Promoting Sustainable Irrigation Management and non-conventional water use in the Mediterranean - PROSIM

Final Evaluation Report

ENI CBCMED
Cooperating across borders in the Mediterranean

Project funded by the EUROPEAN UNION

REGIONE AUTÒNOMA DE SARDIGNA
REGIONE AUTONOMA DELLA SARDEGNA

PROSIM

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13/11/2023

Project funded by the European Union through the ENI CBC MED instrument and implemented by a consortium led by ICU Istituto per la Cooperazione Universitaria

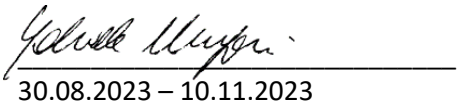
Evaluation Report

Date: 13th November 2023

Project Title: Promoting Sustainable Irrigation Management and non-conventional water use in the Mediterranean - PROSIM

Reference Number: A_B.4.1_0317

Key project information:

Implementation status	Closed (since 31.08.2023)
Type of monitoring report	External Evaluation
Monitoring phase	Final
Type of project	Multi-country project
Contract	Grant – Contract n. 42/1319_29.08.2019
Programme	Cooperation within the European Neighbourhood Instrument ENI – Priority B.4.1
Donor	EU
Budget	3,333,331.62 € total - 2,999,998.46 (EU fund 90%)
Implementing Agency	Istituto Cooperazione Universitaria (ICU)
Geographical area	Italy, Jordan, Lebanon, Tunisia and Spain
Responsible for the Contractor	Mrs Maria Giovanna Pinna - MA of the ENI MED CBC Programme
Responsible for the Implementing Agency	Mr. Massimo De Angelis – ICU President
Project partners	ICU - Institute for University Cooperation (IT) NARC - National Agricultural Research Centre (JO) DGGREE- Directorate General of Rural Engineering and Water Exploitation (TN) CEBAS-CSIC - Centre for Soil Science and Applied Biology of Segura, Spanish Nat. Research Council (ES) Sicilian Region (IT) RCFB - Regional Cooperative Federation in Bekaa (LB)
Start date	01.09.2019
Foreseen end date	31.08.2022
Extended end date	31.08.2023
External evaluator	Gabriele Mugnai
Signature	
Evaluation period	30.08.2023 – 10.11.2023

GRADING

A=high, B= medium, C=low

EQ	Rating
EQ1: Relevance	A
EQ2: Efficiency	B
EQ3: Effectiveness	B
EQ4: Impacts	B
EQ5: Sustainability	A
EQ6: Added Value	B
EQ7: Replicability - Scaling up	A
EQ8: Risk prevention/adaptation	B

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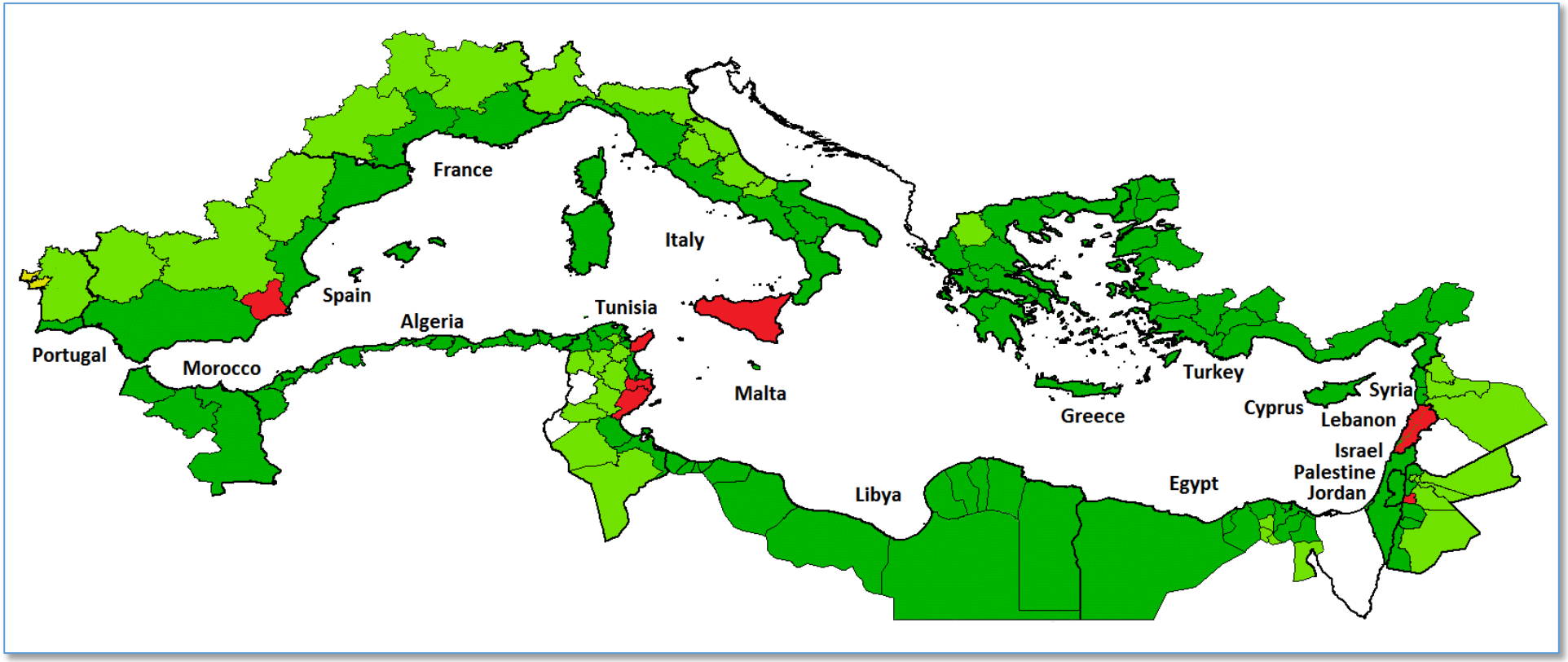
Abbreviations/Acronyms

