordination of pitch activities with the partners
	•	Abstract contribution for the accepted paper to Urban and Maritime Transport 2021
	•	Further pitch materials contributions
	•	Participation on matchmaking events
	•	Coordination of pitch activities with the partners
	•	Coordination of the paper to Urban and Maritime Transport 2021
	•	T9.4:
	•	Interviews with PIXEL ports regarding the sustainability of PIXEL exploitation
	•	PIXEL port configurations and cost structure for the ROI assessment
	•	IPR management and synchronisation with product definition



	Development of the	e commercial offer and pricing model
	Update of market a	ssessment
	Prepare XLAB PIX	EL Showcase for individual exploitation activities
	Usual tasks of Inno	vation Management leadership
	Definition of intera	ctions between T9.4 and WP5 and WP8
	Strategy for KER s	ubmission and impact creation
	Further developme	nt of the commercial offer and pricing model ssessment with IPEOPLE
	Continue to prepare	e XLAB PIXEL Showcase for individual exploitation activities to
	leverage the KER N	Maritime Analytics.
	Blog post (and con	sequent LinkedIn interactions) on maritime analytics (11.3.2021):
	<u>Preparation of abs</u>	<u>//sl/blog/1s-there-such-a-thing-as-too-much-data/</u>
	2021, on the PAS a	pproach to the concept of digital twin
	Proposal of paper f	for the EC Open Research Europe initiative on the PEI impact and
	recommendations t	o adoption as European standard
P04 INSIEL	Attendance to all W	VP9 monthly teleconferences
	Participation with a	all partners in WP9 activities, in particular participation the PIXEL
	webinar.	
P05 CATIE	Attendagnce to se exploitation/innova	veral WP9 specialized telcos: communication/dissemination and tion
	Following all the Twitter) and partic related to PIXEL o	social networks of the PIXEL project (Facebook, LinkedIn and cipates in the creation of impact by relaying various information n our own social medias.
	Participation to the	innovation team
	Preparation of the	vebinar 2.
	Leading of the prep	paration of an abstract and a full paper to the congress IPIC 2021.
P06 ORANGE	Attendance to sev exploitation/innova	eral WP9 specialized telcos: communication/dissemination and tion
	WP9: Prepare PIX Exhibition" interna	EL documentation to be present to the "2020 Orange Research l event (December)
	Further investment leaders	in different tasks and proactive approach towards work package
	Finishing DAL pre	sentation Video.
	Finishing Security	presentation Video
	Contribute to differ contributions to op	ent tasks of WP9 Innovation 2020 stream, especially on leading the en source initiatives (FIWARE and others).
P07 CREO	Attendance to sev exploitation/innova	eral WP9 specialized telcos: communication/dissemination and tion
	Usual activities as	ask T9.3 leader.
	Co-Management w	ith UPV of the industrial dissemination process.
	Tracking of interes	ting industrial events.
	Tracking of events	delayed / cancelled due to the Covid-19 pandemic.
	Questioning / according / acco	npanying the PIXEL partners related to their attendance to selected



	• Industrial Events tracking process (conference) rescheduled due to the Covid-19 epidemic.
P08 MEDRI	• Attendance to all WP9 specialized telcos: communication/dissemination and exploitation/innovation
	• Huge participation in the task T9.2 (scientific dissemination):
	• Lead of 2 papers that have been submitted.
	• Current writing of another paper that will be submitted during the next period.
	• Participation in the KERs, especially in the PEI exploitation discussion
	• Fostering the visibility of PIXEL project and EU funding.
	• Dissemination of PIXEL in Faculty-organised events.
	• Promotion of the project actions through a bilingual web site MEDRI PIXEL to spread the information about the PIXEL project, which are updated on a daily basis
P09 SDAG	• Attendance to all WP9 specialized telcos: communication/dissemination and exploitation/innovation
	• SDAG analysed the content of project communication/dissemination and exploitation tools trying to give useful comments in order to improve the result.
	• SDAG is continuing to update its social medias (Facebook, Twitter, Linkedin and Company Website) trying also to include PIXEL project news and relevant information to improve the project dissemination.
	• SDAG distributed the Innovation questionnaire to relevant stakeholders.
	• Finally, SDAG participated to the second PIXEL webinar scheduled in February 2021
P10 THPA	• Attendance to all WP9 specialized telcos: communication/dissemination and exploitation/innovation.
	• Telcos as well as, physical meetings were held, with the project's subcontractor, assisting in WP9 tasks.
	• Representatives of the team attended the first PIXEL webinar, as part of the project's communication activities.
	• Handover of multimedia material (video) of the port for its integration into the next promotional PIXEL video.
	• THPA was also contributed to the preparation of the paper "The advantage of a green and smart port of the Future".
P11 PPA	• Attendance to all WP9 specialised telcos: communication/dissemination and exploitation/innovation.
P16 APT <u>P12 ASPM</u>	• Attendance to all WP9 specialised telcos: communication/dissemination and exploitation/innovation
(changed in	• Due to Covid19 restriction, the activity related to dissemination has been carried on
Amendment	with online interactions only. Main activities concerned contacts with stakeholders and local institutions.g
	• APT analysed the content of project communication/dissemination and exploitation tools trying to give useful comments from the Port point of view in order to define interesting events and publication for the specific sector.
P14 IPEOPLE	• Attendance to all WP9 specialised telcos: communication/dissemination and exploitation/innovation.
	• Webinars (testing, market research and scheduling and conduct.



