



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 776816



project 

# D7.3: Description and details of the Users Collaborative Platform

V.2.5 - 01.2021

Status of deliverable: PUBLIC

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## Deliverable Review and Approval

The individuals listed below are not directly involved in the preparation of this deliverable and will review the present document.

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## Deliverable Development and Review Process

	Key Event	Deadline	Done by
1	Submission of Draft Deliverable to reviewers	01/10/2020	13/01/2021
2	Initial Review and Comments obtained	15/10/2020	14/01/2021
3	Uploading and submission of Final Deliverable on Participant Portal	31/10/2020	15/01/2021

## Executive summary

The main objective of the Project Ô is to demonstrate innovative approaches and technologies to support the circular economy, addressing the technical, economic, environmental, and social aspects so as to redefine some water value chains.

This document provides description and details of the User Collaborative Platform (UCP), one of the software tools developed within Project Ô: the UCP is mainly business-facing, and targeted to promote circularity and to create new local water loops.

Starting from specifications defined on the D7.2 deliverable, a pilot project was designed (a static demo is hosted at: [http://xake.deib.polimi.it/project\\_o/demo](http://xake.deib.polimi.it/project_o/demo)) inspired by the idea of an integrated marketplace for water reuse, in which the key players in the value chain interact by sharing requests, offers, treatment technologies, and logistics.

The User Collaborative Platform is a multi-user web application, based on an intuitive interface, and role-based: each role has dedicated functionalities and specific views on data, created using preferences and privileges associated with their personal or company profile.

On the basis of the users' interaction and the help of specific algorithms, the platform supports procedures to define new water loops, providing the best match among water demands, water streams, and treatment technologies, exploiting information and data collected.

An open-source software architecture will be used to implement the UCP, in order to ensure modularity and portability of the final solution.

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# 1 Introduction

The main objective of the Project Ô is to demonstrate innovative approaches and technologies to support an integrated and symbiotic use and re-use of water by contributing to the transition to a circular economy, addressing the technical, economic, environmental, and social aspects so as to redefine some water value chains. New water treatment technologies developed by WP2 are different in scope, but all are characterized by their relatively high energy efficiency and low cost. On the one hand this requires a modular approach and a novel control unit based on new smart sensors; on the other information and decision-making support is needed for all stakeholders involved in the planning and management of water resources.

Project Ô provides this support by different software tools:

- a Decision Analytics Platform (DAP), targeting mainly water regulators, relying on a multi-objective decision-making approach to allow the analysis of traditionally incommensurable and conflicting objectives and to exploring their trade-offs;
- a demonstrative Technology Selection Toolbox, allowing to select the best technology to match water requirements (in terms of quantity and quality) with local, “alternative” water availability;
- a User Collaborative Platform (UCP), mainly business-facing, to promote a symbiotic exchange of water volumes over a defined territory to improve the circularity of resources between different partners involved in the water treatment value chains.

The DAP is being developed in the WP4. The aim of this platform is to support the planning decision-making process, to evaluate different scenarios of water-reuse, to consider not only traditional sources of water to supply different water users: drinking water, irrigation, and industrial consumption. The main goal of the DAP is to improve the resilience of a community (at hydrological basin-scale) supporting water authorities to enhance wastewater, e.g. by selecting and adopting the proper technology to reconnect polluted wells to the water main distribution network, or by exploiting refined water from wastewater treatment plants to irrigate suitable crops.

The Technology Selection Toolbox has been developed in the deliverable D7.1: it is a toolbox developed with Microsoft Excel and VBA (Visual Basic for Applications), including a simple user interface to support water treatment facilities and water system managers in the identification of the best technology solution and/or system of solutions to treat a specific water stream.

The third tool of the list, the UCP, is the object of the present document D7.3. In previous D7.2 deliverable, the preliminary requirements of the platform were described and the main components defined. Starting from these specifications, a pilot project was designed, inspired by the idea of an integrated marketplace for water reuse, in which the key players in the value chain interact by sharing requests, offers, treatment technologies, and logistics. While the main goal is to define potential agreements to promote circularity and create new local water loops, the platform does not aim to include also the economic finalization of the agreement: therefore the support of the economic transaction is not envisaged.

The two platforms, DAP and UCP, constitute two sides of the same coin, as they face the decision-making problem on two different horizons and with two different approaches: planning level, long-term and in a centralized way the first; management level, medium-term and distributed decisions the second. Both platforms also share a participatory and transparent development process, to collect information and presenting the analysis results.

Section 2 of this report describes UCP user roles and presents the related functionalities, thanks to the screenshots of the UCP pilot. Section 3.1 introduces the software architecture, based on a mature, well-known, open-source stack. The same architecture will be then shared with the DAP platform.

This deliverable is part of the Work Package 7 - *Circularity of water and circular economy: interfacing systemic issues with innovative business models* and it is specifically related to Task 7.2 *Users collaborative platform*.

Figure 1 shows the link between all Project O WPs: WP7 acts as collector for performance data of the technologies developed in other WPs and Stakeholders needs in term of demand and offers of treated water. The UCP presented in this deliverable is the main result of WP7 and it is oriented to future exploitation of its technology and approach.

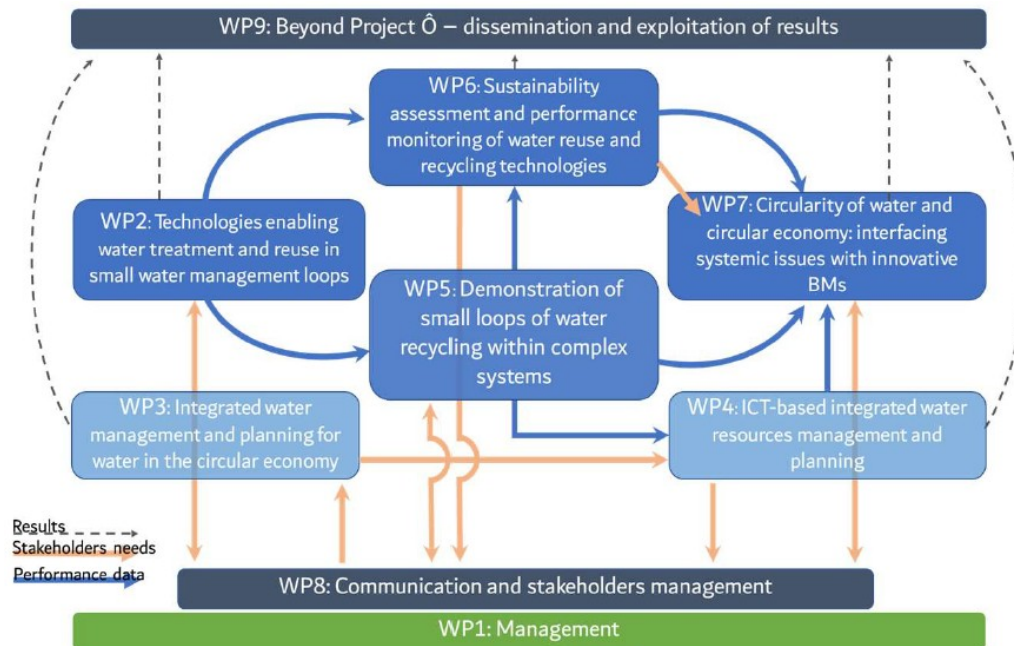


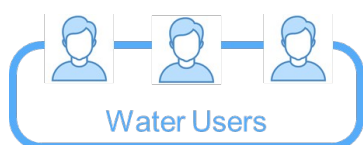
Figure 1: Project O Work packages interdependencies