ACCBAT	Adaptation to Climate Change through improved water demand management in irrigated agriculture by introduction of new technologies and best agricultural practices
ACLIMAS	Adaptation to Climate Change of the Mediterranean Agricultural Systems
AfDB	African Development Bank
ADF	Agricultural Development Fund
CAP	Common Agricultural Policy
CDI	Capacitive Deionization
CEBAS-CSIC	Centro de Edafología y Biología Aplicada del Segura
CIF	Climate Investment Funds
CW	Conventional Water
DSS	Decision Support System
EBRD	European Bank for Reconstruction and Development
EAFRD	European Agricultural Fund for Rural Development
EIP	European Innovation Partnership for Water
EQ	Evaluation Question
GEF	Global Environment Facility
GPS	Global Positioning System
ha.	Hectare
IS	Innovative System
JOD	Jordan Dinar
JREEEF	Jordan Renewable Energy and Energy Efficiency Fund
LB	Lead Beneficiary
LF	Logical Framework
MoU	Memorandum of Understanding
NAPs	National Adaptation Plans
NCW	Non-Conventional Water
NF	Nano Filtration
NWSS	National Water Sector Strategy

OECD-DAC	Organisation for Economic Co-operation and Development's Development Assistance Committee
PGE	National Water Plan (Spain)
PGRI	Piano di Gestione delle Risorse Idriche - Water Resources Management Plans
PPPs	Public-Private Partnerships
PV	Photo Voltaic
RBM	Result Based Management approach
RO	Reverse Osmosis
RCFB	Regional Cooperative Federation in Bekaa
SWIM	Sustainable Water Integrated Management
TWW	Treated Waste Water
USAID	United States Agency for International Development
WAJ	Water Authority of Jordan
WFD	Water Framework Directive
WP	Work Package
WRM	Water Resources Management
WUA	Water User Associations

Map of the intervention area



Executive summary

CONTEXT OF THE EVALUATION: The document summarizes the evaluation of the "Promoting Sustainable Irrigation Management and non-conventional water use in the Mediterranean – PROSIM" project, funded by the EU through the ENI CBC MED program and led by ICU. Although planned for Italy, Lebanon, Spain, Tunisia, and Jordan, the project was implemented only in the latter three from August 2019 to August 2023. The report is based on extensive consultations with project partners and stakeholders.

PURPOSE: The objective of the evaluation is to measure project performance based on OECD-DAC criteria (relevance, effectiveness, efficiency, impact and sustainability) to identify weaknesses, risks and propose recommendations for follow-up actions.

METHODOLOGY: The assessment of the project started with reviewing key documents like the logical framework, project proposal, technical and financial reports to evaluate the expected versus actual outcomes and achievements. Online meetings with PROSIM partners offered insights into challenges and accomplishments. Additionally, online surveys targeting various groups of stakeholders were distributed across participating countries for comprehensive feedback.

MAIN FINDINGS: The project *relevance* is very high. PROSIM closely aligns with the key priorities outlined in the policy agendas of its partner countries. Examination of national and regional laws revealed that adapting agriculture to climate change and reducing water consumption, along with enhancing the efficiency of its use in irrigation, are major themes in the legislation and actions of national and local governments. Therefore, by tackling these issues, PROSIM is fully consistent with the objectives set by the local governments involved in the project. The intervention logic is strong, and the theory of change justifying the identified activities is consistent with the outputs and outcomes generated, as well as to the specific and overall objectives of the project and the purposes of ENI CBC MED instrument.

The project **EFFICIENCY** is limited by several issues as the project partially achieved its goals due to non-participation from key partners in Lebanon and Italy, affecting the mediterranean dimension of the project, particularly in terms of future replicability and impact. Only one out of four planned cooperation agreements was signed, limiting the project's scale-up. While the DSS developed by CEBAS-CSIC in Spain was successful, transfer limitations hindered its adoption in Jordan and Tunisia. However, by properly manage funds with the active partners, PROSIM still managed to meet its beneficiary targets and accomplish significant results in a reduced number of targeted areas.

Project **EFFECTIVENESS** is in the average. PROSIM's goal to enhance irrigation water management for climate adaptation is contingent on wider adoption of best practices, with reduced effectiveness due to limited consortium activity. SO1: the project demonstrated effective sustainable irrigation solutions in Jordan and Tunisia, improving water use and integrating non-conventional water sources. Success is clear but requires deeper analysis for broader insights. SO2: High-quality actions were taken within each country, but challenges like limited partner participation, COVID-19 disruptions, and quick project manager turnover impeded full achievement of this objective. SO3: Successfully met, with farmers effectively adopting the proposed solutions. Positive results were reported in Tunisia and Jordan, showing potential for wider replication.

Concerning the **IMPACT** PROSIM significantly impacted by implementing efficient irrigation systems across 221 hectares, half the target of all ENI CBC MED-funded projects, and installing 10 advanced irrigation solutions using both conventional and non-conventional water sources. However, its efforts to engage the private sector were less successful due to various challenges, underscoring the complexities of integrating new practices into established agricultural and business systems, particularly those driven by public investments and incentives.

The wide adoption of these systems marks a major advancement in agricultural technology, contributing to more sustainable and efficient farming practices. The project's less effective private sector engagement offers important insights for future initiatives, highlighting the need for more focused strategies to effectively involve private stakeholders.

Project **SUSTAINABILITY** is high. The engaged consortium members of the project have taken tangible steps to secure the initiative's long-term viability. They concentrated on the excellence of the installations, the engagement of the end users, and the skill transfer for managing and maintaining the facilities, which is a core part of their operational strategy. Moreover, the regional partners have rapidly assimilated the results of PROSIM, showcasing them to their local stakeholder networks, including institutional donors, as a key investment in agriculture and climate change adaptation.