	Webinars preparation (testing, market research and scheduling).
	• Participation in authoring, reviewing, and suggesting changes in the exploitation documents and KERs.
	• Participation in the abstract and full paper writing for the conference IPIC 2021.
	• Market research in T9.4.
	• Participation in PAS configuration for the pilot.
P15 CERTH	• Attendance to all WP9 specialised telcos: communication/dissemination and exploitation/innovation
	• Contribution to the preparatory actions for the series of webinars by providing a list of emails of potential participants.
	• Participation in the 2 webinars.
	• Contribution to the Exploitation survey by reviewing the survey contents and providing comments.
	• Contribution to Task 9.4 by providing the input for the KER of PEI
	• Contribution to the Exploitation survey by reviewing the survey contents and providing comments.
	• Review of version 0.2 of the final exploitation report of PIXEL D9.8
	• Contribution to the paper submitted and accepted to the 27th International Conference on Urban and Maritime Transport and the Environment to be held from 16 to 18 June 2021 online.
	• Presentation of the PIXEL project in the Huawei Industrial Digital Transformation Conference which took place on the 25th of March, 2021
	• Work on the paper submitted and accepted by the 10th International Congress on Transportation Research (ICTR 2021) to be held in September.

## 2.2.9.4. Results after M31-M36

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

- Conduction of two webinars.
- 9 new videos uploaded to Youtube channel.
- 3 more presentations at industrial events.
- 6 new scientific contributions prepared at different stages previous to publications.
- PIXEL included in the list of TRIMIS of the EC.
- Final design of PIXEL's 4-tiered commercial offer and pricing model
- Completion of KERs structuration and formal submission to EC

## 2.2.9.5. Deviations

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

## 2.2.9.6. Corrective actions

No corrective actions have been set beyond those identified and put in place since the previous reporting period (see deliverable D2.7 and D2.8)

# 3. Impact

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

The dissemination report will be sent through deliverable D9.5 (at the end of the project), with due date on month M41(September 2021) – due to changes through Amendment #2. 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**

The updated dissemination plan (that was introduced via D9.4) has been consolidated during the period M31-M36 and has considered a continuous activity since the start of the project, but with flexibility and possibility of evolving during the lifetime of the project. That is considered as crucial by the PIXEL Consortium as it will help the final product to reach as more potential interested stakeholders as possible. This plan is accompanied by a monitoring tool created by the WP9 leader (UPV) which serves both for planning, tracking and brainstorming of communication/dissemination opportunities.

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

- Definitive webinars plan
- Introduction of a series of actions towards institutional reconnaissance of PIXEL as a product.