## 2 Platform description

The User Collaborative Platform is a multi-user web application, based on an intuitive interface, targeted to provide a marketplace for water circular economy, to become a meeting point for different roles, to enforce relationship between water supply and demand. Given the focus of Project Ô on water-reuse, the exchange of water streams is enabled and facilitated by technology providers and logistic operators.

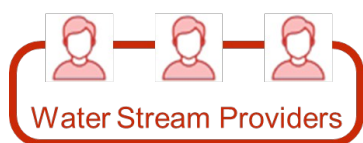
The platform is *role-based*: each role has dedicated functionalities and specific views on data, created using preferences and privileges associated with their personal or company profile.

UCP users can be assigned to one or many of the following roles:



- **Water Users**

Create qualified water demands, receive proposals from water streams and technologies providers and engage logistic operators to get economic quotation for needed water streams.



- **Water Stream Providers**

Submit water stream resources proposal defined in quality and quantity, to be handled by technology provider.



- **Technology Providers**

Provide water treatment technologies, filtering solutions, chemical products and any process that can be applied to a stream offered by a water stream providers to satisfy water users demand specification.



- **Logistic Operators**

Provide quotation to bring the water stream from origin (water stream providers) to destination (water users).

User roles can be chosen during registration phase or can be managed once the user has been created, by the platform administration interface (see Section 3). Figure 2 shows how UCP can be seen as a container where different roles interact, bringing each one its own expertise, needs and resources in order to create New Water Loops, defined (and represented in Figure 2) as the intersection between water demand, water stream offer and water treatment technologies. Once a new water loop has been created, availability of logistic facilities can also be considered and assessed.

The platform makes easier the exchange of information between users belonging to different roles and it foster the creation of new opportunities and water loops.

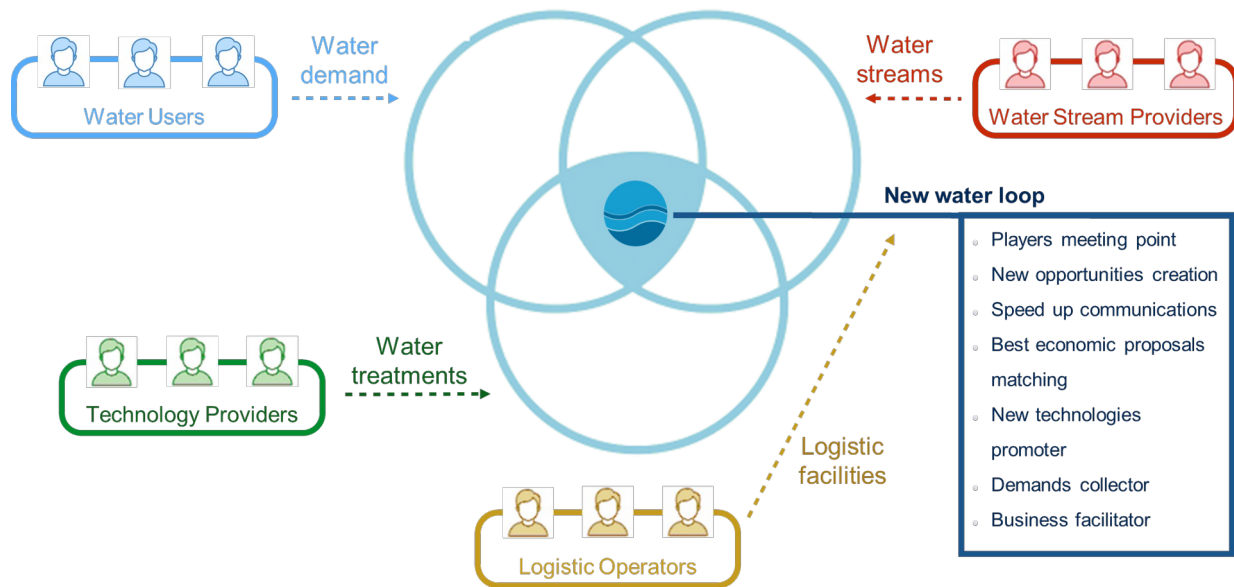


Figure 2: Roles and flows

A UCP demonstrator (or UCP demo) has been designed to provide details and support the description of platform functionalities. The demo is hosted at Politecnico di Milano Server (at the following url: [http://xake.deib.polimi.it/project\\_o/demo/](http://xake.deib.polimi.it/project_o/demo/)) and it has been developed as a set of html static page linked one to each other, that will be then used to orient implementation of the real platform with the architecture presented in Section 3.1.

Following sub-sections describes the UCP concepts: Section from 2.1 to 2.4 present role-specific functionalities, Section 2.5 shows the procedure to create new water loops, while Section 2.6 shows common functionalities shared among all roles. A number of detailed screenshots are taken from the UCP demo, assuming the perspective of a user which has all the roles enabled. An overall outlook of UCP is also provided in Section 2.7, where a possible use of the platform has been exemplified considering one of the Project O Demo-site, the Apulian Aqueduct.

## 2.1 Water User functionalities

Water Users use the UCP to:

- create and publish water demands;
- create a new water loop, by applying for a combination of water stream and treatment technologies;
- receive offers in terms of water streams and related treatment technologies;
- request logistic quotation;
- select the more interesting proposals.

Figure 3 presents the water demand creation form, where water user can describe their own needs in a quick and effective way. The following information can be inserted:

- Estimated flow, expressed as  $\text{m}^3/\text{day}$ : the quantity of water needed



- Application field(s) of water: a list predefined water uses that identify general quality requirements
- Water usage position: geographic position (expressed as an address and then geocoded as latitude/longitude coordinates) of the water request, that will be then used by the platform to locate the nearest stream provider
- Text area for the technical specifications and details like for example tolerance to specific chemical agents and all other details (if known)

Fields marked with an asterisk in Figure 3 are mandatory.

Figure 3: Create water demand

Figure 4 shows instead the list of water demands published by all the platform water users: each demand is reported on a row, with a summary of its features and the expiry date. On the same row, when available, also related proposals of water streams, treatment technologies and logistic facilities are reported, to provide a comprehensive view of the status of water demands.