ADDED VALUE: PROSIM is a mature project, leveraging modern technologies to create innovative and pertinent solutions for diverse applications. Its strategies primarily draw upon previous projects financed by the European Union, like the ENI CBC MED and SWIM programmes, along with contributions from the governments of its partner countries. This approach facilitates new avenues for monetization and extensive application in actual production sectors. Thus, PROSIM goes beyond being an isolated project, evolving into a path of accumulating experience and conducting experiments that have been producing significant outcomes over the years.

REPLICABILITY - SCALING UP: In countries where PROSIM activities were implemented, diverse financing schemes exist, offering ample opportunities for continuing and replicating initiatives in similar contexts, essential for sustaining project momentum and expanding their reach. PROSIM partners recognize the need for increased investments in improving agricultural irrigation efficiency and reducing the energy demand in pumping and distribution systems, particularly those using fossil fuels. The ability to effectively utilize financial resources in these countries is vital for solidifying the project's actions and disseminating the best practices and knowledge gained. This combination of awareness, investment, and resource is crucial to the project's success and overall impact.

RISK PREVENTION/ADAPTATION: The action plan required modification for optimal use of funds for key actions, but this was hindered by the non-participation of the Sicilian Region and the Lebanese Ministry of Agriculture, resulting in their funds remaining unused. The late replacement of the Lebanese partner failed to resolve this, especially with the project's impending conclusion. However, funds were successfully redirected to adapt to COVID-19 travel restrictions, facilitating a higher number of field installations.

CONCLUSION: PROSIM focuses on a critical aspect of climate-adaptive agriculture: optimizing irrigation to enhance efficiency and reduce water competition with other human needs. It blends innovative concepts with established methods and technologies, building on proven solutions from previous EU funded and national funded projects. However, varying commitment levels among partners restricted its international scope and potential for future replication, especially due to the non-participation of the Sicilian Region and the Lebanese Ministry of Agriculture. This absence led to unspent funds and affected consortium management. Despite these challenges, PROSIM achieved notable field success, establishing efficient, safe, and eco-friendly irrigation facilities across 221 hectares in Tunisia, Jordan, and Spain, significantly impacting local agriculture. Photovoltaic-powered desalination facilities were particularly impactful, enhancing local production and influencing farmers' plans.

RECOMMENDATIONS: Systematic field data collection is key to validate these solutions technically and economically, demonstrating their impact on farmers' and associations' incomes. Analyzing market data is essential for accurately calculating the project's return on investment, providing solid grounds for negotiating incentives and support for replicating these solutions. PROSIM's integration of photovoltaic renewable energies with desalination facilities exemplifies a model based on the water-energy-food nexus. This approach promotes rural development through infrastructure investments for efficient irrigation using unconventional water sources and renewable energies, ensuring energy independence and cost containment. PROSIM's experience highlights that innovative, sustainable solutions can address complex rural development challenges. However, since most systems have only recently been completed, a future analysis in two to three years is recommended to fully assess their impact on farmers' productivity and income, providing crucial data for local policy-making.

1. Introduction

The project “Promoting Sustainable Irrigation Management and non-conventional water use in the Mediterranean” has been implemented in the frame of the Cross Border Cooperation within the European Neighborhood Instrument (ENI). The project responds to the Thematic Priority B.4 “Environmental protection, climate change adaptation and mitigation” and the Priority B.4.1 “Support sustainable initiatives aimed at finding innovative and technological solutions to increase water efficiency and encourage use of non-conventional water supply” as for the Joint Operational Programme Document 2014-2020.

The "ENI CBC Mediterranean Sea Basin Programme 2014-2020" is a multinational cross-border cooperation programme funded in part by the European Union through the European Neighbourhood Instrument (ENI). The Programme establishes a framework for the implementation of cross-border cooperation activities within the context of the European Neighbourhood Policy, supplementing efforts made within the framework of the Euro-Mediterranean Partnership, with the ultimate goal of developing a zone of peace, stability, prosperity, and good neighbourliness involving EU Mediterranean Countries (EUMC) and Mediterranean Partner Countries (MPCs).

The Joint Monitoring Committee for this call for proposals identified 4 Thematic Objectives and 11 Priorities of the Programme in accordance with the Joint Operational Programme. The thematic objectives and priorities are reported in the matrix below:

Thematic Objectives	*Priorities*
A.1 Business and SMEs development	*A.1.1: Support innovative start-up and recently established enterprises, with a particular focus on young and women entrepreneurs and facilitate the protection of their Intellectual Property Rights and commercialisation where applicable*
	A.1.2: Strengthen and support euro-Mediterranean networks, clusters, consortia and value-chains in traditional sectors (agro-food, tourism, textile/clothing, etc.) and non- traditional sectors (innovative ideas solutions for urban development, eco-housing, sustainable water-related and other clean technologies, renewable energy, creative industries, etc.)
	A.1.3: Encourage sustainable tourism initiatives and actions aimed at diversifying into new segments and niches
A.2 Support to education, research, technological development and innovation	*A.2.1: Support technological transfer and commercialisation of research results, strengthening the linkages between research, industry and other private sector actors*
	A.2.2: Support SMEs in accessing research and innovation, also through clustering
A.3 Promotion of social inclusion and the fight against poverty	*A.3.1: Provide young people, especially those belonging to the NEETS, and women, with marketable skills*
	A.3.2: Support social and solidarity economic actors, also in terms of improving capacities and cooperation with public administrations for services provision
	B.4.1: Support sustainable initiatives targeting innovative and technological solutions to increase water efficiency and encourage use

B.4 Environmental protection, climate change adaptation and mitigation	***of non-conventional water supply***
	B.4.2: Reduce municipal waste generation, promote source-separated collection and its optimal exploitation, in particular its organic component
	B.4.3: Renewable energy and energy efficiency - Support cost-effective and innovative energy rehabilitations relevant to building types and climatic zones, with a focus on public buildings
	B.4.4: Integrated Coastal Zone Management - Incorporate the Ecosystem-Based management approach to ICZM into local development planning, through the improvement of intra-territorial coordination among different stakeholders

Table 1. Thematic Objectives and Priorities of the JOP of ENI CBC MED 2014-2020

PROSIM goal and activities are in line with the priority 4.1 and it was funded with Euro 2,999,998.46 equal to the 90% of the overall budget (Euro 3,333,331.62) and equivalent to the 35,43% of Euro 8.466.841,39 which is the available funding for the priority 4.3.