With regards to specific the new webinars plan, the definitive plan was announced:

No.	Subject	Date	Speaker 1	Speaker 2	Speaker 3
1	PIXEL presentation	13.1.2021	UPV	XLAB (IM)	
	Technical explanation of user stories,				
2	models and algorithms	10.2.2021	PEOPLE	CATIE	AB member
3	PEI explanation webinar	10.06.2021	MEDRI	AB member	
	Live webinar explaining WP6				
	technical modules and integration /				
4	installation (WP7)	17.06.2021	ORANGE	PRO	AB member
	PIXEL solution as a whole, KPIs and				External project
5	results	16.09.2021	XLAB (IM)	CERTH	member

Table 11. Definitive webinars plan

While two (out of those 5) webinars have been already conducted (with much success):

- Webinar 1: 13-JAN-2021 "PIXEL General presentation - 1st Webinar"
- Webinar 2: 10-FEB-2021
   "PIXEL Webinar 2 -Technical presentation of user stories, models and algorithms"



With respect to the actions towards EC visibility, those are the following:

- Submission of Key Exploitable Results to Sygma platform by the Project Coordinator (done).
- Posting a PIXEL-related article in CORDIS.
- Publishing PIXEL products at the European Investment Project Portal.
- Preparing and submitting an EC Open Research Paper to the official platform of the EC.



## 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:

Partners involved	Type of activity	Title of the event/meeting/article/social media	Date of publication	Journal / Conference / Event
MEDRI, XLAB, UPV	Publication (Scientific Dissemination)	IoT based real-time assessment of atmospheric emission from ports: 2 a case study of the passenger terminal in the Port of Piraeus, Greece	Submitted. Under review.	Environmental Monitoring and Assessment journal.
ALL partners of the project	Publication (Scientific Dissemination)	The Advantage of a Green and Smart Port of the Future	Accepted. Pending to be presented & published.	WIT Transactions of the Environment.
UPV	Publication (Scientific Dissemination)	Leveraging IoT and prediction techniques to monitor COVID- 19 restrictions in port terminals	Accepted. Pending to be presented & published.	IEEEXplore.
UPV	Publication (Scientific Dissemination)	Functioning prototype of IoT and composite indicators for smart port environmental monitoring	Submitted. Under review.	IEEEXplore.
UPV, MEDRI, THPA	Publication (Scientific Dissemination)	Scale-model showcase to monitor environmental impact in ports using IoT and low- resource equipment	Submitted. Under review.	IEEEXplore.
CERTH, MEDRI	Publication (Scientific Dissemination)	Monitoring the environmental impact of TEN-T ports operations – current status and commonly used performance indicators	Submitted. Under review.	10th International Congress On Transportation Research
ORANGE	Presentation at conference (virtual)	Pitch of PIXEL focused on the use of FIWARE and ICT technologies	23rd March 2021	Le Salon de la Recherche (ORANGE event)
CERTH	Presentation at conference (virtual)	Pitch of PIXEL in the context of environmental benefits for ports	25 <sup>th</sup> March 2021	Huawei Industrial Digital Transformation Conference
MEDRI	Presentation at conference (physical and virtual)	Annual Faculty of Medicine Celebration days 2020	8 <sup>th</sup> April 2021	MEDRI Faculty
All the project partners	Global dissemination impact	PIXEL registered as formal offer of Port and Terminal Knowledge Landscape published by the EC about Transport Research and Innovation Monitoring System	8thApril 2021	TRIMIS portal of the EC

Table 12. Industrial and scientific dissemination in period M31-M36



## **3.1.3.Liaison with other projects**

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

D9.3 considered in the communication action the liaison with different project, and a preliminary plan was drafted. D9.4 updated the different actions carried out on that regards, covering up to month M18. However, during the period M31-M36 the relationship with CSA DocksTheFuture and the rest of the projects has been intensified due to closure of DocksTheFuture and the near-closure of the COREALIS project. These actions have not been arbitrary but responding to a specific strategy; in particular, the majority of them have been framed in the joint participation of PIXEL with the rest of the projects during the last three years.

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

- With CSA **DocksTheFuture** (**DtF**): The CSA action lifetime was originally coming to an end during the previous reporting period (July 2020). However, due to the COVID-19 outbreak effects, the end of the action has been postponed few months. The actions of the CSA concluded on 30<sup>th</sup> November 2020 (M31 of PIXEL). During the first month of this reporting period, PIXEL participated as follows:
  - Fulfilment of the Transferability Analysis tool developed by the CSA to be used as sample for the other projects.
  - Active participation in the DtF transferability workshop, conducted on 17<sup>th</sup> November 2020.
  - Presentation by Project Coordinator on the closing event of DtF on 24<sup>th</sup> November 2020.
  - Preparation of joint actions redounding in two candidate proposals for H2020 Green Deal calls.
- With **COREALIS** several actions took place. The majority of them consisted of individual contacts between Innovation Managers and Dissemination leaders, seeking for common dissemination sake, including cross-posting in social networks among other. Additionally, PIXEL's Project Coordinator presented the current status (with pilots results) of our project in the COREALIS' final event on 22<sup>nd</sup> April 2021.