When a new water loop is complete, two more actions can be performed through the related buttons placed on the top of the list:

- *apply for logistic request*: flagging the “Select” column and hitting the related yellow button shown on Figure 4, the water user can verify a water loop feasibility with logistic providers, receiving technical offers and economic quotation;
- *approve selected proposal*: after receiving logistic quotations, the water user can select the most interesting proposal, by flagging the “Select” column and hitting the related green button shown on Figure 4. This action generates a report of the new water loop identified, including contacts of

involved players that will then start the economic negotiation. Moreover, all items related to this water loop (water demands, technology proposals, attached files, etc.) cannot be edited or deleted anymore and are archived in the platform.

**Water demands published**

Listing of all water demands available

Buttons: **Apply for LOGISTIC request** (orange), **APPROVE SELECTED PROPOSAL** (green), **Edit** (blue), **Delete** (red), **Search** (white)

Water user	Needed Flow m3/day	Location	date	Water stream provider	Tech Proposals	Logistics proposals	Select
Water demand A user	10000	Milan	2020/11/28	Waterstreamer Co & sons	-	-	<input type="checkbox"/>
Water demand B user	20000	Milan	2020/10/09	Waterstreamer Co & sons	<b>View</b> (blue button)	<b>View</b> (orange button)	<input type="checkbox"/>
Water demand C user	4500	Milan	2020/01/12	Waterstreamer Co & sons	Tech Proposal AAAA Tech Proposal BBB Tech Proposal CCC	Cell -	<input type="checkbox"/>
Water demand D user	2000	Milan	2020/10/13	Waterstreamer Co & sons	-	Cell-	<input type="checkbox"/>

Available proposals: 3      Summary 3      Summary 4

Showing 1 to 4 of 4

Page navigation: 1 2 3

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Figure 4: Water demand list

## 2.2 Water Stream Provider

Water Stream Providers use the UCP to:

- create water stream offers;
- create a new water loop, by pairing their offer with a suitable technology in order to reply to a water demand published by water users;
- receive new water loop proposal from water users or technology providers and accept or decline them.

Figure 5 shows the form designed to insert in an effective way mandatory information regarding the New Water Streams: the flow, expressed as m<sup>3</sup>/day; the application field of this output flow and its location.

The Water Stream Provider can also integrate information with a number of water quality data<sup>1</sup>, part of them being predefined and part customized by the water stream provider itself, and with laboratory analysis reports, in the form of attached files that can be uploaded on the platform. An accurate data input will help UCP matching algorithm to establish what are the best combination among water streams, water demands and water treatments to suggest the creation of new water loops (see Section 2.5).

<sup>1</sup> The same data are used in the Technologies Selection Toolbox, deliverable D7.1

**New Water Stream**

**Water Stream**

Trough Flow m3/day \*

Application field(s)

Other details \*

Upload PDF / CSV  
- laboratory analysis / Lab report  
- Any relevant data to qualify this stream  
 Nessun file selezionato

**Water stream position / specify address / pick map position \***

Visualizza mappa più grande

City  Country

**Additional informations**

Describe in a few lines your activity and how you provide such water stream:

**Water Stream parameters**

Water specs completion: 20%

Applicable technologies 30%

Stream request completion: 100%

Inlet BOD5 mg/l

Inlet TTS mg/l

Inlet TP

Inlet FE

Inlet Ammonia

Inlet Cod

Inlet Turbidity

E.Coli

Property A

Property B

Property C

Figure 5: Water stream creation

Figure 6 reports the list of water stream offers inserted by all users, together with a summary of their features and the completeness of related information, in the Status column.

**Water streams listing**

Listing of all water streams

Stream provider	Trough Flow m3/day	Location	% completion	date	Field	Status	Select
Waterstreamer Co & sons	10000	Milan	100%	2020/11/28	Agriculture	Published	<input type="checkbox"/>
Waterstreamer Co & sons	20000	Milan	47%	2020/10/09	Industry	Draft	<input type="checkbox"/>
Waterstreamer Co & sons	4500	Milan	100%	2020/01/12	zootechnics	Published	<input type="checkbox"/>
Waterstreamer Co & sons	2000	Milan	41%	2020/10/13	zootechnics	Draft	<input type="checkbox"/>

Total streams: 4

Showing 1 to 10 of 27

Figure 6: Water stream list

## 2.3 Technology Provider

Technology Providers use the UCP to:

- create and publish new water treatment technologies, with detailed information related to quantity of water that can be processed in the time unit and quality parameters, both in terms of input and output water;
- create a new water loop, by submitting a technology and economical proposal, intended as combination of one or more water treatment technologies, to connect water demand and water offer;
- receive proposal requests in terms of water demand or streams.

For interface examples relating to this role, see Section 2.5, where it will be shown how this type of user can promote the creation of a new water loop.

## 2.4 Logistic Operator

Logistic operators use the UCP to:

- create and publish the list of their logistic facilities, like aqueducts, drainage system, tanker truck network, etc. . Each facility is also described by its location on the map;
- receive logistic quotation requests from Water Users: every new request is notified with an alert on the bell icon and a message in the Notification Window (see Section 2.6.1 and Figure 13);
- create and send logistic services proposal, composed with the support of UCP location algorithm: the algorithm suggests possible logistic solutions based on the combination of locations of water demand, water stream offer and existing logistic facilities; the Logistic operator adapt these automatically generated solutions to specific context and compose the logistic quotation, eventually adding technical details.

Figure 7 shows the Logistic quotation creation page: the Logistic Operator select a water loop from the list on the top, the location algorithm suggests several options to physically connect water streams and water demands locations and it also provides a cost estimation that can be used as basis to formulate the quotation. Additional information can eventually be added either as textual information or as uploaded file, and an expiration date is set to define the temporal validity of the offer.

By hitting the submit button, the quotation is sent and notified to Water Users, appearing also in the Water demand list (Figure 4).

**Logistic requests**

Select request to submit logistic economic proposal

Water user	Stream provider	Distance from Water stream	Location	date	Stream source	Select
Water demand A user	Waterstreamer Co & sons	3.5 KM	Milan	2020/11/28	Agriculture	<input type="checkbox"/>
Water demand B user	Waterstreamer Co & sons	5 KM	Milan	2020/10/09	Industry	<input type="checkbox"/>
Water demand A user	Waterstreamer Co & sons	6 KM	Milan	2020/01/12	zootechnics	<input type="checkbox"/>

Summary 1 Available Requests: 3

Showing 1 to 3 of 3

Additional information about logistic proposal

Describe in a few lines the key features of your logistic proposal

Economic Proposal

Upload PDF

Economical proposal Sfoglia... Nessun file selezionato. Specify Total proposal economical value in €

€ value proposed Specify expiration date for this proposal gg / mm / aaaa

SUBMIT PROPOSAL

Figura 7: Logistic proposal creation

## 2.5 New Water Loop creation

The New Water Loop creation procedure is an algorithm targeted to provide the best match among water demands, water streams, and treatment technologies, exploiting information and data inserted in all the pages of the platform. The procedure is divided into three steps, which are contextually adapted to the point of view of the platform user which starts the procedure.