PROSIM was kicked off in Rome, Italy the 28-29 November 2019 and implemented by a consortium of 6 partners from 5 countries of the Mediterranean shores. The partnership includes:

1. BENEFICIARY - ICU - Institute for University Cooperation (IT) Lead Applicant
2. Partner 1: NARC - National Agricultural Research Centre (JO)
3. Partner 2: Ministry of Agriculture of Lebanon (LB) – Then replaced with partner n.6
4. Partner 3: DGGREE- Directorate General of Rural Engineering and Water Exploitation (TN)
5. Partner 4: CEBAS-CSIC - Centre for Soil Science and Applied Biology of Segura, Spanish National Research Council (ES)
6. Partner 5: Sicilian Region (IT)
7. Partner 6: Lebanon_Regional Cooperative Federation in Bekaa -RCFB (LB)

The Associated Partners are: Agricultural Engineering Research Institute (AEnRI) - Agricultural Research Centre (ARC) of the Ministry of Agriculture and land reclamation of Egypt, National Institute of Agronomic Research - Ministry of Agriculture, Fisheries, Rural Development, Water and Forests, Morocco.

PROSIM's goal is to offer new solutions that combine water efficiency and non-conventional water, as well as to build local capacity to adopt/scale them. The project aimed at reducing pressure on water resources in the concerned areas of Italy, Jordan, Lebanon, Tunisia and Spain. At pilot farm level, the project was expected to increase water usage efficiency by 30% and substitute clean water by non-conventional water up to 100% thanks to new/tailored solutions to optimise water consumption. The project was enough ambitious to commit to boost by 5-10% the investments in sustainable irrigation from governments, financial institutions and farmers.

2 Project description and evaluation profile

2.1 Background

The Mediterranean climate is marked by hot, dry summers and mild, wet winters. This climatic pattern has historically influenced agriculture and water management practices in the region, hence Mediterranean countries typically rely on various sources of water for irrigation, which may include:

1. **Surface Water**: Many Mediterranean countries utilize surface water sources such as rivers, lakes, and reservoirs for irrigation. These water bodies receive rainfall during the wet season and are used to store water for later use in the dry season. Large reservoirs are often constructed to capture and store water.
2. **Groundwater**: Groundwater is a vital source of irrigation water in Mediterranean countries. Aquifers store water underground, and wells are used to extract this water for agricultural purposes. Over-extraction of groundwater can lead to issues of aquifer depletion and saltwater intrusion in coastal areas.
3. **Natural Springs**: Natural springs are another source of freshwater in Mediterranean regions. These springs can provide reliable, high-quality water for irrigation, although their availability may vary by location.
4. **Reclaimed Wastewater**: Some Mediterranean countries have implemented wastewater treatment and reuse programs. Treated wastewater, often referred to as reclaimed water, can be a valuable source of irrigation water. It is an effective way to recycle water and reduce the demand on freshwater sources.
5. **Rainwater Harvesting**: In regions with limited access to surface water and groundwater, rainwater harvesting is employed as a supplementary source of irrigation water. Rainwater is collected from roofs or other surfaces and stored for later use in agriculture.
6. **Desalination**: In coastal areas with access to the sea, desalination technologies are used to convert seawater into freshwater suitable for irrigation. While desalination can be energy-intensive and expensive, it provides a reliable source of freshwater.
7. **Imported Water**: In some cases, Mediterranean countries may import water from neighboring regions or through inter-basin transfers. This can involve transferring water from regions with surplus water resources to areas experiencing water scarcity.

Water availability for irrigation in Mediterranean countries is inherently limited due to the region's arid climate. These countries often rely on a combination of sources; however, the availability of these sources fluctuates throughout the year, leading to challenges in managing irrigation needs. The major issues are:

- **Seasonal Variation**: The Mediterranean climate is characterized by distinct wet and dry seasons. The majority of precipitation occurs during the winter months, while summers are typically dry. This seasonal variation in rainfall leads to irregular water availability for irrigation. Farmers must store water during the wet season to sustain crops during the dry season, relying on reservoirs and aquifers.
- **Competition for Water**: Water resources are in high demand in Mediterranean countries for various purposes, including domestic use, industry, and tourism. Competition for water resources can intensify during periods of drought, making it challenging to meet agricultural irrigation needs. This competition underscores the importance of efficient water management practices.

The increasing impacts of climate change are posing threats to agricultural sustainability and food security, particularly when it comes to availability and seasonality of water for irrigation. Climate change is particularly relevant for:

- **Climate Change Impacts**: Climate change is amplifying the existing challenges of water availability and seasonality in Mediterranean countries, exacerbating the vulnerabilities of agricultural systems.

- **Reduced Precipitation**: Climate change models predict a decrease in overall precipitation in many Mediterranean regions. Reduced rainfall during the wet season can lead to more prolonged droughts, further straining water resources for irrigation.
- **Increased Temperature**: Rising temperatures associated with climate change accelerate evaporation rates, causing increased water loss from reservoirs and aquifers. Higher temperatures also contribute to greater water demand, as crops require more irrigation to combat heat stress.
- **Increased Frequency of Extreme Events**: Mediterranean countries are already prone to extreme weather events like heatwaves and wildfires. Climate change is expected to increase the frequency and intensity of such events, which can damage irrigation infrastructure and disrupt water supply systems.
- **Sea-Level Rise**: Coastal regions in Mediterranean countries are at risk of saltwater intrusion into groundwater sources due to sea-level rise. This can compromise the quality and availability of freshwater for irrigation.