Figure 1. Presentations by the PIXEL Coordination team on closure events of DtF (left) and COREALIS (right)

Consequently, during the period M31-M36, PIXEL has been involved in several actions according to the plan. In order to report the main work performed in this regard, there will be a table in the deliverable D9.5 including information about how PIXEL has collaborated with the CSA and how PIXEL has participated in several initiatives both with DocksTheFuture and individually with other projects of the Ports of the Future Network.

#### Liaison with other projects:

- With the project **DataPorts**: PIXEL has reinforced its technical provision to the DataPorts project, in particular on the Data Acquisition elements and the use of pyngsi. Additionally, PIXEL will be participating in a workshop organized by DataPorts in the upcoming BDVA DataWeek on May 2021.
- PIXEL has actively collaborated with the project ASSIST-IoT, devising joint publications in the short future and potential cross-dissemination actions (e.g. in the IoTWeek 2021).
- PIXEL is also planning to enhance collaboration with other projects, in especial with those connected to PIXEL partners for maximising promotion and dissemination of PIXEL results.



# 4. Risk Management

As commented at the beginning of this report, the last part of the period M31-M36 has been strongly marked by the COVID-19 associated restrictions, and how those (and other causes) have affected the workplan, formalised through Amendment #2 of the Grant Agreement. Project partners have been motley affected (diminish of effort amount able to be provided, non-physical accessibility, etc.) and, therefore, certain tasks have suffered consequences such as delays or postponement of actions.

Some of the risks identified in the previous reporting period (M25-M30) materialised and the different mitigation measures were applied (e.g. supervision procedures, spotting shared responsibilities, responsible assignments). Although the project has been impacted (no physical meetings, delays on the installation due to inaccessibility of premises, cascading effects, etc.), the task T2.4 has been able to properly manage the situation and the project is advancing correctly, with only relevant concerns with regards to the evaluation of the pilots in WP8. The project extension of 5 months should allow the partners to meet all the objectives of the project. The Consortium is convinced this will be achieved timely and properly.

A lot of work was carried out in the risks' task (T2.4), generating a whole new set of risks that are being managed, where mitigation measures are being applied if necessary.

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

# 4.1. New risks identified in the period M31-M36

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

## **WP2**

- Advisory Board members not accessible and impossibility to hold final plenary AB meeting.
- Over/under resources consumption.
- Physical meetings.

## **WP7**

- Some integrations are missing or not well/clearly posed.
- Delays in the implementation of T7.2-T7.4 pilots.
- Delays in the implementation of the PIXEL Platform and PEI tool
- Data availability

## **WP8**

The risk on WP8 identified during the previous report (R#8.7) is still of application and is carefully tracked continuously as it is materialising w.r.t the WP7->WP8 transition. It is attached in the Appendix as it is really relevant for the project at this moment.

## WP9

- Physical events for dissemination.
- Scale-model demonstrations.



# **5. Deliverables and milestones**

# **5.1.Deliverables**

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

Table 13. Sent deliverables list



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



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

# **5.2. Milestones**

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



							2018. Every partner attended the meeting.
MS2	State of the art and use-cases defined	3	IPEOPLE	28/2/2019	Yes	15/03/2019	Final version of D3.4 Use-cases manual and scenarios, was delivered. D3.1 and D3.3, inputs of the former, were also completed.
MS3	Requirements gathered	3	INSIEL	30/04/2019	Yes	30/04/2019	Requirements are gathered and available in our JIRA platform. D3.2 is finished and delivered.
MS4	Environmental Analysis completed	5	MEDRI	30/04/2019	Yes	30/04/2019	Deliverable D5.1 has been completed and released.
MS5	Predictive models/algorithms established	4	CATIE	30/04/2020	Yes	30/04/2020	D4.2 and D4.4 have been completed. Code has been uploaded to GitHub. Algorithms and models are finished.
MS6	PEI developed	5	MEDRI	30/04/2020	Yes	30/06/2020	Delay of 2 months in delivering D5.3: 30/06/2020. The <u>Project Officer was</u> <u>informed.</u>
MS7	ICT solution developed	6	PRO	30/06/2020	Yes	30/06/2020	D6.4 and D6.5 delivered on time.
MS11	PIXEL components integrated to start pilot trials	7	PRO	30/10/2019	Yes	24/11/2019	Official version submission 24/11/2019 - 1 month delay accepted by PO.



