



Innovative and Sustainable Groundwater Management in the Mediterranean

D7.6 Exploitation Plan

VERSION 1.0



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Authors	Cláudia Escada Leonardo Azevedo			
Reviewer(s)	Janire Uribe Asarta Vanessa A. Godoy J. Jaime Gómez-Hernández			

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Executive Summary

The overall objective of the InTheMED project is to implement innovative and sustainable management tools and remediation strategies for MED aquifers (inland and coastal) in order to mitigate anthropogenic and climate-change threats by creating new long-lasting spaces of social learning among different interdependent stakeholders, NGOs, and scientific researchers in five field case studies. These are located at the two shores of the MED basin, namely in Spain, Greece, Portugal, Tunisia, and Turkey.

InTheMED will develop an inclusive process that will establish an ensemble of innovative assessment and management tools and methodologies including a high-resolution monitoring approach, smart modelling, a socio-economic assessment, web-based decision support systems (DSS) and new configurations for governance to validate efficient and sustainable integrated groundwater management in the MED considering both the quantitative and qualitative aspects.

This deliverable is the Exploitation Plan for the InTheMED project results. It includes a summarized version of key exploitable results, and the strategies and modes the InTheMED Consortium plans for the creation of impact and the potential upscaling to other regions of the world. Preparation for exploitation was co-developed with all partners of the Consortium and reflects the interactions with the relevant stakeholders for each the case studies. All project partners are involved in dissemination and exploitation to increase awareness about the results of the project and topics associated with innovative modelling and management methods for groundwater systems in the Mediterranean region.

1. Introduction

The success of the InTheMED is also related to the exploitation of the project's results and their potential usage by key and strategic actors from academia, governmental agencies, private entities and citizens in general. Due to its importance, the InTheMED Consortium devoted a considerable amount of time and effort to reflect on the exploitation goals, measures, actions and collaborations which would contribute to guarantee this accomplishment.

The exploitation strategy of the project aims at three main objectives:

- To provide decision makers relevant information regarding high-resolution monitoring systems;
- To provide decision makers smart numerical modelling tools to respond to environmental, climatic and socio-economic pressures;
- To provide decision makers with a durable, interactive, innovative and easy-to-use Fuzzy web-based decision support system (WebDSS).

This deliverable, the InTheMED Exploitation Plan, designs an exploitation strategy to help the consortium to define potential ways for making the results impactful, as all outcomes of the project are open-access, for use by relevant stakeholders after the end of the project.

We first highlight the difference between disseminating and exploiting results¹:

- Dissemination actions share research results with potential users and peers in the research field, industry, other commercial players and policymakers. By sharing research results with the rest of the scientific community, dissemination aims at contributing to the progress of science in general;
- Exploitation actions use selected and prioritised outcomes from the project of due to its high potential to be used (in activities other than those covered by the project itself) and derive benefits downstream the value chain of a product, process or solution, or act as an important input to policy, further research, or education. Results are used for

¹ https://www.kdt-ju.europa.eu/sites/default/files/2018-10/EU-IPR-Brochure-Boosting-Impact-C-D-E_0-1.pdf

developing, creating, and marketing a product or process, or in creating and providing a service, or in standardisation activities.

Stakeholders should be targeted with specific results according to the desired impact the project aims to have. Examples of exploitation actions are illustrated in Table 1.

Table 1. Potential relevance for stakeholders (eufunds.me)

Stakeholder	Results	Impact
Research institutions	Publications, data, and software	Promote novel research activities and publications containing new results
Industry	Patents, pilot plants and prototypes, transfer agreements, joint venture/start-ups, new products, and services	Generate economic growth. Development of a new product or service Improvements of production processes and competitiveness. Improve product quality and consumer protection
Society	New products, services or technology, trainings, presentations and visits, educational materials, skills and knowledge.	Increase groundwater management policies, improve urban and rural services, improve healthcare, reduce energy consumption, increase product quality control, improve employability
Policy makers	Reports, policy papers and recommendations, roadmaps, operational guidance.	Revision or creation of a new directive or regulation (EU Law)

Considering the information provided above, the InTheMED Exploitation Plan provides a general exploitation plan to enhance the most important project outcomes (Table 2), which can be used further in the product/service value-chain and where the results of the project can be used in the future (i.e., exploitation routes) (Figure 1). Examples of these exploitation ways are:

- The use for further research;
- Developing and selling new products/services;
- Spin-off activities;
- Cooperation agreement/Joint Ventures;
- Selling IP rights/Selling IP-related business;

- Licensing IP rights;
- Standardization activities.

