

D3.3 The Online SWS Platform



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Deliverable author(s):	Anastasios Zafeiropoulos (UBITECH), George Karavokiros (NTUA), Klio Monokrousou (NTUA), Christos Makropoulos (NTUA, KWR)
Quality assurance:	Gerard van de Berg (KWR)
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Executive Summary

In the current document, description of the SUBSOL Subsurface Water Solutions (SWS) Online platform is provided. The SWS online platform consists of the main web-based platform developed by SUBSOL aiming to act as a hub providing access to the set of designed and implemented online services. These services include a) access to the SUBSOL Knowledge Base where information regarding the set of solutions, products and applications considered within SUBSOL is collected and made available to end users, b) access to the SUBSOL Toolkit that supports the collection and monitoring of environmental data, as well as the identification of locations that can be suitable for applying subsurface water solutions and c) the SUBSOL Marketplace that regards an online platform supporting the sharing of knowledge and lessons learnt between cases examined in the project and across regions and help facilitate innovative technologies and applied solutions.

1 Introduction

The current document provides details with regards to the design and implementation of the SUBSOL Subsurface Water Solutions (SWS) online platform and especially the SUBSOL Marketplace. The SUBSOL SWS online platform consists of three parts, namely the landing page, the Knowledge Base and the Marketplace.

The landing page¹ provides overall information regarding the functionalities supported by the SWS online platform, entry points for the Knowledge Base and the Marketplace as well as registration, login and search functionalities. The Knowledge Base supports a set of data management functionalities with regards to SWS related data. It consists of a public and private part. In the private part, SUBSOL users are able to add, edit, update or delete data related to products and services, measures, applications, projects, publications, regulations, data providers, working groups and persons. In the public part, end users are able to view detailed information regarding the data that is available in the Knowledge Base, navigate through them via a set of views based on lists and pivot tables, as well as search for data based on keywords. The Marketplace aims to support the promotion of SWS products, projects, measures and applications to any interested party and facilitate both product or technology solutions owners and project members to identify opportunities for usage of specific products in specific SWS cases. It aims to serve as a virtual marketplace to share knowledge and lessons learnt between SWS cases in various regions and help facilitate the technology interface. A set of services are provided to end users (organization representatives or simple marketplace users) for managing content as well as navigating through it, providing rating for specific products as well as interacting among them for materialising potential interest for the available solutions in the Marketplace.

A unique end user interface is designed and applied to the three parts of the SUBSOL SWS online platform, aiming at providing a unified experience to the end user through its navigation in the various parts, as well as reducing the complexity in the management of the SWS-related information. A set of workflows for navigation among the various parts depending on the requirements and the access rights of each type of end user are examined and taken into account.

It should be also noted that the design and development of the SUBSOL SWS online platform has been based on the definition open interfaces, able to be extended in the future and being in parallel interoperable with open services provided by existing platforms (e.g. the EIP Water Marketplace).

¹ <http://subsol-data.euprojects.net/>

The document is structured as follows: in section two, the overall architecture of the SUBSOL online platform is presented, including a short description regarding the role of each component; in section three, a detailed description of the SUBSOL Marketplace is provided, including the set of implemented functionalities and a short guidance on their usage; in section four, the approach being followed with regards to continuous source development and system integration is described in detail, while section five concludes the document.

2 SUBSOL Online Platform

2.1 SUBSOL Type of Users

In the SUBSOL SWS online platform, the following type of users are considered:

- **Knowledge Base Editor:** He has access to the public and private part of the Knowledge Base and is able to add/edit/delete content in all the database tables of the SUBSOL database (except the part of tables with fixed content).
- **Organization Representative:** He has access to the Marketplace and is able to add/edit/delete content that is associated with his organization (Products & Services, Projects, Measures, Applications). He is also responsible for interaction with interested parties with regards to the items belonging to the organization (e.g. expression of interest for a product). He is able to view all the content made available regarding Products & Services, Projects, Measures, Applications.
- **Simple User:** He has access to the Marketplace and is able to view all the content made available regarding Products & Services, Projects, Measures, Applications. He is able to express interest for specific items, provide rating for items and initiate communication with the organization representatives.
- **Anonymous User:** He has access to the public part of the online platform and the Knowledge Base. He is able to see custom views and perform simple and advanced queries over the available content.
- **Administrator:** He has access to all parts of the online platform and is able to add/edit/delete any content in the SUBSOL database.

2.2 SUBSOL Online Platform Components

The SUBSOL SWS online platform consists of three parts, namely the landing page, the Knowledge Base and the Marketplace. Access to the platform is provided through the URL <http://subsol-data.euprojects.net/>, where the end user is able to view introductory information regarding the set of services provided through the platform. Most of the information made available through the landing page is public, while login or registration functionalities are provided in order for the user to gain access to the Marketplace and the private part of the Knowledge Base. A screenshot, depicting part of the home page of the online platform is provided in Figure 1.

Through the top menu the following functionalities are provided:

- access to the SUBSOL Marketplace
- access to the public part of the Knowledge Base, consisting of information provided in the form of lists and pivot tables
- interfaces for search and advanced search functionalities

In the main part of the homepage, entry points to the Marketplace, the SUBSOL Toolkit and a set of custom views concerning the available products, measures and applications are provided. Furthermore, information regarding newly introduced items (e.g. recent products or applications) is provided in a right sidebar toolbox.