# **6. Explanation on the Use of Resources**

# 6.1. Use of resources

The following graph provides an overview vision of the evolution of resources consumption by PIXEL partners in the period M1-M36. It aims at reflecting the overall status of project financial execution, considering that the project still lasts till M41 (now, officially):



Figure 2. PIXEL resources consumption (evolution graph) M1-M36

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

Table 14. PIXEL resources	consumption (summary report)	considering PIXEL lasts till M41
---------------------------	------------------------------	----------------------------------

						-		-			-				
	UPV	PRO	XLAB	INSIEL	CATIE	ORANGE	CREO	MEDRI	SDAG	THPA	PPA	ASPM	GPMB	IPEOPLE	CERTH
Planned	105,2	90,0	68,2	42,4	62,7	38,3	29,5	84,1	31,9	24,8	36,9	15,2	25,2	23,7	54,7
Actual	95,8	98,2	68,4	39,1	57,0	38,9	13,4	90,7	33,1	25,4	31,8	15,6	19,0	39,6	41,9
delta pms	-9,35	8,12	0,26	-3,26	-5,73	0,69	-16,18	6,60	1,11	0,55	-5,17	0,40	-6,17	15,91	-12,78
delta %	-8,89%	9,02%	0,39%	-7,70%	-9,14%	1,80%	-54,78%	7,85%	3,47%	2,23%	-14,00%	2,61%	-24,46%	67,09%	-23,37%

As it can be seen, most partners are pretty aligned with the planned consumption, remaining between the  $\pm 25\%$  margin. This is good from a Financial Management point of view, as there are still 5 months to have all partners adjusted to their plan. This report roots on the results of amendment #2, therefore the table above (planned vs actual consumption) is already adjusted to the final figures and will remain that way till the justification in the final Periodic Report.

However, one partner shows bigger deviation than 25%: CREO. The reasons that drove to under-consume resources were thoroughly explained in the Project Technical Report for the mid-term review and in the previous report (D2.7 and D2.8). The problems have been tackled, but other conditions associated to the COVID-19 outbreak have prevented the partner to recover yet from the deviations. The main problems behind those are: (i) difficulties in hiring adequate people in companies that have been increased due to (ii) Administrative departments deadlocks due to the epidemic crisis and (iii) internal prioritization of activities with regards to personnel allocation. Nonetheless, according to the PC these deviations are not affecting the good advance of the project and any budget mismatch will be corrected by the end of the project.

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



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

• WP2

Risk subcate	gory				Risk subcategory								
Organisation, external entities.													
Risk N°	Risk Name	e	Risk De	scription	Co	nsequences							
R2.14	Advisory Board meetings Advisory hold fina			y Board members not accessible and impossibility to al plenary AB meeting.									
Likelihood		Severity		Impact		Criticality							
Moderate		Moderate		-		-							
Contingency	plan												
Avoid/Minim	nize Likeliho	ood Strategy		Mitigate Severity St	rateg	<u>zy</u>							
The AB men advanced and dates.	nbers have I have been	been contacted given several op	well in ptions of	In case any of the AB Plenary meeting, communication will PIXEL.	mem an be o	bers will not attend the final offline, peer-to-peer established till the end of							
Handler		Current Status	•	Creation Date		Transfer Strategy							
UPV Identified and being January-2021 managed													
Work Log	Work Log												
Continuous w	ork												

Risk subcategory									
Organisation, financial.									
Risk N°	Risk Name	e	Risk De	scription	Cor	nsequences			
R2.15	Over/under consumptio	r resources	Partners have overspend or underspent their resources allocated.		Unequal, difficult procedure for payment distribution and excessive need of justification towards final review.				
Likelihood		Severity		Impact		Criticality			
High Moderate					-				
Contingency	plan								



