

Deliverable 5.6

Project Acronym: PRECIMED

Project full Name: Precision Irrigation Management to Improve Water and Nutrient Use Efficiency in the Mediterranean Region

Final Sustainability Plan (M40)

Due date	31/01/2023
Actual submission date	31/01/2023
Project start date	01/10/2019
Duration (months)	42
Action(s) concerned	Task 5.3
Nature	PU
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Document history

Date	Author	Action	Status
24/1/2023	National Institute of Agronomic Research of Algeria (INRAA) SEMIANI Mohammed	Release of the first draft	A first draft released from INRAA for review
27/1/2023	OPTIM	Optim's update	Draft released
27/1/2023	Odin Solutions	Odin's update	Draft released
30/1/2023	UTH	Revision and UTH's update	Draft released
30/1/2023	CEBAS-CSIC	Revision and CEBAS-CSIC's update	Draft released including partners updates
30/1/2023	INRAA	Update final version with partner contributions	Final version released
31/01/2023	CEBAS-CSIC	Revised final version	Approved

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Summary

The deliverable [**D5.6 – Final Sustainability Plan (M40)**] has been formulated as an update of *D5.4- [Intermediate sustainability plan (M18)]*. This final sustainability plan is focused, essentially, on the exploitable results of PRECIMED, the keys stakeholders, the sustainability approach, the strategies to increase the involvement of end users and organizations in the project for a better sustainability of PRECIMED and the activities achieved to ensure its sustainability during the lifetime of the project and after the funding period. It describes, notably, the activities aiming to increase awareness of the potential stakeholders for the project. Globally, the project aims to develop an IoT platform and a Decision Support System (DSS) for water and nutrient management to improve their efficient use. These two ultimate objective need to be sustained during and after the funding period of the project. This final sustainability plan will be completed at M42.

1. Introduction

This deliverable is the final sustainability Plan of the Project "Precision irrigation management to improve water and nutrient use efficiency in the Mediterranean region".

A sustainability plan is a roadmap for achieving long-term goals to continue the program, activities and partnerships. Sustainability can be defined in different ways a) the sustainability of the values that the project promotes, b) the sustainability of relationships between organizations and c) the sustainability of services (1). In our case, there is a need to promote the project results, after the funding period is over, especially the DSS. It is important for the project, also, to involve/track more and more end users of the IoT platform and the DSS developed under PRECIMED project by increasing awareness of potential stakeholders by a wide dissemination of the project, its activities and its results.

2. Sustainability plan

To create a sustainability plan some important steps are needed to be followed like the identification of what needs to be sustained, what resources are required, key partners and determining the financing strategies. In this final sustainability plan, we will focus on the project PRECIMED exploitation results; the key stakeholders of the project, the strategies to involve more end users in the project and, finally the identification of activities achieved to ensure the sustainability of the project.

Objectives of sustainability plan

The global objective of this sustainability plan, is to ensure the wide dissemination of the project, its activities and its main results to involve more stakeholders. Towards this direction, its main objectives are as follow:

- To ensure the sustainability of the project and its intermediate results by intense dissemination;
- To ensure the wide use of the solution developed after the end of the project works;
- To propose a business plan for the exploitation of the results;
- To propose some actions for promoting and improving the results

3. Sustainability for PRECIMED project

The sustainability of PRECIMED project aims:

To increase awareness of large group of end users on the PRECIMED project and its activities associated to the fertigation in field and hydroponic crops;

To ensure a large dissemination of the decision support system (DSS) on fertigation to promote its wide use;

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To ensure a continuous improvement and extension of the DSS for other crops after the end of the project.

Exploitable results of the PRECIMED project.

The project aims to offer for different stakeholders a data driven irrigation/fertilization management system, to improve Water and Nutrient Use Efficiency, integrating the knowledge about fertilizers and irrigation water management with Information Communication Technologies.

The project integrates:

An IoT platform able to optimize the water and fertilizer in open air and in hydroponic greenhouse crops.

The PRECIMED platform integrates:

IoT devices including sensors and weather stations for the monitoring climate conditions and soil water contents;

Decision support system (DSS) for water management of potato and fruit trees. Models based on soil water content and climatic data were used to schedule irrigation;

DSS for fertigation of cucumber and tomato crops, notably under hydroponic crops.