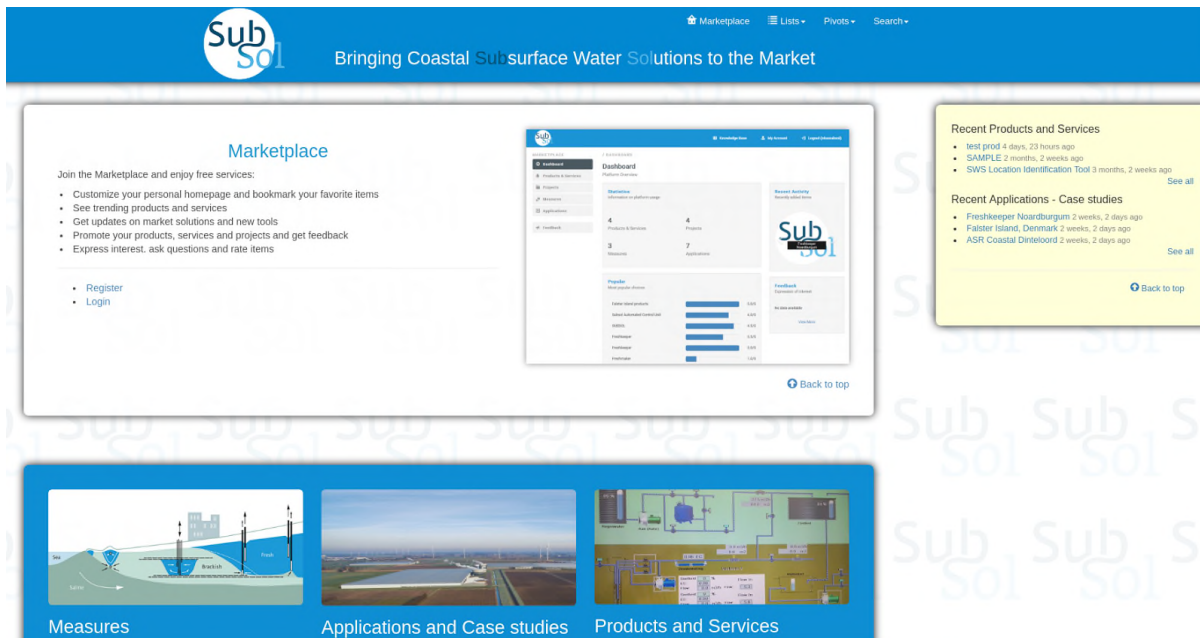


Figure 1: SUBSOL Online Platform home page

Access to the public part of the Knowledge Base is provided through a set of user friendly interfaces. Information is presented in the form of “Lists” and “Pivot Tables”. By selecting an option from the “Lists” dropdown menu in the top bar, the user is able to view the entries of the selected data category (see Figures 2 and 3). For those data categories for which illustrations are available (e.g. Projects, Measures, Applications), two different type of layouts are supported; a detailed layout providing detailed information regarding each item and an icons layout providing a graphical overview of the items.

Through the “Pivots” dropdown menu, pivot tables combining parameters from the set of existing tables in the SUBSOL database are provided, facilitating the end users to get aggregated and comparative information over the whole dataset in an easy and straightforward way (see Figure 4).