Considering the case when the Technology Provider starts the New Water Loop creation, the steps are:

1. Technology Provider selects one or multiple water streams to be connected to its water treatments: the choice is supported by the UCP matching algorithm, which use the information related to water stream output features and water input requirements of available technologies to suggest the best matching (Figure 8);
2. Technology Provider selects one or more water demands to which they want to apply: the system asks the application fields targeted by the technology proposal in order to orient the UCP matching algorithm, which supports the choice by providing a water demands list, ordered by relevance (Figure 9);
3. Technology Provider defines the technology proposal, specifying the combination of treatment technologies, the application fields, the quantity of water processed in a day, quality features, all technical and plants details and, finally, the economic proposal (Figure 10).





**New Water Treatment proposal - step 3**

**Water Technology qualification**

Water Treatment proposal completion: 80%

Number of water stream(s) selected 2  
 Number of water users will be notified selected 4

**Technology short name**  
 specify name to show for this treatment

Your technology best apply to a specific field? (INPUT STREAM)  
☐ Check ITEM(s) if application is for a specific field  
 Agriculture

Technology fits a specific domain?  
☐ Check ITEM(s) if application is for a specific field  
 REVERSE OSMOSIS DESALINATION

Specify a different domain not included in list  
 Domain of application specification

Flow processed m3/day  
 flow in m3/day

**Treatment full description**  
 Write a detailed description of the treatment proposed and technologies

Upload PDF / CSV  
 - Technical documents  
 - Specifications  
 - Certifications Scegli file Nessun file selezionato

**Additional informations**

Extra infos

Describe in a few lines the product technology and benefits of the treatment

**Economic Proposal**

Upload PDF  
 Economical proposal Scegli file Nessun file selezionato Specify Total proposal economical value in € € value proposed

Specify expiration date for this proposal gg/mm/aaaa

**SUBMIT PROPOSAL AND NOTIFY**

Figure 10: New water loop creation - step 3

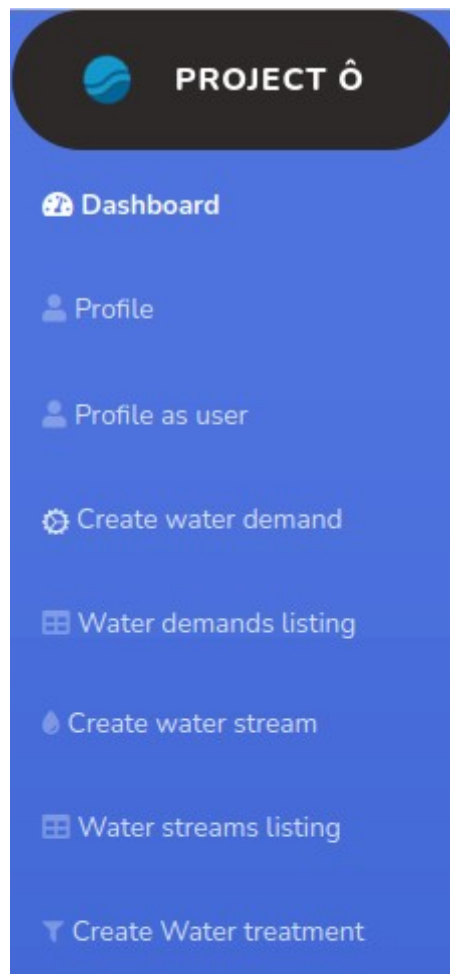
## 2.6 Common functionalities

All user roles share also a set of functionalities, hereafter described and presented with some screenshots.

### 2.6.1 Menu and Top bar

All the pages of the platform share two fix components: the left menu and the top bar.

Figure 11 shows the first items of the left Menu: Project Logo links to the Dashboard page (see Section 2.6.3), other links are explained in the related sections of this report. Menu content is depending also from the user role: e.g. if the user using the platform is classified only as “Water User”, he finds the “Create water demand” link but not the “Create water stream” one.



*Figure 11: Left menu*

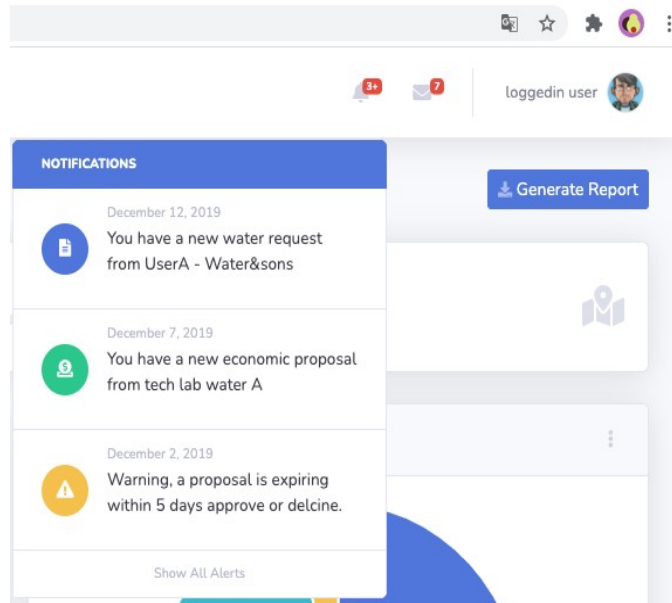
Figure 12 presents the content of the top bar, with a search box, notification icons and active user profile.



*Figura 12: Top bar*

The bell icon gives access to the notification modal window (Figure 13): all new contents created inside the platform will be resumed and notified contextually to the user role, within this window, inviting the user to take action.





*Figure 13: Notifications modal window*

### 2.6.2 Company and User profile

Each User is acting on the platform as part of a Company, defined as a group of user coordinated by a Company Administrator. Both the User and the Company have a profile page containing detailed information and listing the user (or company users) global activities in the page.

Figure 14 presents the User profile page, where user roles, personal information and the company name are listed, together with a resume card reporting activities indicators for the profile. Information included in this page qualify the subject and orient the New Water Loop creation procedure.

Extra details are also stored in the Company profile: the company application field(s); the list of Company Users with the Company Administrator highlighted; a list of recent Company activities on the platform; a map containing the localization of the Company activities.

Profiles information are also used to orient and improve the algorithm matching water demands, stream offers and treatment technologies.