4. PRECIMED project key stakeholders

Considering the potential interests of stakeholders is the key for the project sustainability. In this context, the PRECIMED project aims to **develop an IoT platform able to optimize the water and fertilizer** for open air and hydroponic greenhouse systems. The PRECIMED platform integrates heterogeneous sensors using communication interfaces to a common API, which will enable data interoperability between the different hardware components providing scalability solutions. The platform includes DSS related to fertigation scheduling for hydroponic crops and irrigation scheduling for open-air crops.

Therefore, the implementation of these PRECIMED solutions related to water and nutrients management need to involve a lot of stakeholders acting as developers (case of OdinS) which is, at the same time, project partner), researchers from universities and research centers and end users (farmers)

The key stakeholders of the project are as follow:

➤ **Farmers**

Farmers will be among the most impacted actors after the adoption of the PRECIMED solutions related to the efficient use of water, fertilizers and reducing the cost of energy. During the implementation of the project, 7 pilot farms (2 in Algeria, 2 in Spain, 2 in Greece and 1 in Tunisia) had been selected to develop, test and validate the DSS for irrigation and fertilization management. The deployment of the seven pilots were integrated from the beginning of the implementation of the project. Participatory approach was adopted to define the needs of farms in term of information requirements and measurement devices for efficient crop management. In addition, meetings/consultations with other farmers, which are not engaged

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with the project consortium, were achieved by the four participant countries. These pilot farms act as end users and gradually could involve more users / farms. The project expects to involve more than 1000 farms 3 years after the project- funding period is finished.

According to Goedknegt and Silvius, 2012, stakeholder participation requires *"a process of dialogue and ultimately consensus building of all stakeholders as partners who together define the problems, design possible solutions, collaborate to implement them, and monitor and evaluate the outcome"*.

➤ **Environmental organizations:**

PRECIMED will have an important impact on climate change due to its expected impacts on the improvement of water and nutrient use efficiency. The expected impacts are a reduction of water use and fertilizers. An uncontrolled water and fertilizer management affects the quality of soil and ground water resources and a waste of water in despite of the water scarcity in Mediterranean regions. Hence, these organizations could be considered as key stakeholders for the sustainability of the project and its results.

➤ **Policy makers**

Local authorities, as agricultural services and agricultural room, are concerned by the project and its results, so, they need to be involved in the project activities. They need to be convinced to adopt/accept the solution offered by PRECIMED project since PRECIMED will support the local and national agricultural development in the field of water and fertilizer management. In addition, the policy makers can be considered as a strong funding source if a positive impact of the project is demonstrated. Therefore, a socio-economic and environmental impact assessment study must, necessary, to be implemented after, at least, 3 years following the end of PRECIMED project funding to show the positive impact of the DSS developed on the crop productivity and the quality of production, the water and fertilizers use efficiency, the preservation of the quality of soil and underground water resources from pollution due to the uncontrolled fertilization and irrigation. INRAA has associated directly the agricultural room in its activities.

➤ **Research institutes and university**

The project partners include 2 universities (University of Thessaly, UTH, in Greece and University of Sfax in Tunisia), 2 research institutes (Spanish National Research Council, CSIC, in Spain and National Institute of Agronomic Research, INRAA, in Algeria) and a spin-off of Murcia University (OdinS). These institutions can extend the DSS to include other crops and other agricultural exploitation types. Young researchers and students need to be also involved in the project. Students will be trained and will most probably use the PRECIMED solutions when they finish their studies.

5. The sustainability approach

The PRECIMED activities must ensure the sustainability of the project results during and after the PRECIMED funding is finished. In this context, the plan for dissemination and exploitation results activities and the plan for communication need to be taken into consideration when developing the sustainability plan as several aspects related to the dissemination of the project and its results to stakeholders were developed under these two plans, such as demonstrations in pilot farms, the organization of workshops, field visits for farmers and students, organization of conferences, etc.. Hence, the sustainability plan must be associated with WP5 tasks T5.1 "Communication and Dissemination plan". The task T5.2 "Exploitation and I.PR management of the project's results" must be, also, associated to the sustainability plan through the establishment of business model for the exploitation of main project results.