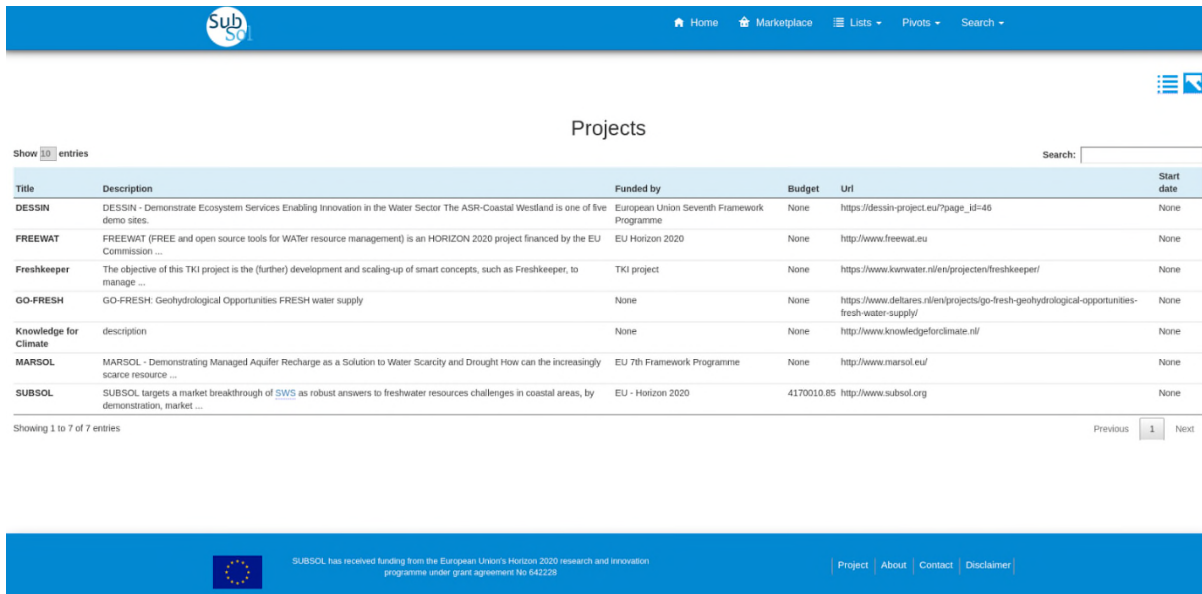


Figure 2: Lists in Knowledge Base

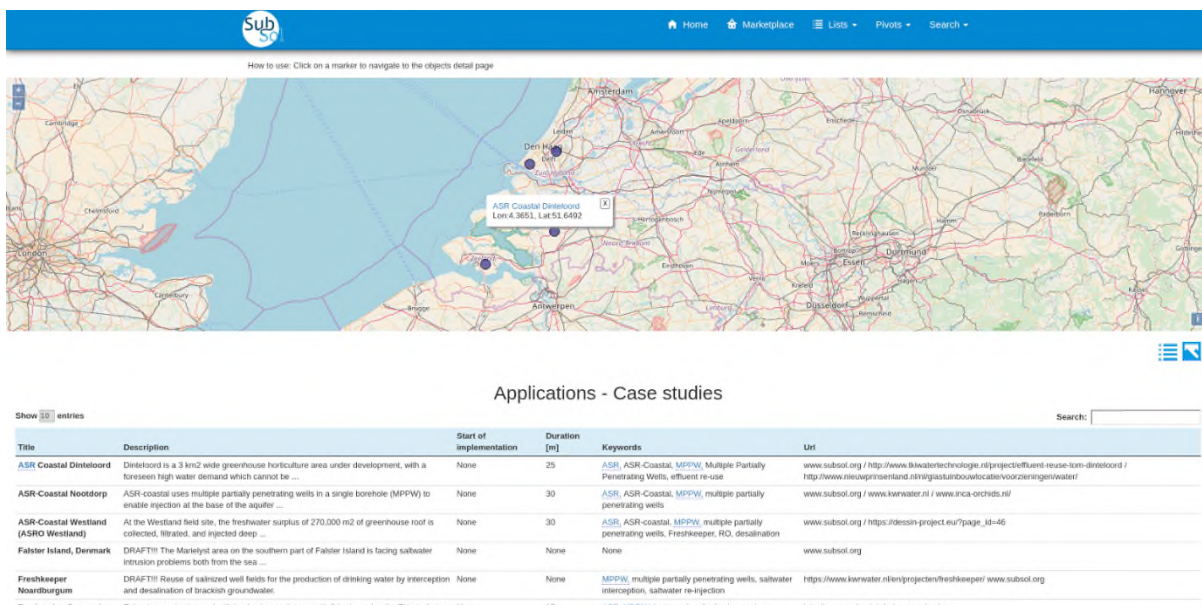


Figure 3: Lists combined with geomaps

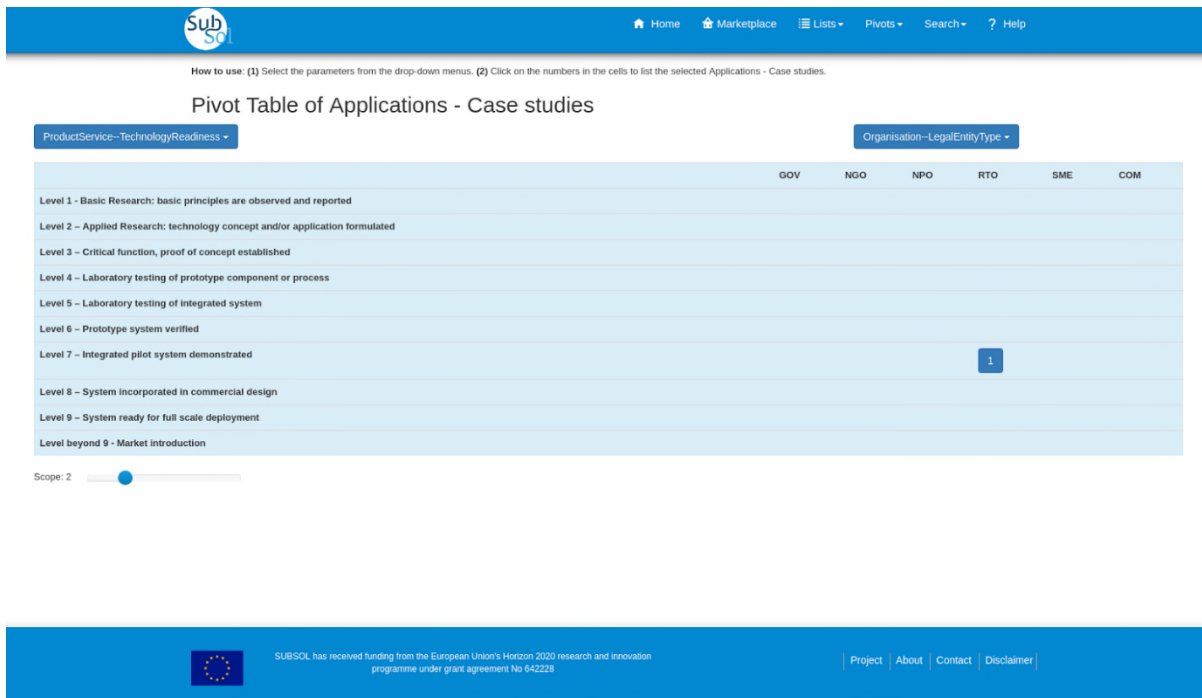


Figure 4: Pivot Tables

The private part of the Knowledge Base, accessed by data managers is related with populating the database with new data and the management of existing knowledge. This functionality has been described in detail in the deliverable SUBSOL D3.1 (A web-based knowledge environment) [1]. In the following section the functionality of the SUBSOL Marketplace, accessible only by registered users, will be described in detail. Users may register to the system in a secure way by selecting the registration option from the landing page.

It should be noted that, although the website consists of several subsystems (Knowledge Base, Marketplace, Homepage), the transition from one subsystem to another when browsing through the website is transparent to the user. This is accomplished by applying common design specifications and thus achieving a coherent structure of the website and a common look-and-feel of all parts of the user interface. At the same time the appearance and behaviour of the user interface is adjusted according to the user role.