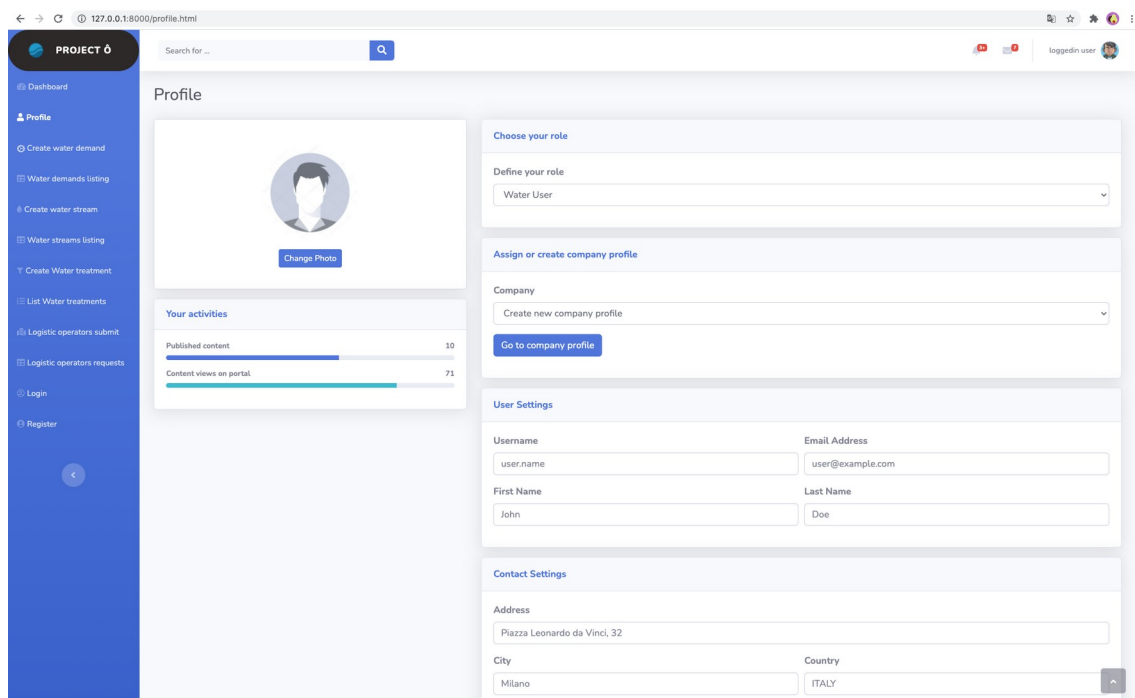


Figure 14: User profile

### 2.6.3 The Dashboard

A contextual Dashboard page is available for each user, presenting a resume of User or Company activities on the UCP and providing at first glance the status of proposals and requests.

The Dashboard is composed by a combination of cards, interactive charts and maps, that can be customized according to user roles and preferences. Figure 15 shows an example of the Dashboard page for a Company Administrator User, which can control the activities of all roles related to his Company.

Considering the potential synergies between DAP and UCP introduced in Section 1, the Dashboard could also be further developed to show information coming from both platforms and improve the integration among the two tools.

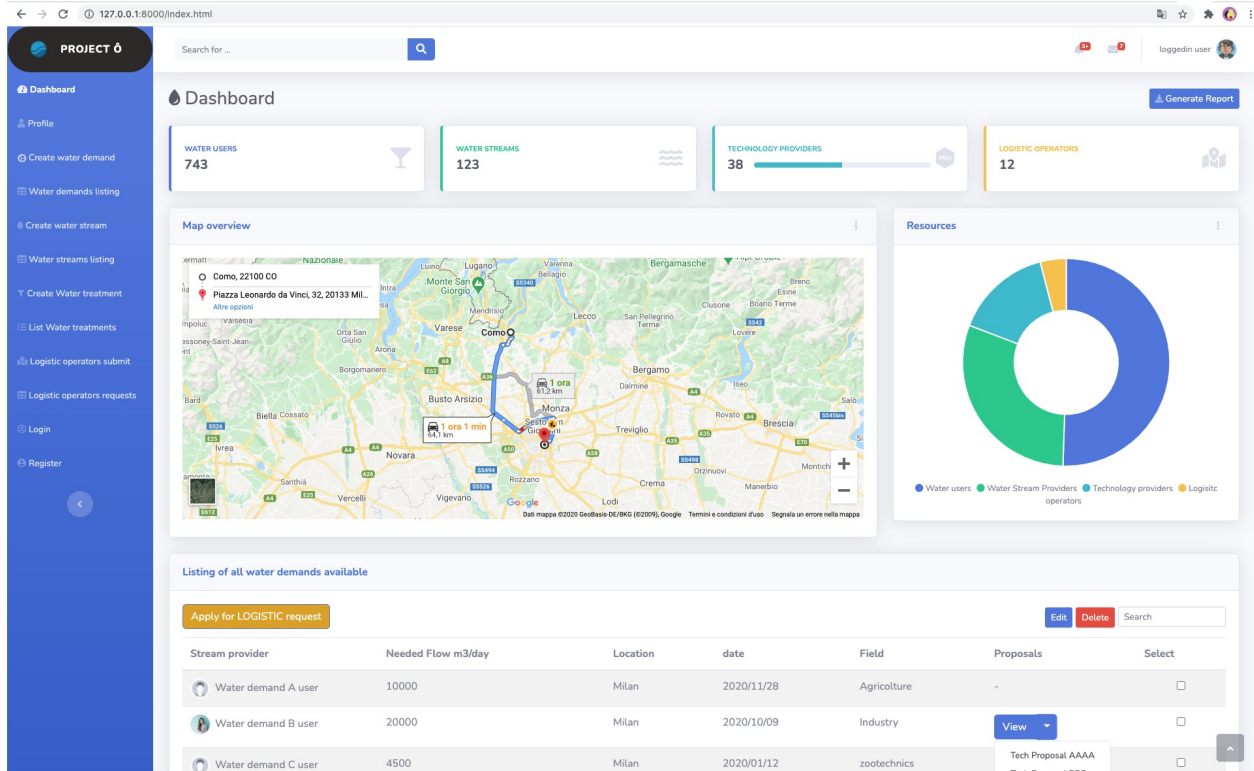


Figure 15: Dashboard

## 2.7 Use case

To provide an example of possible platform use, we can consider the value chain for the Apulian Aqueduct demo site, described in Section 2.4.1 of Deliverable D7.6, where two possible scenarios for a new water loop have been identified.

Figure 16 presents the value chain of the demo site with the introduction of a new water source to face a water demand increase. Matching of new water demands and offers implies to connect water provider and water users with technological and logistics facilities that can transfer the requested amount of water, with suitable quality feature, at the desired location.

In this case, the new source is an artesian borehole: the water it provides needs to be treated with ADV.ERT technology (see WP2) before entering in the distribution network.