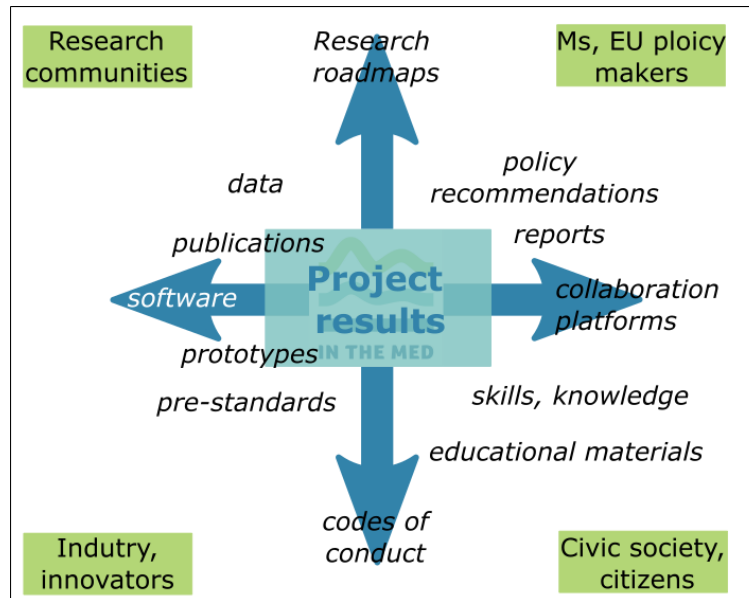


Figure 1. Schematic representation of exploitation of project results (modified from the European Commission)

Furthermore, each result highlights:

- Target groups and sector of application: the audience to whom the results are being made available to, and the sector interested in such results;
- Quantitative targets and indicators: these are measurable goals to be achieved from a partner level to manage the successful exploit;
- Impact: the economic, commercial, societal, environmental, technical, educational, or scientific effect each result will cause;
- PR measures: the specification of the ownership for each innovation after the end of the project (e.g., patents, copyright, trademarks)²;

² https://intellectual-property-helpdesk.ec.europa.eu/regional-helpdesks/european-ip-helpdesk/europe-fact-sheets_en

- v. Possible barriers to exploitation activities and mitigation measures – these are foreseeable roadblocks for exploiting the results and the strategy in place to mitigate them.

The detailed definition of each relevant components aims at the successful exploitation of the InTheMED results. This deliverable is expected to provide a better understanding of possible ways of exploiting InTheMED results, the IPR restrictions of the partners' know-how and the results, the main points of strengths, and weakness when implementing them.

2. Exploitable Results & Services

A broad range of expertise, numerical tools and results have been developed in the InTheMED project. Under the scope of the project, there are relevant questions for the exploitation these outcomes by the project partners and third parties:

1. Exploitable outcomes: which project outcomes are exploitable?
2. For whom and with what purpose?
3. When will these outcomes be exploitable?
4. What exploitation route should be followed to enable exploitation?

The InTheMED exploitation plan addresses these questions.

2.1. Exploitable Outcomes

Table 2 shows a summary of the project's outcomes considered exploitable. These results are those as defined in the InTheMED Data Management Plan³. Target groups of these results are multidimensional, and include the stakeholders mapped during the execution of the project, the research community contributing to socio-environmental policy analysis, farming associations and cooperatives, private entities, and the EU.