3 SUBSOL Marketplace

3.1 Marketplace Functionalities

The SUBSOL Marketplace has been designed as an online system supporting the promotion of content related with SWS solutions to interested stakeholders from the industrial, research and academic community as well as public sector institutions. The SUBSOL Marketplace supports a number of useful functionalities such as the following:

- dissemination of products, services and technological solutions,
- collection of feedback and rating from the end users,
- expression of interest for selected products,
- identification of trends,
- personalised presentation of content,
- view of recent activities and overall statistics and
- facilitation of the interaction among members of the platform having a common interest in a product or a technological solution.

In this section, the services offered by the Marketplace to organization representatives and to simple users, two of the main user categories of the Marketplace, are briefly introduced. Organization representatives have access to two type of views, namely the user and the manager view. The manager user interface provides additional functionalities which facilitate data management and the interface is similar to data management interfaces developed within the SUBSOL Knowledge Base. Material added by organization representatives or Knowledge Base editors is made available to both subsystems, given the existence of a unique database.

For simple users the entry point in the Marketplace is the Marketplace home page where the end user is able to see a set of descriptive statistics regarding the number of available items per category (e.g. projects, products), popular items per category, items that have been declared as favourites as well as the recent activity of the Marketplace, i.e. items which have been added recently to the system. Figure 5 gives an example of the Marketplace home page. It should be noted that part of the content of the user's home page is planned to be created "on-the-fly" based on the declared preferences and areas of expertise of the end user (see Figure 6). The "on-the-fly" content is going to regard set of suggestions for highly relevant products, projects, measures and applications according to the end user profile.

MARKETPLACE / MARKETPLACE

Marketplace
Platform Overview

Statistics
Information on platform usage

7 Products	7 Projects	4 Measures	7 Applications
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Popular
Most popular choices

Category	Item	Rating
Products	Falster Island products	5.0/5
	SWS Location Identification Tool	5.0/5
Projects	SUBSOL	4.7/5
	GO-FRESH	4.0/5
Measures	Freshkeeper	5.0/5
	Freshmaker	3.0/5
Applications	Freshkeeper Noardburgum	5.0/5
	ASR-Coastal Nootdorp	4.0/5

Favorites
Overview of my favorite choices

Name/Title	Organisation
SUBSOL	Ubitech
Freshmaker	-
Freshkeeper Noardburgum	KWR

[View More](#)

Recent Activity
Recently added items

Category	Item
Products	test prod
	SAMPLE
Applications	Freshkeeper Noardburgum
	Falster Island, Denmark

Figure 5: Marketplace home page

The screenshot shows a web browser window with the URL `subsol.euprojects.net/account/profile/edit`. The page features a blue navigation bar with the SUBSOL logo and links for Home, Marketplace, Lists, Pivots, Search, User Management, My Account, and Logout (subsol). The main content area is divided into several sections:

- Old Password:** A text input field.
- New Password:** A text input field.
- Repeat Password:** A text input field.
- Organisation:** A text input field containing the word "Other".
- Role in Organisation:** A dropdown menu with "ADMIN" selected.
- Areas of expertise:** A list of tags including "Artificial recharge" and "Aquifer vulnerability".
- Interests:** A list of tags including "Hydrogeological solutions" and "Data management".

At the bottom of the page, there is a blue footer containing the European Union flag, the text "SUBSOL has received funding from the European Union Horizon 2020 research and innovation programme", and navigation links for Project, About, Contact, and Disclaimer.

Figure 6: Declaration of areas of expertise and interests of end user

The end user is able to navigate through the Marketplace and view the introduced items per category (Products and Services, Projects, Measures, Applications) by selecting the appropriate category from the left-side menu. For each item of the selected category, a small characteristic image is provided along with a short description and a set of icons supporting rating, “add to favourites” and “expression of interest” functionality (see Figure 7). The ratings are expressed in a scale from one to five stars, and interests are stored in the profile of the end user in the SUBSOL database and are taken into account for the creation of a personalized user home page (e.g. presentation of recent additions to the favourite items, view of rating of most popular items).

Furthermore, by selecting a specific item, the user is able to view additional information regarding this item including a detailed description of the item, while, there is also the option to view the full set of available information provided through the SUBSOL Knowledge Base (see Figure 8).

Finally, through the expression of interest for a specific item, a dialogue is initiated between the two related parties, i.e. the end user declaring interest for a product or service and the organization representative which offers it. This feature facilitates their communication and supports the exchange of useful information and potential exploitation of the items promoted through the Marketplace (see Figure 9). The exchange of information may regard collection of advanced data with regards to the considered item, as well as the initiation of business-oriented interaction among the involved parties.