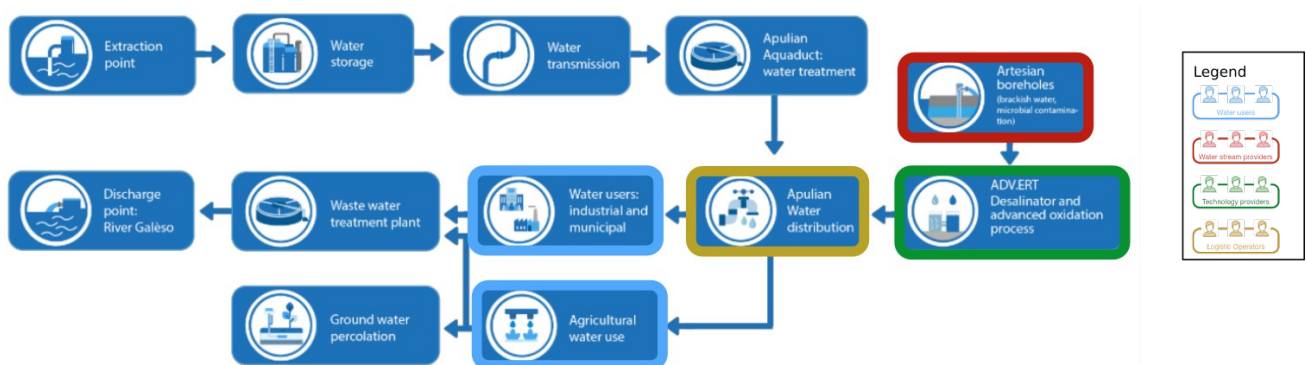


Figure 16: A possible new value chain for Apulian Aqueduct, with UCP roles highlighted

In this example UCP could support the new value chain creation as follows:

1. Industrial and Agricultural Water Users create their water demand, specifying the amount of water needed, the location, the related application field and eventually their requirement in term of chemical specifications (see Figure 3);
2. given its geographical location, the owner of the artesian borehole gets notification of the new water demands created in the platform and can access its detail from the Water Demands Listing page (Figure 4). Since the water demands are potentially interesting, he creates, if not already present, its water stream offer, by entering the details of the water that could be extracted and supplied from the borehole, expressed in terms of quantity, location, application field and chemical parameters (see Figure 5);
3. Technology Providers get notifications of new water demands and water stream creations. One of them, owner of the ADV.ERT technology starts the New Water Loop creation procedure, by selecting a combination of water stream and water demands, and by entering the technology proposal details (see Figures 8, 9 and 10);
4. Water Users are notified of the new water loop created to reply to their respective demands. At this point they can decide to select the new water loop and apply for logistic quotation (Figure 4);
5. Logistic operator, which in the use case example of Figure 16 is the Apulian Aqueduct Water Distribution Department, receives the requests, evaluate the automatic solutions proposed by the UCP location algorithm, check the feasibility of support the water supply in term of quantity, quality and location of the water to be transported and eventually finalizes his proposals in terms of technical solutions and economic quotations to Water Users (Figure 7);
6. Water User select the final combinations of water source, treatment technology and logistic facility, approving them (Figure 4). The platform generates a report with all Water Loop details, the contact information for all the subjects involved in the loop and archives all the related information, making them still accessible but no more editable.

## 3 Implementation details

The User Collaborative Platform will be developed with a stack of open-source software, mixing mature and well-known solution with customized software component in order to provide features described in Section 2. Development strategy is also oriented in order to:

- ensure synergies with the Decision Analytic Platform, currently under development within the WP4 activities, as anticipated in Section 1;
- provide portable and modular software solutions, oriented to commercial exploitation, coherently with the goals of the Exploitation Plan (see WP9).

Section 3.1 presents the architecture of the UCP Platform, Section 3.2 provides insights on the Content Management System selected to publish content.

### 3.1 Platform architecture

Figure 17 presents a schematic view of the stack that will be used to develop the UCP: the idea is to build a virtual machine containing all the software needed to run the platform, that could also be easily installed, moved and replicated anywhere. Considering this target and the requirements mentioned above, the components composing the UCP stack are the following:

- [Vagrant](#) - *Virtualization Environment*: Vagrant is a tool for building, managing and distributing virtual machines. It uses a well structured workflow to build, deploy, update and manage virtual machines, ensuring the possibility to replicate and move them anywhere. The starting point for virtual machine creation is a configuration file, named *Vagrantfile*, specifying the type of virtual machine, the base image for the operating system and the so called *provisioner* to be used.
- [Ansible](#) – *Provisioner*: Ansible is an IT automation tool. In the UCP stack is used by Vagrant to install and update software and configurations on the virtual machine, and more in general to manage it minimizing the direct operation within the machine itself, ensuring portability.
- [Virtualbox](#) – *Virtual Machine*: VirtualBox is a cross-platform virtualization application, licensed under the terms of the GNU General Public License (GPL) 2. It allows the creation of the virtual machine itself, that can be defined as a software mimicking the functioning of a real computer machine.
- [Ubuntu Server](#) – *Operating System*: Ubuntu is the choice for the server OS. It is a mature, stable and up-to-date Linux Distribution, with a wide repository of packaged open source software ready to be installed and integrated. This server will be equipped with a LAPP software bundle, an acronym where the first letter is for the server itself (Linux) and the others stands for:
  - [Apache](#) – *Web Server*: one of the most secure and reliable servers to publish content on the web;
  - [Postgresql](#) + [PostGIS](#) – *GeoDatabase*: one of the most advanced and modern relational database managers, its spatial extension PostGIS allows to manage and process geographical data;
  - [PHP](#): a popular programming language in the web environment, it is the base of Drupal (see below).
- [QGIS Server](#) – *Map Server*: QGIS is the choice for the publishing of maps and other spatial contents of the UCP. The use of the QGIS server grants the platform to be compliant with the OGC standards<sup>2</sup> as the geographical information (layers) added to the QGIS server can be eventually reused on other platforms or website through standard web services like WMS (Web Map Services) and WFS (Web Feature Service).

<sup>2</sup> Open Geospatial Consortium

- [Drupal](#) – Content Management System: Drupal is a content-management framework that can be tailored and customized to simple websites or complex web applications. Section 3.2 will provide more details on this CMS.