The main objective of the InTheMED was the development of innovative and sustainable management tools and remediation strategies for MED aquifers (inland and coastal), including a high-resolution monitoring approach, smart modelling, a socio-economic assessment and the Fuzzy WebDSS. A multi-actor approach, based on participatory modelling and stakeholder engagement, was followed to reach these objectives. All these numerical tools are freely available in the project website and can be used by anyone.

The methodological framework chosen within the InTheMED distinguishes itself from alternative approaches to tackle current challenges in groundwater management by:

- i) Strengthening the understanding of groundwater functioning and trends.

³ <https://doi.org/10.5281/zenodo.4577338>

- ii) Improving groundwater resilience and security in a sustainable social learning process.
- iii) Developing sustainable management and remediation strategies.
- iv) Reinforcement of the DSS, communication and dissemination activities using the combination of high-resolution monitoring and smart modelling.

As important than the data and models produce as part of this project are the collaboration networks built with other PRIMA initiatives in the MED region (i.e., Sustain-COAST, GOTHAM, RESERVOIR, eGROUNDWATER) and other industrial and governmental stakeholders at each case study. This capacity building paves the way for further development and exploitation of project expertise and results, including services which can be provided to third parties who are interested in the project outcomes and systemic approach followed.

Table 2. InTheMED outcomes with potential for exploitation

Key Project Outcome	Case Studies					Mediterranean Level (or other)	WP	Relevant Deliverable
	Requena-Utiel, Spain	Konya, Turkey	Tympaki, Greece	Castro-Verde, Portugal	Grombalia, Tunisia			
ERT inversion models							WP2	D2.1
Guidelines and best-practices for high-resolution monitoring systems							WP2	D2.1
Historical groundwater data in the MED							WP2	D2.4
Downscaled climate projections for the MED							WP3	D3.3
Surrogate models of complex groundwater systems							WP3	D3.2
Numerical simulation models for participatory systems							WP4	D4.4
Innovative water remediation processes							WP5	D5.3
Fuzzy WebDSS							WP6	D6.1/D6.2
Scientific Journal papers							WP2-7	D7.2
Scientific Conference Papers & Abstracts							WP2-7	D7.2

2.2. Exploitation Targets

A general conclusion of the project is that stakeholders and target groups relevant for exploitation are easier engaged in participatory events, living labs and when easy-to-use quantitative tools are freely available online. The Fuzzy WebDSS can contribute to policy support by showing the effect of decision making in each case study. However, tools like the one produced in this project require a close relationship with the local communities. To alleviate this need, the numerical tools developed under the scope of the project are accompanied with online video tutorials to guide the users.

Also, the results of the project show the benefits of using improved and high-resolution monitoring systems to better understand the behaviour of complex groundwater systems and local and regional trends. Additionally, the smart models of the five case studies illustrate how the most recent advances in machine learning can be used to facilitate the prediction of the behaviour of aquifers.

Target groups for exploitation can be divided into four types with overlapping interests:

- i) Services and administrations supporting decision-makers related to groundwater management.
- ii) Business operators, economic actors and organisations looking for sustainable solutions to groundwater management.
- iii) Research and academic organisations working on groundwater modelling and management.
- iv) Educational organisations looking for training material and tutorial examples to address problems related to groundwater. This type of use is considered less marketable or exploitable with the large number of textbooks, guidelines, and examples available, often free of costs.

2.3. From Outcomes to Exploitability

Exploitation of the project results is a continuous effort as it depends on the appropriate timing, or maturity of the outcomes, the quality of the product as well as the purpose of this

exploitation. For example, the Fuzzy WebDSS is the first and more mature outcome of the project and already available as open data through the Zenodo platform and the InTheMED website⁴. The smart models could be provided as independent tools, and additional ones created, to facilitate the prediction of the groundwater systems behaviour. Also, the local and regional groundwater trends might pave the way for policy makers.

Table 2 shows a summary of the project outcomes considered exploitable at different levels, as well as their relationship with the work packages and the project deliverables.