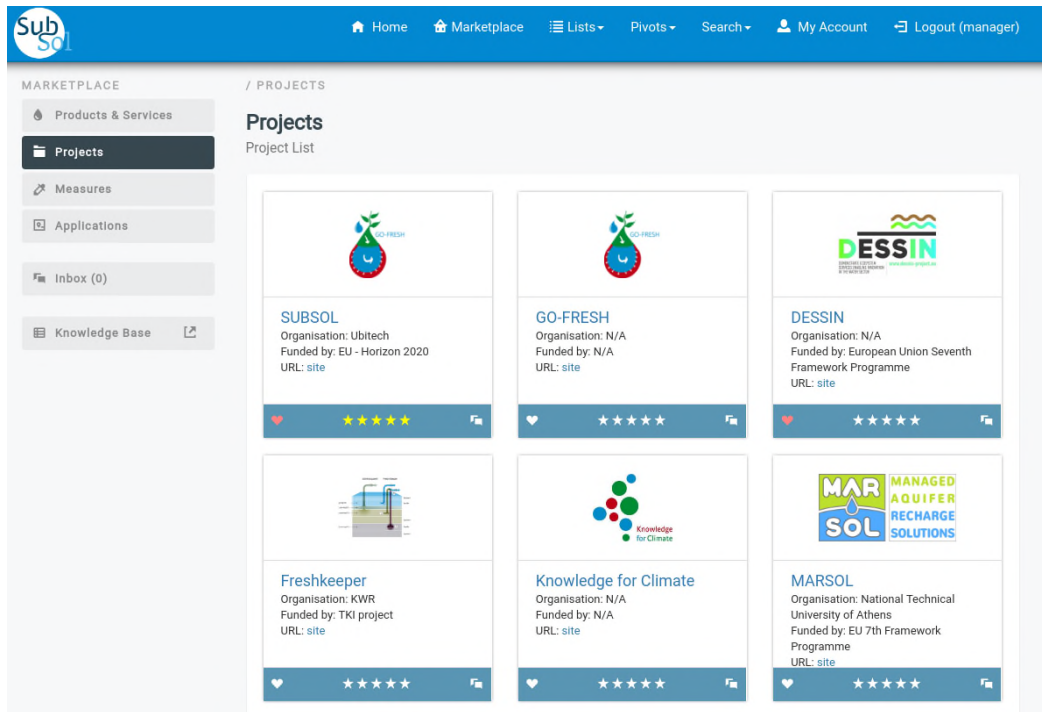


Figure 7: Content presentation and set of functionalities

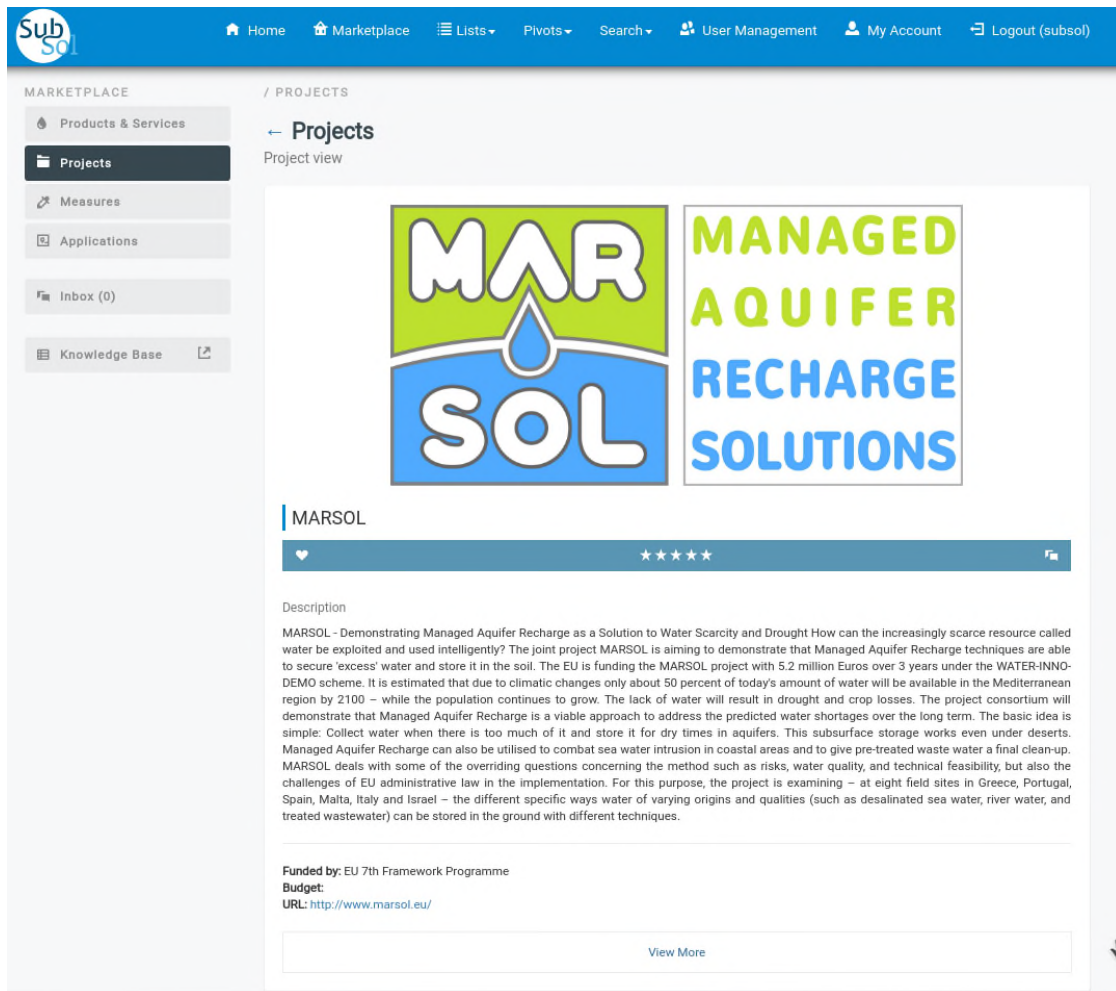


Figure 8: View of a specific item in the Marketplace

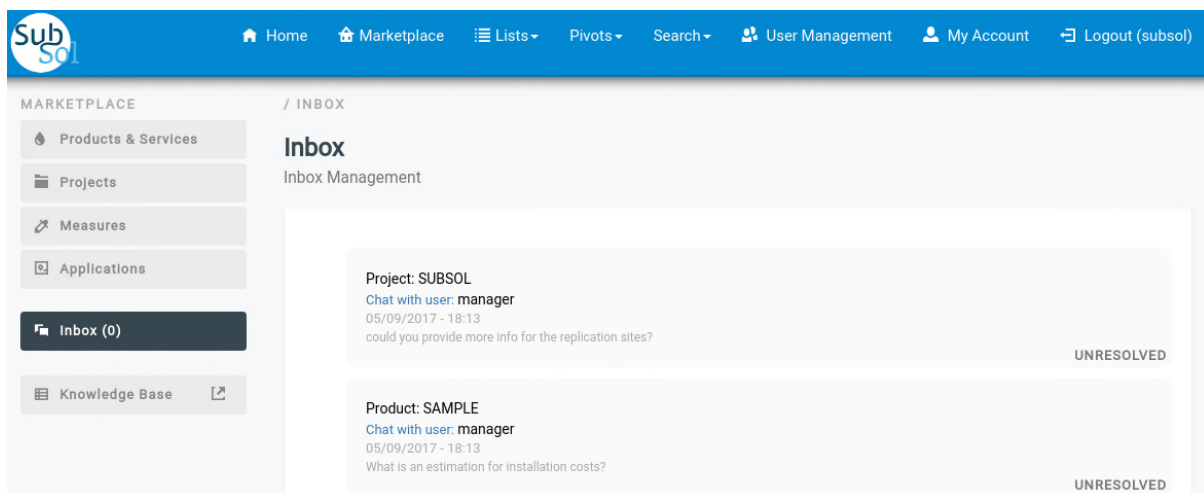


Figure 9: Set of dialogues initiated for the products of the organization

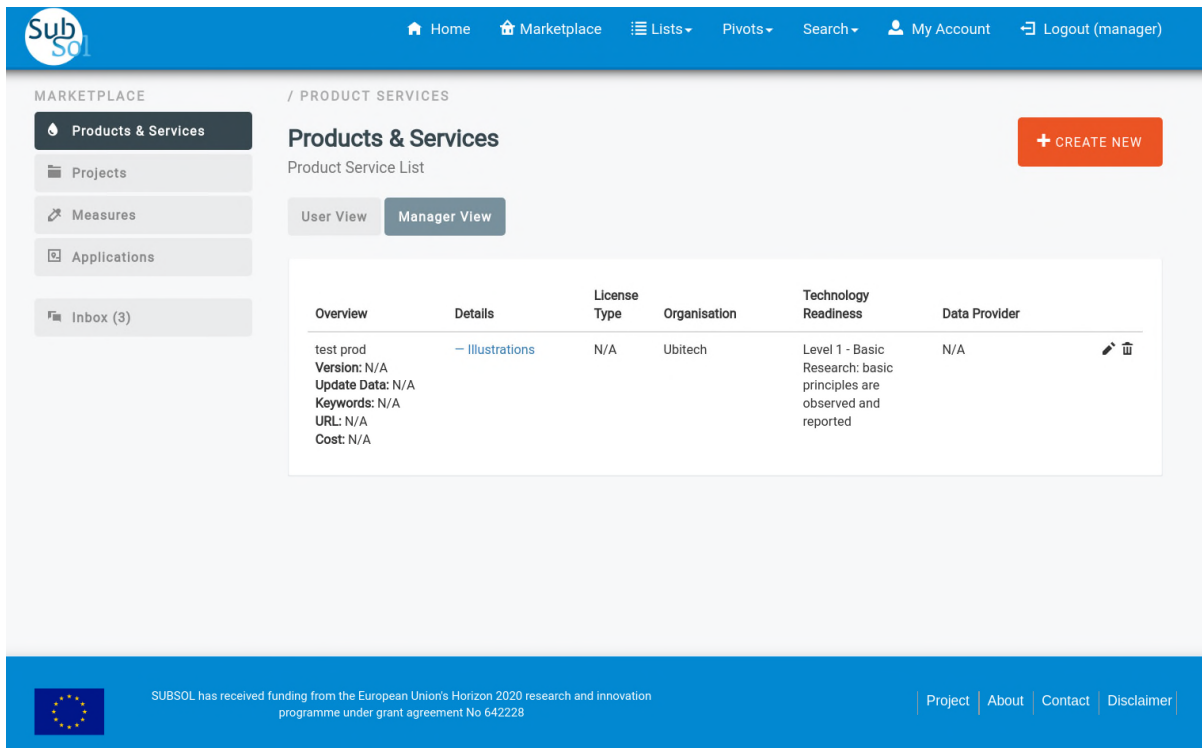


Figure 10: Organization representative manager view

Organization representatives may log into the system having additional privileges. In this case the user interface is similar to the one developed for the data management of the Knowledge Base, aiming to facilitate end users using both systems. The organization representative is able to view the existing content as well as edit/add/remove any content related to his organization. An indicative view of the interface provided to organization representatives for this purpose is shown in Figure 10.

It should be noted that both the Knowledge Base and the Marketplace are managing the same information stored in the SUBSOL database. A set of interfaces supporting access to data from both systems have been developed enforcing the specified access rights policies. Thus, the Knowledge Base and the Marketplace can be considered as fully interoperable and extensible components that can be easily maintained and extended in the future.

3.2 Interaction with EIP-Water Marketplace

An important requirement towards the design and implementation of the SUBSOL Marketplace was its interoperability with the EIP Water Marketplace (<http://www.eip-water.eu/>). Towards this goal, a set of activities have taken place aiming at producing in the first phase a set of specifications which will be implemented before the end of the project,

ensuring the capability for interoperability between the two marketplaces. This includes the use of services provided by the EIP Water Marketplace to the SUBSOL Marketplace, as well as the exchange of content among the two marketplaces. From the SUBSOL Marketplace point of view the interest lies mainly in projects and their successful implementation using SWS measures. In order to achieve such an interoperability, modelling of information across the marketplaces had to be unified, while a set of exchangeable content types had to be defined.

Modelling of information was based on the already defined and evolving glossary and the associated thesaurus used in the EIP Water Marketplace. The thesaurus aims to establish and promote a common terminology and to provide clear definitions for terms as well as to demonstrate the relationships between them. The EIP Water glossary is freely accessible under the URL <http://vocabulary.eip-water.eu/>. This glossary is going to be extended based on terms applicable to subsurface water solutions and adopted by both marketplaces. Towards this direction, an hierarchical structure of SWS terms has been specified within SUBSOL.