By the 2050 horizon, a significant decrease (25–50%) in freshwater resources is projected over the whole Mediterranean basin (Figure 1).[1]

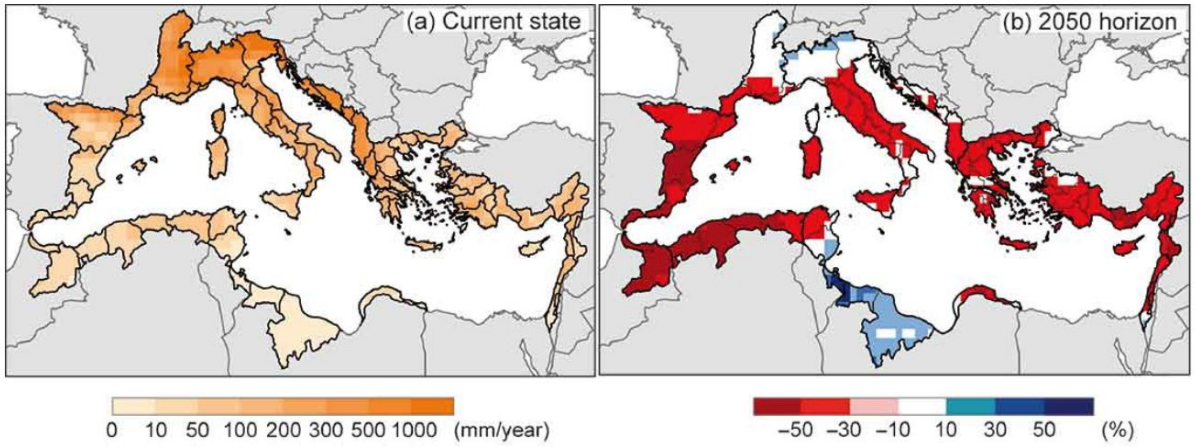


Figure 1. current mean annual freshwater availability (left); evolution rate in freshwater availability by the 2050 (right)

To address the challenges posed by climate change and ensure the sustainable use of water for irrigation in Mediterranean countries, several strategies can be implemented:

1. **Improved water management**: enhance water use efficiency through modern irrigation techniques, such as drip and sprinkler systems, and promote responsible water practices.
2. **Water storage and reservoirs**: invest in the construction and maintenance of water storage infrastructure to capture and store excess rainfall during the wet season.
3. **Climate-resilient crops**: promote the cultivation of drought-tolerant and heat-resistant crop varieties that require less water.
4. **Desalination and wastewater reuse** (non-conventional water): desalination technologies and wastewater treatment to augment freshwater supplies.
5. **Policy and international cooperation**: develop regional agreements and policies to manage shared water resources effectively, considering climate change impacts.

[1] Milano et al. 2013, http://dx.doi.org/10.1080/02626667.2013.774458

PROSIM project comprehensively work on the above mentioned aspects, with emphasis on non-conventional water use and irrigation optimisation.

2.2 Project description

PROSIM long term result is the decrease of pressure on water resources for irrigated agriculture in Mediterranean area due to: higher water usage efficiency - estimated in 30% improvement - and substitution of clean water by non-conventional water - up to 100% - thanks to new/tailored solutions to optimise water consumption in irrigated agriculture. A further project goal is to boost by 5-10% the investments in sustainable irrigation from governments, financial institutions and farmers.

The indicators of achievements concerning expected results and outputs for PROSIM are reported in the below matrices.

<table>
<tr><th colspan="3">Programme Overarching objective</th><th colspan="2">Programme Priority</th></tr>
<tr><td colspan="3">B.4 - Environmental protection, climate change adaptation and mitigation (Address common challenges in environment)</td><td colspan="2">B.4.1 - Support sustainable initiatives targeting innovative and technological solutions to increase water efficiency and encourage use of non-conventional water supply</td></tr>
<tr><th colspan="5">PROSIM general and specific objectives</th></tr>
<tr><td colspan="3">General objective:</td><td colspan="2">Specific objectives:</td></tr>
<tr><td colspan="3" rowspan="3">To contribute to environmental protection, climate change adaptation and mitigation in irrigation water management through water use efficiency and use of non-conventional waters</td><td colspan="2">1. To demonstrate new/enhanced, sustainable irrigation solutions that ensure an increased water-use efficiency and entail a larger use of NCWs, adapt their technical complexity to local conditions and capacities of target areas and make tailored solutions available to stakeholders at Med basin level</td></tr>
<tr><td colspan="2">2. To strengthen cross-border cooperation, capacity building and engagement in sustainable irrigation water management of relevant local institutions and private stakeholders at Med basin level, by sharing and capitalising know-how; providing mutual support in the implementation of innovative solutions</td></tr>
<tr><td colspan="2">3. To support farmers' adoption of sustainable irrigation water management solutions combining environmental, technical and economic advantages and foster civil society engagement in environmental sustainability at Med basin level</td></tr>
<tr><th colspan="5">Priority, expected results and indicators for the Programme and PROSIM</th></tr>
<tr><th>Priority</th><th>Expected results</th><th>Expected results indicators</th><th>Programme target</th><th>PROSIM target</th></tr>
<tr><td>B.4.1 - Support sustainable initiatives targeting innovative and</td><td>4.1.1 Increased</td><td>4.1.1B Number of measures and</td><td>30 measures</td><td>10 measures</td></tr>
</table>

technological solutions to increase water efficiency and encourage use of non-conventional water supply	adoption of innovative sustainable water-efficiency technologies and systems in agriculture by public authorities, specialized agencies and other relevant stakeholders	initiatives to showcase, exchange, test and transfer water management solutions to end-users in the agricultural sector in view of improving water use efficiency and quality and use of non-conventional water resources (NCWR) in agricultural practices		
		4.1.1.A Surface in ha. of land irrigated with treated wastewater and non-conventional water or equipped with modern and efficient irrigation systems	150 hectares	91 hectares
		4.1.1.C Investments in up-scaling of appropriate technologies to increase water efficiency and use of non-conventional water supply systems for irrigation purposes	12 Investment Initiatives	4 Investment Initiatives