The sustainability strategy of the PRECIMED project must be considered at short and long term:

a) Short term (During funding period):

The project developed some activities related to the communication, dissemination and exploitation of the results. In this context, two plans (Communication and Dissemination Plan "D5.1" and Plan for Dissemination and Exploitation of Results "D5.3") were established with the objective to:

- Raise awareness of end users;
- Raise awareness among public authorities in the Mediterranean area;
- Ensure that the SMEs in the AgroFood sector in the Mediterranean area are aware of the PRECIMED project and its activities;
- Communicate the results of the project to Research and Development sector;
- Define a roadmap for the results exploitation.

b) Long term (Sustainability after the funding period is finished)

A roadmap for the results exploitation after the project funding is finished needs to be defined. The funding source is an important aspect needed to be taken into account. This aspect is considered as key for the sustainability. Business plan planned to be developed at the end of the project need to take into account these aspects.

6. Strategy to increase the end users

The actions allowing attracting and engaging the end users are an important aspect of the sustainability strategy. The intermediate sustainability included the following actions:

➤ **The involvement of end users in the project:**

Initially, the consortium includes the project partners and 7 pilot farms. Each partner must to identify others farmers interested for the use of the DSS developed and PRECIMED platform. Thus, the owners of seven pilot farms, involved in the PRECIMED project from the beginning of its starting to develop the DSS according to the needs of farms and farmers, has committed to contribute to the project. During the implementation of the WP2/ task2.1 related to *the Identification of farmers participating in the project and establishment of experimental approach in the pilot farms*, others farmers were involved in the discussions.

In addition, the selected pilot farms were used to achieve the dissemination activities related to the development and the validation of the DSS and the presentation of different IoT devices through meeting and media TV. During these events, others stakeholders as local policy makers, universities were participated to these events. In the framework of regional meeting of extension where farmers and policy makers were participated, the project and its activities were presented to ensure their wide dissemination among different stakeholders. These dissemination actions in the pilot farms and at regional level can raise awareness of end users on the PRECIMED project and its activities.

Others important dissemination activities were implemented under the project, such as the website, the social media and Forum (Facebook and LinkedIn) can raise awareness of more potential users on the PRECIMED solutions to improve the efficient use of water and nutrients management. In this context, the project created a website (<https://www.precimed-prima.org>), two social media (Facebook and twitter account) (<https://www.facebook.com/precimed.prima/>, <https://twitter.com/precimedp>) and a forum (LinkedIn account) (<https://www.linkedin.com/company/precimed-prima/>). An intense dissemination was achieved through these communication tools.

Videos on YouTube describing the DSS for irrigation and fertigation are planned to be achieved before the end of the project.

➤ **The involvement of entities in the project**

Different entities can act as end users need to be involved in the project. Among these entities, we can cite:

- **The Agricultural Services at local and regional levels** could act as users of DSS through their development programs on irrigation and agricultural development. In some countries, like INRAA, Algeria, these services are in charge of local agricultural development. The room of agriculture (INRAA) has participated directly to the project. In this context, an intensive dissemination using the social media (Facebook and TV) was achieved.
- **The Agricultural Technical Institutes** could be, also, involved with the consortium and could act as user of the DSS. In some countries, these organizations are in charge for the development of new agricultural practices, the transfer of technology and testing/using the research products before their wide use by farmers. In the case of INRAA, there no institute involved in the project.

- **Public Authorities (Agricultural Ministry)** could be considered as potential stakeholder of PRECIMED project. In fact, the use at wide scale of DSS depend on its acceptance/adoption by the policy makers.
- **The High School of Agriculture and University** needs to be associated to the PRECIMED project. They can act for the training of future users of DSS. Their involvement in the project is limited to some visits in the field by the students.

For all these organizations, some of them were invited to participate in the different events planned to be organized by the project, like workshops and regional days of extension. Hence, they became aware on the project, its activities and its outcomes.

7. Actions implemented in sustainability plan

To sustain the activities and the project results, a series of activities to implement during the project's lifetime have been identified. These actions are achieved during the 3 years of the duration of project and all PRECIMED partners (INRAA, UTH, OdinS, OPTIM and CSIC) are involved in their implementation.