EIP Water Marketplace supports indexing of descriptive information which takes place upon entering the text into the system, i.e. indexed information can be searched through the web pages of EIP Water Marketplace immediately after it has been stored in the Knowledge Base. The SUBSOL Marketplace takes advantage of the available EIP Water glossary and will be able to search using the functionality of its Marketplace.

Based on the current discussions with administrators of EIP Water, it is envisaged that EIP Water Marketplace will develop and expose through a Restful API specific content of the Knowledge Base allowing its use from other systems. Currently and until the necessary infrastructure is in place, this process is realised manually, based on the exchange and processing of excel files using a template provided by the EIP Water Marketplace.

4 Continuous Development and Integration

The development of the Online SWS Platform under the SUBSOL project is a continuous process which follows all necessary steps that ensure a high quality of the produced software during its entire lifetime. In this process one would recognize the following functional components: a) Source-Code-Versioning/Management, b) Continuous Integration, c) Quality Assurance, d) Release Management and e) Issue/Bug Tracking.

Each part of this process is supported by powerful and established software tools that are designed to complement each other. These tools are:

- a) **Git** for Source Versioning, Quality Assurance and Release Management,
- b) **Jenkins** for Continuous Integration and
- c) **GitHub** for Issue Tracking.

In the following sections we will analyse the reasons why the aforementioned tools have been chosen in this project and how the development of the Online SWS Platform benefits from using them.

4.1 Version Control System (Git)

There are a lot of opinions regarding which version control system (VCS) is the best. This issue can lead programmers and project management teams to fierce debates. There is no universal tool which would be optimal for all application. When choosing the right version control system, next to the specifications of the tool and the users opinions, one should consider the specific requirements of the project such as speed and IDE plug-in capabilities. The main difference between version control systems lies in the way the repository is managed. In a server based system (e.g. CVS), a central repository stores all code and clients connect to the server to get the newest version and upload changes. On the other hand peer-to-peer system applies a decentralized concept for version control. Beyond that, there are several other factors to be considered when choosing the VCS like speed, functionality, and the learning curve associated with the system. Another feature of many VCS is branching, i.e. the duplication of a source code file or even a whole directory tree so that modifications can happen in parallel along both branches.

For the selection the appropriate VCS in the SUBSOL project, special attention has been paid to speed and flexibility. Due to the nature of the project, the selected system should be able to create, manage and merge branches. This happens whenever a new feature is introduced, a bug is fixed or an enhancement is applied. As such, branch management should be inexpensive in terms of time and space consumption. Additionally, the selected system should

be robust and provide the flexibility to support the cooperation of developer teams working in different countries. Therefore the consortium has selected Git as the primary VCS system. The main Git repository is located at <https://github.com/ubitech/subsol> and access is currently limited to the consortium developers (see Figure 11). After the finalization of the project the consortium will make the repository public, including the full set of developed modules as declared in the SUBSOL Data Management Plan [3].