Avoid/Minimize Likeliho	ood Strategy	Mitigate Severity Strateg	3 <b>y</b>		
UPV (as Project Coordi (throughout all project c about their consumption. I is being done during this need of attention to resou tackled by project coordin	nator) has been warning luration) project partners However, a specific action period to emphasise the irce consumption. Action ation.	If the risk materialises after the mitigation measures, corrections may be done after finalising the project. At the most extreme case, some partners would need to adjust their balance (received-spent) and not receive any additional money on the final distribution payment.			
Handler	Current Status	Creation Date	Transfer Strategy		
UPV	Identified and being managed	January-2021			
Work Log					
Continuous work					

\_\_\_

Risk subcategory									
Organisation.									
Risk N <sup>o</sup>	Risk Name	e	Risk Description         Consequences						
R2.13	Physical m	eetings.							
Likelihood		Severity		Impact		Criticality			
High		Moderate		-		-			
Contingency	plan								
Avoid/Minim	nize Likeliho	ood Strategy		Mitigate Severity St	rateg	3y			
Handler		Current Status		<b>Creation Date</b>		Transfer Strategy			
UPV Identified and being August-2020 managed									
Work Log									
Continuous w	vork								

## • WP7

Risk subcategory	
technology	



Risk N°	Risk Name	Risk Name		scription	Consequences			
R7.25	Missing integration		Some integrations are missing or not well/clearly posed. There are some data not integrated in the pixel platform because the dada sources (Sensors, APIs) were not available until Spring 2021.		Delays on tasks WP7 and WP8 This is a blocking issue to run some models.			
Likelihood		Severity		Impact		Criticality		
High		High		-		-		
Contingency	plan							
Avoid/Minim	nize Likeliho	ood Strategy		Mitigate Severity Strategy				
To mitigate this risk, the evaluation of the status of these implementations is being checked weekly (TC-PC mechanism) and in case of a problem with an specific data source we will create simulated data or made adjustments to the model to work with this data.			status of weekly lem with ated data with this	Strategies have also been put to be able to run the models without some data (inference of data from the past, using default values, etc.).				
Handler		Current Status		Creation Date		Transfer Strategy		
PRO Currently all data sources are available, and the implementation of the last agents are under development.			data vailable, nentation ents are nent.	November-2020				
Work Log								
Creation (Nov	ember 2020	)						
Update (April	2021)							

Risk subcategory								
technology, organisation, cross-WP								
Risk N°	Risk Name	Risk Description	Consequences					
R7.26	Delays in the deployment	The implementation of the pilots is progressing well in the past months, but there is little additional delay margin	Models may not be running for (at least) 3 months in the pilots so assessment in T8.3 may be biased or difficult to perform.					



				to start t May 202	the evaluation during 21			
Likelihood		Severity	<b>*</b>		Impact		Criticality	
Moderate		High			-		-	
Contingency p	olan							
Avoid/Minimi	Avoid/Minimize Likelihood Strategy     Mitigate Severity Strategy							
In other to avo	In other to avoid problems with the evaluation. We are not going to wait until having the pilots finalized. As							
soon as we ha	ve any mode	er ready, we	will s	tart the ev		•		
Handler		Current Sta	tus		Creation Date		Transfer Strategy	
PRO		Identified	and	being	November-2020		UPV, CERTH involved as	
		managed					PC and WP8 leader.	
Work Log								
Continuous w	Continuous work							

Risk subcategory									
technology, organisation,									
Risk N°	Risk Name	e	Risk De	scription	Co	nsequences			
R7.27	Delays implementa PIXEL Pla app	in the ation of the atform and PEI	Due to including COVID- are o impleme systems for the and exec	y various reasons, g the outburst of the 19 Pandemic, delays bserved in the ntation of the various in the 4 ports needed PEI implementation ution	Thi with the	s delay comes hand in hand h delays in the execution of evaluation			
Likelihood		Severity		Impact	•	Criticality			
High		Moderate		Moderate -					
Contingency	plan								
Avoid/Minim	nize Likeliho	ood Strategy		Mitigate Severity St	rateş	3y			
Technical partners are taking all the necess measures in order to proceed asap with installation and testing of all systems so the evaluation (both technical and business can start			ecessary with the so that start)	The measures take extension granted to t point adequate.	en, i the pr	n combination with the roject, are considered at this			
Handler		Current Status		Creation Date		Transfer Strategy			
MEDRI		Identified and managed	l being	November 2020		UPV as Project Coordinator.			