Expected result	Project outputs	WP	Output indicator(s)	Programme target values* (From Annex 2 of the JOP)	PROSIM target value

4.1.1.	Cross border training initiatives on WUE and NCWs for partner institutions	WP3	4.1.1.3.d Number of staff of different stakeholders trained that are involved in CBC-MED projects	480 persons	28 persons
	Joint Letter of Commitment on adoption of WUE and NCWs solutions	WP3	4.1.1.2.b Number of public / private actor alliances engaged in non-conventional and efficient water management plans	6 Alliances	1 Alliances
	Joint Letter of Commitment on adoption of WUE and NCWs solutions	WP3	4.1.1.2.c Number of local authorities applying integrated approaches for water cycle management in agriculture	18 public authorities	7 public authorities
	Capacity-building training programme on WUE and NCWs use for EAs and WUAs	WP3	4.1.1.3.d Number of staff of different stakeholders trained that are involved in CBC-MED projects	480 persons	292 persons
	4 Memorandum of Understanding (MoU) on local WRM plans based on public-private cooperation	WP3	4.1.1.2.b Number of public / private actor alliances engaged in non-conventional and efficient water management plans	6 Alliances	4 Alliances
	4 Memorandum of Understanding (MoU) on local WRM plans based on public-private cooperation	WP3	4.1.1.5.f Number of organizations involved in WRM applying sustainable innovative water efficiency and non-conventional water technologies within local water governance frameworks	30 organizations	16 organizations
4.1.1	WUE irrigation systems demonstrated	WP4	4.1.1.4.e Number of replicable technologies for water efficient use and use of non-conventional water resources	9 technologies	2 technologies

	WUE technology solutions demonstrated	WP4	4.1.1.4.e Number of replicable technologies for water efficient use and use of non-conventional water resources	9 technologies	2 technologies
	TWW reuse solutions demonstrated	WP5	4.1.1.4.e Number of replicable technologies for water efficient use and use of non-conventional water resources	9 technologies	1 technology
	Desalination solutions demonstrated	WP5	4.1.1.4.e Number of replicable technologies for water efficient use and use of non-conventional water resources	9 technologies	3 technologies
	Mixed waters solutions demonstrated	WP5	4.1.1.1.a Number of new or enhanced ICT solutions for water resources management in agriculture	6 ICT solutions	1 ICT solution
	Mixed waters solutions demonstrated	WP5	4.1.1.4.e Number of replicable technologies for water efficient use and use of non-conventional water resources	9.0 technologies	1.0 technology

2.3. Scope and objectives of the evaluation

During the final stages of the project's implementation, an external consultant selected by ICU Istituto for la Cooperazione Universitaria, evaluated PROSIM project. The evaluation's goal is to assess project performance using OECD-DAC criteria (relevance, effectiveness, efficiency, impact, and sustainability), added value, scale-up potential and risk management, identify lessons, and make recommendations for next steps. The evaluation's methodology was designed to assess achieved benefits, discover and comprehend unforeseen impacts, and assess the long-term sustainability of project actions.

Beyond the project's conclusion, all project partners are capable of overseeing the proper management of the irrigation solutions and promote those best practices that have been identified, realized on ground and tested by the project consortium. The alignment of partners' mandates with the role played in PROSIM implementation reassures on their commitment to long-term sustainability of the actions and - to varying degrees for each specific country frame - replication of the best practices piloted by PROSIM to achieve reduced water consumption for irrigation and higher rate of non-conventional water employed.

The evaluation takes in consideration all the activities implemented by PROSIM project from 01.09.2019 to 31.08.2023 in Spain, Italy, Jordan, Lebanon and Tunisia.

2.4. Methodology

As indicated in the Indicative Monitoring and Evaluation Plan of the ENI CBC MED PROGRAMME 2014-2020, the MA and the JTS will apply the Result Based Management approach (RBM) to the ENI CBC MED funded projects. The advantages of using the RBM in the framework of ENI CBC MED Programme, are:

1. **Planning**: the RBM offers a systematic approach to select interventions that are most likely to address the targeted problems;
2. **Consensus, coordination, and ownership**: the RBM provides the opportunity to work with key stakeholders coordinating the implementation approach, agreeing on and verifying the expected results, highlighting and checking the underlying assumptions and specifying needed resources;
3. **Management**: the RBM offers a tool for guiding corrective adjustments to activities, reallocating resources, and re-evaluating targeted objectives or underlying assumptions;
4. **Communication and reporting**: the RBM acts as a vehicle for communicating about the resources, activities, and outcomes to Programme staff, Project partners and other relevant stakeholders. It can be an important tool in illustrating to the beneficiaries what a project is meant to achieve;
5. **Project Evaluation**: the description of each level of Results with associated Indicators, Priorities, Targets and Milestones establishes an effective framework for ongoing monitoring and evaluation. The RBM clearly identifies how progress toward the targeted objectives will be measured and thus provides the basis for the development and use of the monitoring system;
6. **Positive and negative lessons learned**: the systematic use of the RBM allows the Programme staff to assess what approaches contribute most effectively to achieving the Thematic Objectives (TOs). The RF helps identify good practices for replication and better manage risks and opportunities.