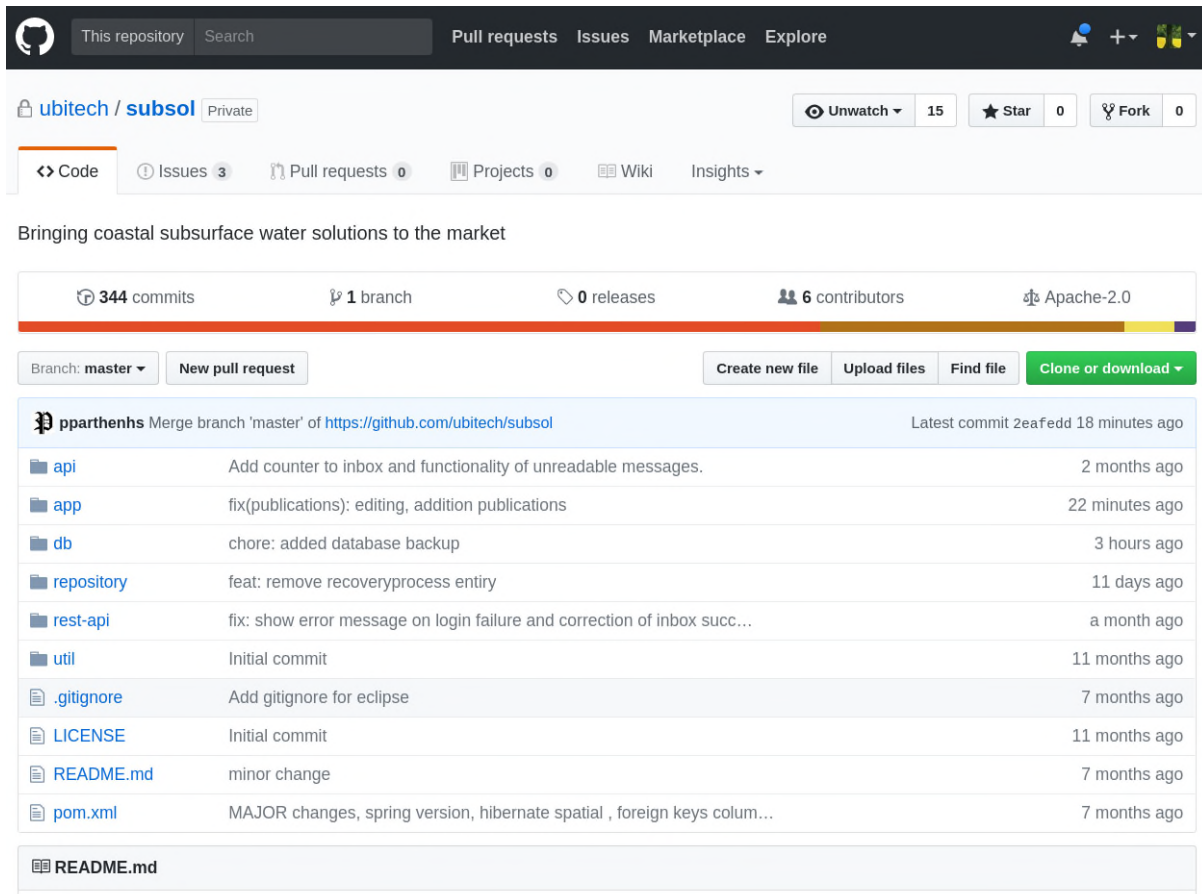


Figure 11: SUBSOL Github Repository

4.2 Continuous Integration (Jenkins)

A Continuous Integration process is adopted during the development of the SUBSOL platform. Continuous Integration is a software development practice where the members of a team frequently merge their work to a shared mainline— usually each contributor integrates his software code at least daily, leading to multiple integrations per day. Each integration cycle is

verified by an automated build (including test) to detect integration errors as quickly as possible. Many teams find that this approach leads to significantly reduced integration problems and allows a team to develop cohesive software more rapidly. A Continuous Integration server exposes the following set of abilities:

- Contact a source code management (GIT in our case) server and make updates of changes detected in a local directory;
- Launch and build one or more Apache ant or maven scripts as needed for compilation and the packaging of archive files (jar, war and ear); Apache Ant is a software tool for automating software build processes, which originated from the Apache Tomcat project in early 2000. Similarly, Maven is a build automation tool used primarily for Java projects. Maven addresses two aspects of building software: first, it describes how software is built, and second, it describes its dependencies. Contrary to Apache Ant, it uses conventions for the build procedure, and only exceptions need to be written down.
- Add plugins for code auditing, testing, and measurement of test coverage unit such as FindBugs, checkstyle, PMD, emma, cobertura.
- Execution of scripts launch tests;
- Launch application server and deployment of applications through the ant and maven scripts;
- Define inter-project dependencies;
- Perform tasks of publications such as sending mail notification about the progress of the build process, the result of the builds and test results;
- Send mail notification to developers with test results and identified inefficiencies in the source code;
- Prepare summaries and metrics on the build process.

In the frame of SUBSOL project Jenkins has been selected. The greatest and most wide ranging benefit of Continuous Integration is reduced risk. The trouble with deferred integration is that it's very hard to predict how long it will take until it is done. Even worse, it's very hard for a developers team to estimate how far it is in the development process. Without Continuous Integration developers may find themselves in a position to not having the process under control even in the rare cases where they aren't under time pressure. With Continuous Integration no time consuming integration is required and the responsible people are always aware of the pending issues and problems.

Another benefit of Continuous Integration is that it facilitates bug searching, tracking and removal soon after they have been introduced. From the software engineering perspective this poses a great advantage, as the early detection of bugs is key to a high quality source code. In the contrary, accumulation of errors in the source code will hamper the bug fixing

process in many ways. It is not only that remaining errors in the source code may propagate to other modules and cause unpredictable effects. The “Broken Window” phenomenon has also been observed in the IT sector, i.e. developers leaving bad/poor code unrepaired because they are overwhelmed by the number of bugs. Continuous Integration addresses this issue and helps to maintain the high quality of the source code.

4.3 Issue tracking (GitHub Issue tracker)

Another critical aspect of SUBSOL development lifecycle is issue tracking. Regardless of how carefully and detailed the software was tested before going online, there always will remain bugs and problems that haven't been fixed yet. Therefore, it is necessary to install right from the start of the development process an issue and bug tracking system.

An issue tracker accessible to every developing partner of the SUBSOL project has been installed to manage development issues such as problem reports, feature requests, and work assignments. For issues concerning coding, features and distribution the GitHub issue tracker has been chosen.



Figure 12: Bug Reporting Mechanism

Both the internal and external issue reporting processes are implemented in the following way (see Figure 12): An end-user or a SUBSOL product encounters a problem or missing feature. He reports his request by creating a new issue via the front end of the issue/bug tracker. The

newly created issue is picked by the responsible SUBSOL entity and is assigned to a developer. A notification mechanism, usually implemented using e-mail, notifies the assignee about created issues and updates. The developer starts working on the ticket and documents the progress.

In order to derive a suitable process time, time restriction requirements have been introduced:

- Every developing partner should check the issue tracking system regularly.
- Normally processing a ticket should not take more than one week. Exceptions are made for difficult issues.

5 Conclusions

In the current document, we have provided description of the SUBSOL SWS Online Platform. The set of components comprising the platform along with the provided functionalities and current development status are detailed. Focus is given on the description of the SUBSOL Marketplace, given that the Knowledge Based and the Toolkit are detailed at D3.1 [1] and D3.2 [2] accordingly. The supported type of users along with the functionalities provided per type, a walkthrough throughout the Marketplace functionalities as well as its interconnection with the other components are detailed. Furthermore, a set of ongoing activities with regards to collaboration and interoperability with the EIP-Water Marketplace re provided, aiming to ensure the sustainability of the platform through the development of a long-term management strategy of the platform utilizing linkages to existing networks.

References

- [1] SUBSOL D3.1 - A web-based knowledge environment, Available Online: http://www.subsol.org/uploads/deliverables/D3.1_SUBSOL_KE_.PDF, December 2016
- [2] SUBSOL D3.2 - The SWS Toolkit, August 2017
- [3] SUBSOL D.5.1 – Draft Data Management Plan, April 2017