2.4. Exploitation Strategy

We propose an exploitation strategy and supportive guidelines to reach these goals. However, the implementation of these measures varies depending on the outcome and the case study considered. For successful exploitation of the project results, there is the need of a growing community of experts and users. This would be the InTheMED Community and will grow around the freely available outcomes of the project. All results of the project are available on the project website and on the Zenodo platform (Section 3). InTheMED Consortium partners will be available to continue collaborating with academic, public and private entities to exploit these results. Below we provide potential exploitation strategies for the InTheMED deliverables:

- Innovative monitoring and data analysis in the MED: the unique collection of curated historical data related to groundwater in the MED region allows a better understanding of this natural resource and provide relevant information for better groundwater management that can be used by private companies and national authorities to develop sustainable management strategies. These data might trigger the development of new modelling and management tools and will impact further research in groundwater trends in the MED region. The HMRS data showed that this information can be successfully used to improve subsurface numerical models. The set of recommendations made in deliverable D2.1⁵ might promote their generalization and commercialization in other regions of the globe.

⁴<https://inthemedprima.com/Results-DSS>

⁵<https://zenodo.org/record/5464303>

- Innovative smart modelling in the MED: the smart, easy-to-use, numerical models developed within the project have the potential to spark a new generation of numerical models that run faster and are easier to use than the current commercial solutions.
- Innovative Governance and Socio- Economic Assessment in the MED: the lessons learnt from the participatory system mapping, the living labs, workshops and interactions with the relevant local stakeholders (deliverable D4.2⁶) have the potential to transform current management policies and regulations towards transparency and sustainability. These examples of best-practices can be adopted in other regions.
- Innovative Decision Support Systems in the MED: the exploitation of the Fuzzy WebDSS⁷ should focus on communication and promotion activities on the applications rather than the description of the methodology, techniques and other numerical tools. This implies the creation of video tutorials. The Fuzzy WebDSS has the potential to be updated with new case studies and alternative climate scenarios allowing its generalization.