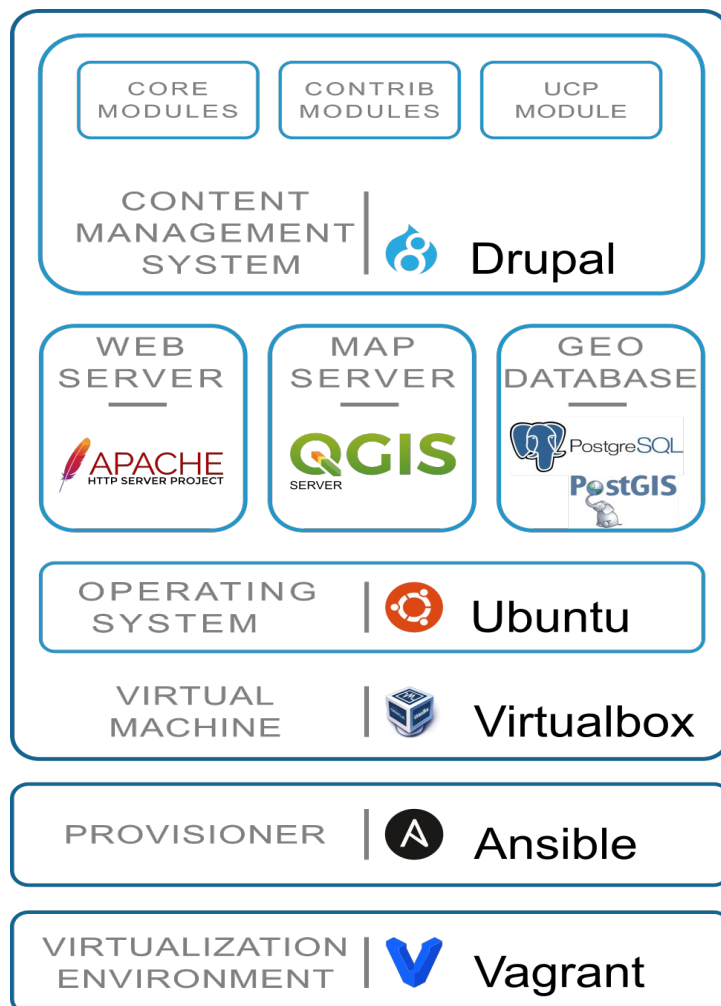


Figure 17: User Collaborative Platform stack

## 3.2 Drupal CMS

All user and site-building aspects are experienced through Drupal, an open source content management system written in PHP language, as a graphical user interface.

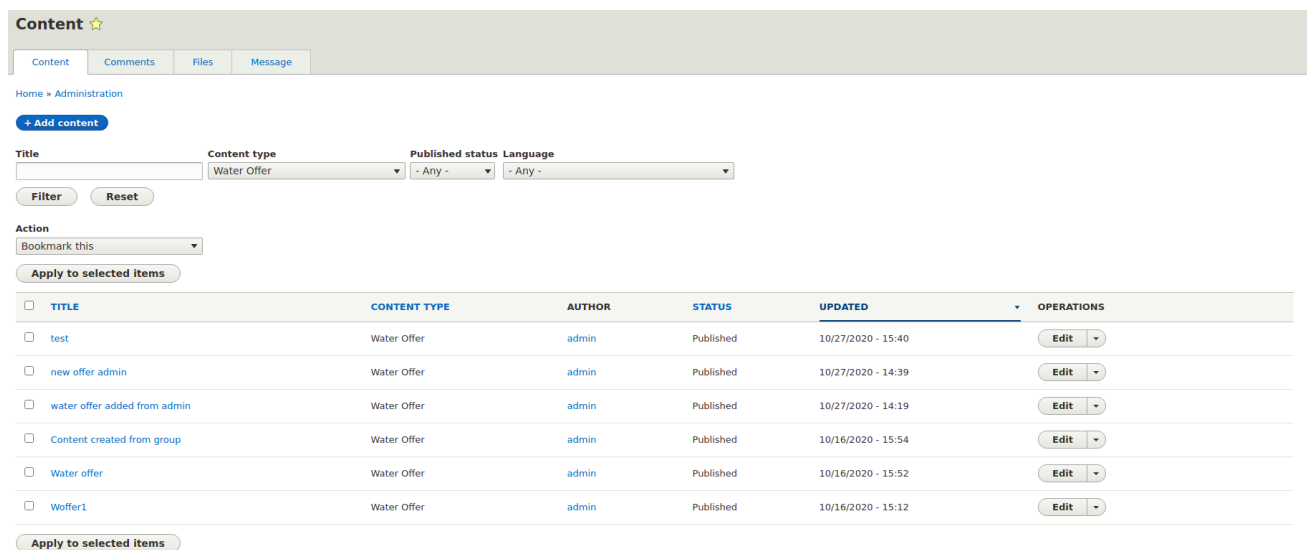
Drupal sites are highly customizable, featuring a Lego-like framework that can be built to match exact specifications. Drupal has a number of standard features out-of-the-box, like easy content authoring, reliable performance, and excellent security, but it gains popularity because of its flexibility and modularity: modules expand Drupal's functionality, while themes let the user customize content's presentation. Moreover, Drupal is used by a huge number of popular and high traffic websites<sup>3</sup> and boasts a large user community, with thousands of designers and developers contributing to the modules library.

<sup>3</sup> For further references see, for example, <https://w3techs.com/technologies/details/cm-drupal> or <https://www.drupal.org/case-studies>

Modules can be divided into three categories (as presented also at the top of Figure 17): core modules, which are part of the standard Drupal release; contributed modules, developed by Drupal Community and supporting a wide variety of website features; custom modules, to further extend and customize the system.

All the base functionalities rely on core modules. This are intended to be:

- user and role management;
- contents and comments management and publication: every content type or entity manage by Drupal can be viewed in the form of a list with the possibility of filter by type and status (Figure 18);
- user interface configuration: Figure 19 shows the configuration panel for Drupal Site Administrator. Contributed or custom modules can add section to this panel in order to manage modules configuration parameters.