Description of the activities achieved during the life time of the project to deploy sustainability strategies of the DSS across theMediterranean basin

The initial sustainability activities achieved during the lifetime of the project are presented in Table 1

Table 1: Activities achieved during the lifetime of the project

Actions	Steps	Who	Related WP/Task	When	Prerequisite	Results indicators
Involvement of end users	Identify the stakeholders (farmers, farms) that will be interested	All partners	WP5/T5.1	Year 1 Year 2 Year 3	-	INRAA: Farmers of two large regions (Mitidja and Tiaret), 01 agricultural rooms, 01 Agricultural services, 02 university CEBAS: Farmers of citrus and fruit trees (Southeast Spain), 02 universities UTH: Farmers of hydroponic crops, universities -



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						research institutes, agricultural services OPTIM: Farmers of olive Farm located at Sfax, 02 universities
	Small meetings in pilot farm on the vision of PRECIMED project	All partners	WP5/T5.1	Year 1 Year 2	All the project partners are responsible to organize meetings with potentials stakeholders	INRAA: 04 CEBAS: 03 UTH: 04 OPTIM: 04 <u>TOTAL: 15</u>
	Multi-stakeholder meeting in pilot area	All partners	WP5/T5.1	Year 1 Year 2	All the project partners are responsible to organize meetings with potentials stakeholders	INRAA: 04 CEBAS: 03 UTH: 04 OPTIM: 04 <u>TOTAL: 15</u>
Involvement of entities	Identification of entities which could be involved in the project	All partners	WP5/T5.1	Year 1 Year 2	All the project partners are responsible to organize meetings with potentials stakeholders	INRAA: 08 (ITGC, INSID, 02 agricultural rooms, 02 agricultural services, 02 university, 01 association) CEBAS: 02 Universities, Regional government of agriculture in the Region of Murcia, 01 Agricultural Technical Institute of Murcia UTH: SMEs in the agro-food sector, actors in the agro-food value chain, public authorities,



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						and research and development bodies, agricultural services OPTIM: 02 universities, 01 olive tree institute Sfax, 01 regional delegate for agricultural development. ODIN: 01 University
Dissemination materiel preparation (website, social media and forum)	Development of website to present the project and its results	INRAA	WP5/T5.1	Year 1	-	Number of Visits of PRECIMED website
	Creation of social media (Facebook and twitter)	UTH	WP5/T5.1	Year 1	-	Number of Visits of Facebook and twitter
	Creation of a Forum (LinkedIn)	UTH	WP5/T5.1	Year 1	-	Impressions of LinkedIn Followers
	Preparation of Video to publish on YouTube	All partners	WP2/T.2.3	First six months of year three	All the project partners are need to develop a video on DSS device and its publication on YouTube	Visualization of the video on YouTube
Preparation of dissemination material	Preparation of project leaflets, posters and banners (number of document printed by type).	UTH and INRAA	WP5/T5.1	Year 1 Year 2	Project document	-2000 leaflets in English and French languages ; -12 banners in English and French languages. CEBAS: 1 poster 03 banners UTH: 200 leaflets and PRECIMED



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						banner, and flyers OPTIM: 200 leaflets in English and French languages; - 04 banners in English and French languages.
	Preparation of project newsletters	UTH	WP5/T5.1	Year 1	Project document	02 project newsletters were inserted in the Facebook and website
	Preparation a farmer practical guide on water and nutrient management	All partners	WP2/T2.3	Year 3	Activities involved in WP2	Deliverable D2.3
Update of dissemination (website, social media and forum)	Update the website	INRAA	WP5/T5.1	Year 1 Year 2 Year 3	Activities achieved under all work packages and tasks	- Visited by number: 8927 people; - Expected visitors: 30000
	Update the Facebook	All partners	WP5/T5.1	Year 1 Year 2 Year 3	Activities achieved under all work packages and tasks	- Numbers of followers: 471
	Update the LinkedIn	All partners	WP5/T5.1	Year 1 Year 2 Year 3	Activities achieved under all work packages and tasks	Number of subscribers: 72
	Press publications	All partners	WP5/T5.1		-	ODIN: 01 publication
Distribution of dissemination material	Project leaflets, posters and banners	All partners	WP5/T5.1	Year 2 Year 3	-	INRAA: 1500 leaflets and 09 banners; CEBAS: 1 poster, 3