# Work Log

Continuous work

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Risk subcategory								
technology, organisation,								
Risk N°	Risk Name	9	Risk Des	scription	sequences			
R7.27	Data availability		Due to various reasons, including the outburst of the COVID-19 Pandemic, delays are observed in the implementation of the various systems in the 4 ports needed for the PEI implementation and execution		Son wou and repl app resu	Some of the PEI component would be harder to calculate and they would be needed replace with sometimes rough approximations which could result in a less precise PEI		
Likelihood		Severity		Impact		Criticality		
High		Moderate		Depending of various factors				
Contingency	plan							
Avoid/Minim	ize Likeliho	ood Strategy		Mitigate Severity St	rateg	39		
Make use of strategies and approaches) to	all the data workaroun get the nee	a port can provi ds (different cal ded results	de. Find culations	The measures take extension granted to t point adequate.	en, i The pr	n combination with the oject, are considered at this		
Handler		Current Status	5	Creation Date		Transfer Strategy		
UPV?		Identified and managed	l being	November-2020				
Work Log								
Continuous w	ork							

## • WP8

•	Risk subcategory	
•	RISK Subcategory	

technology, organisation,

Risk N°	Risk Name	Risk Description	Consequences
R8.7	DelaysintheimplementationofthePIXEL Platform	Due to various reasons, including the outburst of the COVID-19 Pandemic, delays	This delay comes hand in hand with delays in the execution of the evaluation
		are observed in the	



	is		impleme systems	implementation of the various systems in the 4 ports.			
Likelihood		Severity		Impact		Criticality	
High		Moderate		-		-	
Contingency	plan						
Avoid/Minim	nize Likeliho	ood Strategy		Mitigate Severity Strategy			
Technical partners are taking all the necessary measures in order to proceed asap with the installation and testing of all systems so that evaluation (both technical and business can start)			The measures taken, in combination with the extension granted to the project, are considered at this point adequate.				
Handler		Current Status		Creation Date		Transfer Strategy	
UPV, CERTH	Í	Identified and managed	being	Since the preverse of the prev	ious		
Work Log							
Continuous w	ork						

## • WP9

Risk subcategory							
technology, organisation,							
Risk N°	Risk Name		Risk Description		Consequences		
R9.33	Physical events for D dissemination. ev or id ge st		Due to COVID-19, most events are going fully virtual or hybrid. The events identified for PIXEL are (in general) adopting this strategy.		Less outreach and impact of the industrial dissemination of the project. Less opportunities of technological demo showcase.		
Likelihood		Severity		Impact		Criticality	
High		Low		-		-	
Contingency plan							
Avoid/Minimize Likelihood Strategy				Mitigate Severity Strategy			
Conducting five webinars inviting wide audience, including a final event of the project gathering all connected experts, other projects, AB members, etc.			Some physical events may be attended as well, and WP9 team is working hard on achieving it, so in case of impossibility, PIXEL could demonstrate willingness.				
Handler Current Status				Creation Date		Transfer Strategy	



UPV	Identified managed	and	being	January-2021	
Work Log					
Continuous work					

Risk subcategory									
technology, organisation,									
Risk N°	Risk Name		Risk Description		Co	Consequences			
R9.34	Scale-model demonstrations.		One objective of WP9 is to demonstrate PIXEL tools using a scale-model of a port. Non-phisicallity of events, difficulty to retrieve material and non-feasibility of code- camps or hackathons organistion.		Non-ideal development of the scale-model demonstration. Not having a validated scale- model demonstrator of the project for bringing to fairs and events.				
Likelihood	Severity		Impact		<u> </u>	Criticality			
Moderate L		Low		-		-			
Contingency	Contingency plan								
Avoid/Minimize Likelihood Strategy     Mitigate Severity Strategy					39				
To be done only by a group of partners with local affinity (therefore, not needing to travel across the continent) and working online with other developers/integrators of the project.									
Handler Current Status		ļ	Creation Date		Transfer Strategy				
UPV		Identified and managed	l being	March-2021					
Work Log									
Continuous w	'ork								