The Evaluation phases (mid-term and final) is expected to provide valuable information for decision-making and lessons learnt for the future, and the fifth point of the project cycle (evaluation) incorporates outcomes from all the other 5 steps, as reflections on the project results and sustainability. The evaluation steps have been:

Preliminary documents and data review: Retrace the project implementation process in order to grasp the key crucial features and define shared knowledge between the evaluator and project partners, which will be useful in establishing the succeeding evaluation phases.

All relevant documents are thoroughly examined in order to perform all analysis above mentioned. While logical framework and the project proposal document represent the baseline/expected results, on the other side mid-term monitoring and evaluation reports, financial reports, main resuming accounting documents, donors' official letters show the real project implementation trend.

The preliminary phase focuses on:

- relevance analysis of the project on the basis of LF and National/local policy strategy. A deep examination of the proposal, together with the collection and understanding of the main national laws, strategic plans, and socio-economic rules of the concerned communities.

- financial efficiency analysis, based on the main resuming financial documents. The project documentation should clearly show how the budget has been allocated in the different actions and in specific moments. Accountancy reports versus monitoring reports: will point out the extent of financial efficiency.

Project staff meeting and discussion: Several on-line meetings have been organized with reference persons of all PROSIM partners, to understand the key difficulties, challenges, results from PROSIM in the whole lifespan.

Preparation of questionnaires for different stakeholders and beneficiaries: on-line questionnaires (prepared through Google Drive templates) have been prepared for different stakeholders and beneficiaries of PROSIM project in particular, farmers and farmers associations representatives. The questionnaires have been shared with the PROSIM coordinators in each country and they took care of delivering them to the appropriate recipients.

2.4.1 Evaluation criteria

The evaluation will measure OECD parameters as they are considered as a standard benchmark in project evaluation framework:

RELEVANCE

It indicates the coherence between project objectives, as identified problems addressed by the project, and physical, social and political environment of intervention area. Specific information will be gathered about:

- National, local policy frame, including strategic and sectoral laws in force in the area.
- Logical Framework Analysis, aimed at comparing the project design with the operational framework (goals and objectives, risks and assumption, management system set up in the project document, target group identification in the respect of gender issues and capacity, in other words, the rationale and completeness of project design process and internal logic and coherence of the intervention itself).
- Beneficiaries' analysis: comparing the needs and priorities of beneficiaries with planned actions and sector achievements. Measuring the appropriateness of the deployed strategy with beneficiaries' engagement, the consistency of project actions with needs of people, disaggregated for sex and age. The extent of involvement of local groups in the project phases (since identification of strategy).

EFFICIENCY

The costs, the timely, and the wise project resources management, that translated financial and human resources into concrete results with proper objectively verifiable quality. Detailed assessment will be addressed to following elements:

- Daily budget management (appropriateness budget value for each action) and project personnel employed, with specific organisational and management structure.
- Relations and coordination with local authorities, institutions, beneficiaries and other donors.
- The adherence to deadlines.

- Costs and value-for-money of implemented actions: by a cost-benefit analysis project costs have to be compared with benefits. The assessment should contain as much as possible monetised values, although not all benefit could be easily internalised through a scientific approach. The results should be further compared with results expected and mentioned in the project document.
- Contributions from counterparts: partners, local institutions, beneficiaries and government. Evaluation of expected versus performed contribution, and communication with counterparts.
- Level of technical assistance.
- Quality of monitoring.

EFFECTIVENESS

The level of achievement of project objectives, by the realisation of concrete results, in the specific implementation context. It is composed by:

- Indicators analysis, based on Logical Framework and value of indicators at baseline data collection.
- Stakeholders' vision on project impacts, intended as all those changes recorded by them in their daily life.
- The contingency strategy adopted by the project to minimise those risks considered at project design phase or those unexpectedly occurred during the project implementation: flexibility of management team, shared process with counterparts.
- General ability of project staff to deal with complex and unexpected changes within implementation frame.

IMPACT

The changes that the project brought to the social, cultural, political and physical environment, and its contribution to sectoral aim indicated in the LF as Overall Objective. The impact is also defined by OECD (Organisation for Economic Co-operation and Development) as "**the positive and negative, intended and unintended, direct and indirect, primary and secondary effects produced by an intervention**".

SUSTAINABILITY

It indicates the probability that positive output and outcome of the project will last in the long run. To be sustainable the project should:

- Be consistent with national and local policy to ensure a proper attention of policy makers toward the project outputs and outcomes
- Financial and economic sustainability: resources can be public, private or mixed, but appropriate availability of funds must be ensured. While the financial analysis is a mere evaluation of cash flows, the economic analysis is a wider evaluation of monetised costs and benefits recorded at social level, useful element to know the social value of the plants for all the communities. It has to evaluate environmental benefits, ecological services, improved health better sanitation condition and, as far as it makes sense, assign to each unit, a monetary value.
- integrated in the socio-cultural environment. A key issue is the participation of relevant stakeholders in the project. The project must be congruous with local power management systems, and operate in abidance with those laws. Behaviours of project staff are further

important to ensure proper ownership of beneficiaries, and pushing an effective hand-over of infrastructures, from project board to beneficiaries' committees.

- Foresee the deploy of appropriate technologies based on available human resources (knowledge, skills, people) to manage assets, and services.
- In line with institutional capacity: managerial, technical, political ability of policy makers and civil servants to follow up and support institutions in the proper use and maintenance data collection, offices, data processing units for irrigation technologies and use of non-conventional water for irrigation.

ADDED VALUE

It investigates how PROSIM ensures complementarities and generate synergies with other programmes and stakeholders at local, national and European level. It is conceptually in line with sustainability but it focuses more on the potential network that the consortium was able to stimulate with the aim of reinforcing its action and amplify its results.

REPLICABILITY AND SCALING UP

This is a very important aspect of the sustainability, particularly focused on the locally available funds to sustain the project efforts, replicating the pilot project and strengthening the policy and private sector ecosystem to enhance irrigation efficiency and decrease water demand competition at country level.