**Content** ☆

Content Comments Files Message

Home » Administration

+ Add content

Title:  Content type: Water Offer Published status: - Any - Language: - Any -

Filter Reset

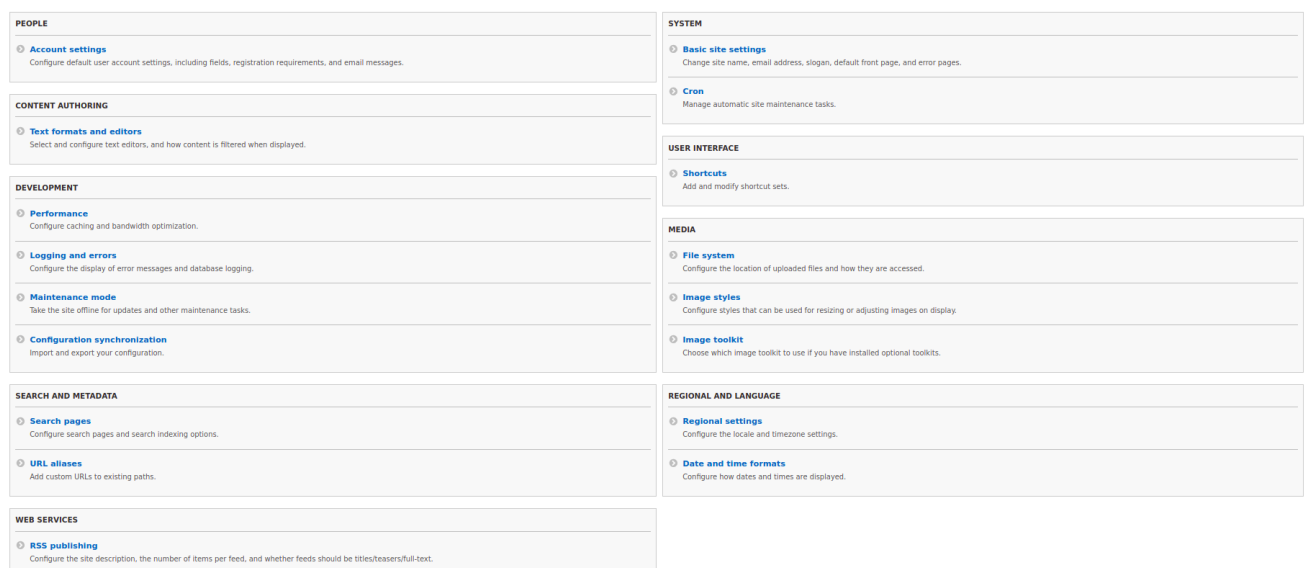
Action: Bookmark this

Apply to selected items

<input type="checkbox"/>	TITLE	CONTENT TYPE	AUTHOR	STATUS	UPDATED	OPERATIONS
<input type="checkbox"/>	test	Water Offer	admin	Published	10/27/2020 - 15:40	Edit
<input type="checkbox"/>	new offer admin	Water Offer	admin	Published	10/27/2020 - 14:39	Edit
<input type="checkbox"/>	water offer added from admin	Water Offer	admin	Published	10/27/2020 - 14:19	Edit
<input type="checkbox"/>	Content created from group	Water Offer	admin	Published	10/16/2020 - 15:54	Edit
<input type="checkbox"/>	Water offer	Water Offer	admin	Published	10/16/2020 - 15:52	Edit
<input type="checkbox"/>	Woffer1	Water Offer	admin	Published	10/16/2020 - 15:12	Edit

Apply to selected items

Figure 18: Drupal administrative page: Content list



**PEOPLE**

- Account settings**  
Configure default user account settings, including fields, registration requirements, and email messages.

**CONTENT AUTHORIZING**

- Text formats and editors**  
Select and configure text editors, and how content is filtered when displayed.

**DEVELOPMENT**

- Performance**  
Configure caching and bandwidth optimization.
- Logging and errors**  
Configure the display of error messages and database logging.
- Maintenance mode**  
Take the site offline for updates and other maintenance tasks.
- Configuration synchronization**  
Import and export your configuration.

**SEARCH AND METADATA**

- Search pages**  
Configure search pages and search indexing options.
- URL aliases**  
Add custom URLs to existing paths.

**WEB SERVICES**

- RSS publishing**  
Configure the site description, the number of items per feed, and whether feeds should be titles/teasers/full-text.

**SYSTEM**

- Basic site settings**  
Change site name, email address, slogan, default front page, and error pages.
- Cron**  
Manage automatic site maintenance tasks.

**USER INTERFACE**

- Shortcuts**  
Add and modify shortcut sets.

**MEDIA**

- File system**  
Configure the location of uploaded files and how they are accessed.
- Image styles**  
Configure styles that can be used for resizing or adjusting images on display.
- Image toolkit**  
Choose which image toolkit to use if you have installed optional toolkits.

**REGIONAL AND LANGUAGE**

- Regional settings**  
Configure the locale and timezone settings.
- Date and time formats**  
Configure how dates and times are displayed.

Figure 19: Drupal administrative page: Configuration panel

The most important contributed modules introduced in the UCP platform are, instead, the following:

- [Groups](#) module to manage 'groups' of subjects who wants to operate inside the platform like an organization;

- [Flag](#) module is the base for the customization of notifications between the subjects of the platform;
- [Geolocation Field](#) module is used to define a location for water offer/water request in order to perform a first step in the possibility tree;
- [Geocoder](#) module is a Drupal wrapper/implementation for the Geocoder PHP library, an Application Programming Interface (API) for general operations on geographical data server side.

Given the description of UCP requirements presented in Section 2, it is evident that core and contributed modules can not cover all the UCP needs. To address these features, customs modules will be developed by the Project Ô team, with the aim of change default behaviors or completely introduce new functionalities.

UCP users who access the platform will be able to view/insert contents that they are interested in. This is managed using Drupal concept of roles: it is possible to associate different permissions to different roles, granting specific functionalities to different users or 'groups' of users.

Specifically, the customization regards

- **Registration:** a customization of the standard Drupal registration module. It has been modified to perform the necessary operation on the user account along with it's registration. The user will be inserted like a single user with the selected role, if she/he will apply for a Single user account. Thanks to the use of the Groups contributed module, a group of the selected role type will be created if the user will apply for a Company user account, and the user who made the request will be the Company Administrator. The use of groups give to the administrator the possibility to manage other people that belong to the same organization. This is useful for companies or other kinds of organizations that want to contribute/use the platform identifying different competence/skills for each user.
- **Notifications:** Since the introduction of different roles for the users, the notifications will be filtered by type (e.g. water demands, water offers, logistic quotation requests... ) and the users will be notified only by messages they are interested in (see Section 2.6.1). The notification flow could be expanded with the send of mail or with a push notification system leveraging on other contributed modules.
- **Matching algorithm:** the New Water Loop creation procedure presented in Section 2.5, takes advantage of all the information inserted by different users to rank by relevance the possible combination among water demands, water stream offers and technologies, in order to effectively support the water loop creation and maximize the value added to water value chain.
- **Location algorithm:** position of users and of their assets will be used to support the matching algorithm and to propose possible logistic solution to Logistic Providers (see Section 2.4).
- **Theme:** a custom theme will be developed based on Bootstrap4, one of the most popular framework for building responsive, mobile-first sites.



## 4 Conclusions

This document describes the User Collaborative Platform (UCP), one of the software tools developed within Project Ô, implementing the specifications defined on the deliverable D7.2 and taking inspiration from a market-place for the exchange of water volumes.

The proposed User Collaborative Platform is a multi-user web application, in which users with different roles can submit their requests and offers for water, treatment technologies, and transport and distribution services: each role has dedicated functions and specific views on the data, created using preferences and privileges associated with personal or company profile.

This document shows many screenshots obtained from an interactive demo (accessible at the following url: [http://xake.deib.polimi.it/project\\_o/demo](http://xake.deib.polimi.it/project_o/demo)), to describe functionalities, users interaction and UCP algorithms outcomes. Thanks to these tools, the platform supports the procedures for defining new water loops, providing the best match between water demand, water flows and treatment technologies, exploiting the information and data collected.

Finally, the software architecture that will be used to implement the UCP is proposed: a combination of well-known and robust open-source products and customly developed software will be used, as well as standard and modern software paradigms and modes of interactions, in order to guarantee an effective, modular and portable solution, also able to allow future exploitation.

Next months will be dedicated to the interaction with other Project Ô partners, including demo-sites owners, and to the platform development and configuration. The final version of UCP will be released as Demonstrator with the Deliverable D7.4.