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						banners UTH: 200 leaflets and flyers, and banner OPTIM: 200 leaflets and 04 banners
	Project newsletter	UTH CEBAS INRAA OPTIM	WP5/T5.1	Year 2 Year 3	-	INRAA: newsletters (prepared by UTH) inserted in the project website CEBAS: newsletters inserted in the Social Media of CEBAS-CSIC UTH: newsletters inserted in the project website and Facebook OPTIM: newsletters inserted in the Miracl research laboratory
Presentation of results in conference, scientific magazines, workshops and opendays	Co-organization of Interregional Conference 'Sustainable Production in Agroecosystem with Water Scarcity (Spain)	All partners	WP5/T5.1	Year 3	Project results	CEBAS: 02 communications UTH: 01 communication ODIN: 01 communication TOTAL : 4
	Co-organization of Conference on Intelligent Digitalization of Agriculture in the Mediterranean (Spain)	All partners	WP5/T5.1	Year 3	Project results	INRAA: 01 communication CEBAS: 02 communication UTH: 01 communication OPTIM: 01 communication ODIN : 01



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						TOTAL : 6
Participation in Workshops and Conferences	Conference on climate change impact on citrus crop	INRAA	WP5/T5.1	Year 2	WP5/T5.1	INRAA: 01-communication
	Workshop on Innovation activities and on Clustering Activities of PestNu's sister projects (Greece)	CEBAS	-	Year 3	Project results	CEBAS: 02 communications
	Workshop on Innovation activities related with SHUI Project-PRECIMED (Spain)	CEBAS	-	Year 3	Project results	CEBAS: 01 communication
	10th International Micro Irrigation Conference (Morocco)	All partners	-	Year 3	Project results	CEBAS: 02 communications UTH: 01 communication OPTIM: 01 communication ODIN: 01 communication TOTAL : 05
	Digital Around the World 2022 Global Online Conference	ODIN		Year 3		ODIN: 01 communication
	Publications	All partners	WP2, WP3 and WP4	Year 2 Year 3	WP2, WP3 and WP4	INRAA: 02 UTH: 04 CEBAS: 02 OPTIM: 05 ODIN: 01 TOTAL: 14
Business	Presentation	All	WP4/T.4	Year 3	WP2, WP3	Deliverable D4.4



model	of the business model (underway)	partners			and WP4	
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8. Sustainability plan after the end of the project

After the lifetime of the project, a strategy for the sustainability needs to be determined, notably, for the sustainability of the PRECIMED platform and the DSS.

There is a need to ensure the continuation of the PRECIMED platform and its accessibility by new users. For that perspective, the following actions need to be taking into account:

- Funding for the maintenance of PRECIMED platform and further integration of new crops and DSS on water and nutrient management. Different options can be retained in this context. We can cite:
 - Subscribers;
 - Payable license;
- The sustainability of PRECIMED platform and the DSS, need to be taking into account by the business model planned to be presented at M42.- It needs to cover the maintenance of the platform, the data management collected from different IoT devices and the use of DSS developed by each partner.

Regarding the case study developed under the PRECIMED project, the activities to deploy to ensure the sustainability of the platform after the end of the project are listed below, being most of them common to the whole consortium:

- Training for farmers and technical staff including extension agents on the use of the PRECIMED platform and the use of devices used in precision agriculture to improve water and nutrient management;
- Publish in scientific journals the latest trends and research directions for precision agriculture based on precise irrigation and fertilization management, as well as the results obtained during the validation of the PRECIMED DSS;
- Publish in scientific journals all the results obtained from the validation of PRECIMED DSS in hydroponic tomato and cucumber crops;
- Continuation of research and development activities under national projects through the access to public initiatives, which foster innovative solutions for the agricultural development to keep improving the PRECIMED platform.



Conclusion

In this final Sustainability Plan, the key stakeholders of the project and the strategy to be followed for achieving the sustainability objectives, notably, the raising awareness of the main stakeholders is presented. As well, the compromise of the different partners to ensure the sustainability of the project after the funding period is showed. In this context, a business model covering the maintenance of the PRECIMED platform, the data management collected from different IoT devices and the use of DSS developed has been identified.

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