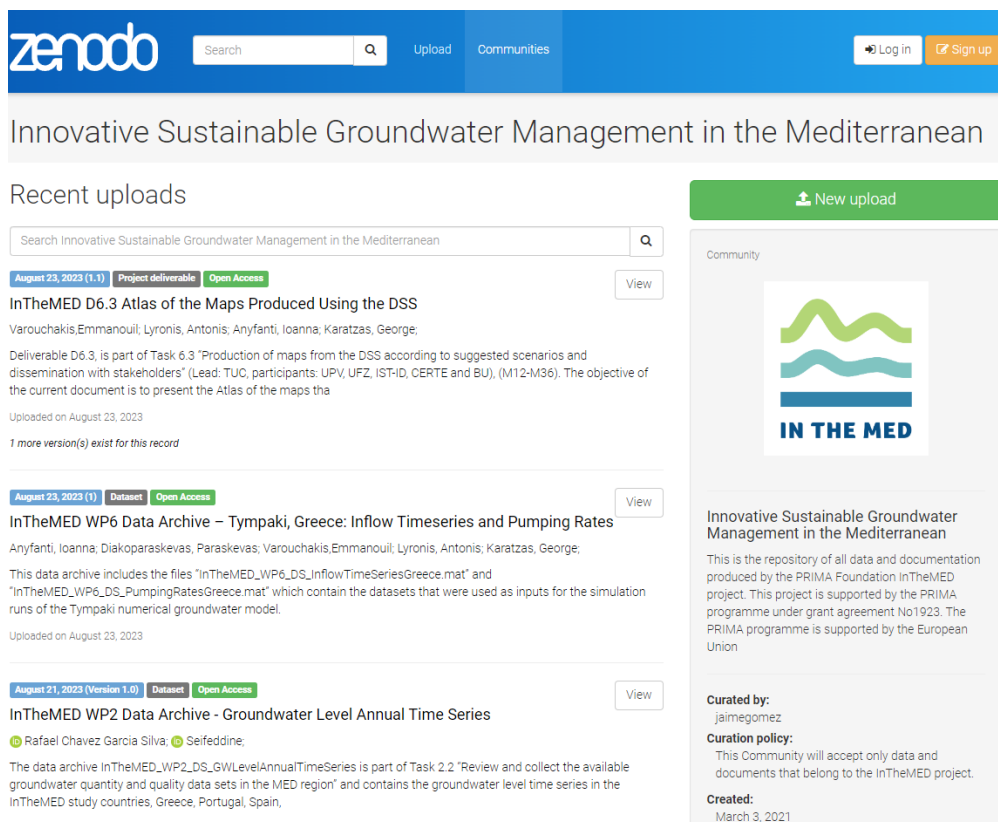
⁶ <https://zenodo.org/record/6401942>

⁷ <https://inthemedprima.com/Results-DSS>

3. Zenodo

InTheMED has all its deliverables shared online on Zenodo (Figure 2), a shared platform built for open access and open data storage. Open-access is core at the InTheMED project. Zenodo ensures that the target the scientific community follows the FAIR principle: Findable, Accessible, Interoperable, and Reusable digital assets. Zenodo was select as the main platform to store the results and deliverables in the Data Management Plan and in the first consortium meeting. The main reasons for selecting the Zenodo are the user-friendliness of the platform, the wide use for research data generated in EU projects, the support for a wide range of data types, including qualitative and quantitative data, and the general holistic focus of the platform. Besides, Zenodo is free of charge, and it is able to store files up to a size of 50 GB. If necessary, restricted access conditions can be added when uploading data.

Data sets are deposited with a record containing metadata such as a reference to the project, description and contact persons. The InTheMED webpage links the deliverables stored on the Zenodo platform. For accessing InTheMED community on Zenodo page please visit: <https://zenodo.org/communities/inthemed>



The screenshot shows the Zenodo community page for 'Innovative Sustainable Groundwater Management in the Mediterranean'. The page features a search bar, navigation links for 'Upload' and 'Communities', and 'Log in' and 'Sign up' buttons. Below the header, there is a 'Recent uploads' section with three entries:

- InTheMED D6.3 Atlas of the Maps Produced Using the DSS** (August 23, 2023, 1.1) - Project deliverable, Open Access. Uploaded by Varouchakis, Emmanouil; Lyronis, Antonis; Anyfanti, Ioanna; Karatzas, George. Description: Deliverable D6.3, is part of Task 6.3 'Production of maps from the DSS according to suggested scenarios and dissemination with stakeholders' (Lead: TUC, participants: UPV, UFZ, IST-ID, CERTe and BU), (M12-M36). The objective of the current document is to present the Atlas of the maps tha. Uploaded on August 23, 2023. 1 more version(s) exist for this record.
- InTheMED WP6 Data Archive – Tympaki, Greece: Inflow Timeseries and Pumping Rates** (August 23, 2023, 1) - Dataset, Open Access. Uploaded by Anyfanti, Ioanna; Diakoparaskevas, Paraskevas; Varouchakis, Emmanouil; Lyronis, Antonis; Karatzas, George. Description: This data archive includes the files "InTheMED_WP6_DS_InflowTimeSeriesGreece.mat" and "InTheMED_WP6_DS_PumpingRatesGreece.mat" which contain the datasets that were used as inputs for the simulation runs of the Tympaki numerical groundwater model. Uploaded on August 23, 2023.
- InTheMED WP2 Data Archive - Groundwater Level Annual Time Series** (August 21, 2023, Version 1.0) - Dataset, Open Access. Uploaded by Rafael Chavez Garcia Silva; Seifeddine. Description: The data archive InTheMED_WP2_DS_GWLevelAnnualTimeSeries is part of Task 2.2 'Review and collect the available groundwater quantity and quality data sets in the MED region' and contains the groundwater level time series in the InTheMED study countries, Greece, Portugal, Spain. Uploaded on August 21, 2023.

On the right side, there is a 'New upload' button and a community profile for 'Innovative Sustainable Groundwater Management in the Mediterranean'. The profile includes the community logo, a description of the repository, and information about the curator (jaimegomez), curation policy, and creation date (March 3, 2021).

Figure 2. InTheMED community page on Zenodo