PROJECT CAPACITY TO DEAL WITH RISK/PREVENTION AND ADAPTATION

The capacity of the project to deal with risk refers to its ability to identify, assess, mitigate, and manage potential risks that may arise during the project lifecycle. Building a robust risk management capacity is crucial to minimize the negative impacts of uncertainties and increase the likelihood of project success. The assessment will measure:

- What kind of risks the project implementation faced and how they were treated;
- To what extent the workplan was adapted to unforeseen conditions that has put at risk the proper project implementation;
- How the key risks were properly identified in the project document in the ex-ante phase. The identified risks were: Risks: A)staff insecurity; B)political situation worsening; C) delays caused by partners/suppliers Probability: low Possible effects: hindering activities Corrective measures: A) Relying on: national embassies warnings, local staff constant monitoring of the situation, B) On field monitoring, involvement of PPs institutions that ensure the prosecution of the action if the situation worsens; C) Population is involved and informed on the positive impact on public budget and environment. External conditions: Stability of economy/inflation/exchange rates: conditions quite firm in target countries. Mitigation: adaptation of pilots/equipment/budget to modified conditions, ensuring an advantageous cost/benefit ratio. - Solid political situation: current political stability in target areas; involvement of institutional PPs ensures government support. Mitigation: target areas changed in case of problems, on-field staff ensure constant monitoring to act early and avoid delay.

2.4.2 Evaluation Questions

The evaluation is structured around 8 Evaluation Questions (EQ) covering different aspects of PROSIM. The questions have been defined during the identification of the terms of references for the evaluation and have been confirmed during the first phase of documents' desk review and analysis with ICU.

The 7 Evaluation Questions are:

1) **Key question on relevance:** "Is PROSIM strategy aligned with the goals and priorities of key stakeholders and beneficiaries? Does this strategy work directly toward attaining the objectives?"
2) **Key question on efficiency:** "Are the activities implemented in line with the plans? Are they implemented and the outputs delivered in a cost-efficient manner?"
3) **Key question on effectiveness:** "What are the major factors influencing the achievement or non-achievement of the objectives of PROSIM project?"
4) **Key question on impact:** "What is PROSIM project's likely contribution to the overall objective of ENIC CBC MED funding line? To what extent the project benefited the target beneficiaries, directly or indirectly and a larger number of people in the sector and/or region"
5) **Key question on sustainability:** "What was put in place by the project to ensure the sustainability of the expected project outcomes?"
6) **Key question on added values:** "How did the implementation of PROSIM ensure complementarities and generate synergies with other programmes and stakeholders at local, national and European level"; "What are the strengths and weaknesses of having the EU implement the project?"
7) **Key question on project potential replicability and scaling up:** "Are PROSIM partners in the position to ensure funding at the national level to ensure the continuity of this project's activities? How could this consolidate the activities in phase 2?
8) **Key questions on project partnership capacity to deal with risks and prevention and adaptation measures adopted to ensure the best performances: "**How did you modify the action plan to address unforeseen risks? What solutions did you implement to navigate challenges during the project's execution?"

2.4.3 Evaluation time line

According to the ToR the evaluation was carried out in three different stages: (i) desk evaluation, (ii) on-line consultation with project partners, stakeholders and beneficiaries and (iii) report writing.

The desk evaluation started on August 30th 2023. The list of analyzed documents is included in Annex 1. The consultation phase took place from September 10th to October 20th 2023.

The final report-writing phase started soon after the end of the reiterated data collection and led to the first draft of the final report. Review by the evaluation manager led to the final document.

3. Evaluation findings

3.1 EQ1: Relevance

Is PROSIM strategy aligned with the goals and priorities of key stakeholders and beneficiaries?

Does this strategy work directly toward attaining the objectives?

POLICY FRAMEWORK STRATEGIC ALIGNMENT

In order to provide a concise yet comprehensive overview of the political, regulatory, and legislative frameworks that describe the commitment of central and local governments in each country to enhance irrigation efficiency and the use of non-conventional water sources for irrigation, it is below presented a brief analysis for each country.

As member states, Italy and Spain share the **EU directives** and strategies aimed at increasing efficiency in irrigation and the use of non-conventional water in irrigation. Concerning EU framework, we mention:

- Water Framework Directive (WFD): The WFD is a fundamental piece of EU water policy that aims to achieve "good status" for all water bodies by 2027. It emphasizes sustainable water management, including the sustainable use of water resources in agriculture, which encompasses improving irrigation efficiency.
- Common Agricultural Policy (CAP): The CAP is a key EU policy that provides financial support to European farmers. Under the CAP, the EU promotes the adoption of environmentally friendly farming practices, including those related to irrigation efficiency. Farmers can receive incentives for implementing water-efficient irrigation systems.
- Circular Economy Package: The EU's Circular Economy Package encourages the reuse of water, including treated wastewater, in agriculture. It promotes the safe and controlled use of non-conventional water sources for irrigation, reducing the demand for freshwater resources.
- Farm to Fork Strategy: As part of the EU's Farm to Fork Strategy, there is an emphasis on reducing the environmental footprint of food production. This includes promoting sustainable agricultural practices, water conservation, and efficient irrigation techniques.
- European Innovation Partnership for Water (EIP Water): EIP Water brings together stakeholders from various sectors, including agriculture, to foster innovation in water management. It supports initiatives that improve irrigation efficiency and sustainable water use in agriculture.
- Climate Adaptation Strategy: The EU's Climate Adaptation Strategy recognizes the importance of adapting agriculture to climate change. Water management and efficient irrigation are crucial components of this strategy, ensuring agricultural resilience in the face of changing weather patterns.

Italy and Spain have transposed, either entirely or partially, these directives into their national regulations with appropriate legislation.

Italy had implemented several laws, measures, and initiatives to promote irrigation efficiency and the use of non-conventional water sources for irrigation:

- National Irrigation Plan: Italy has developed a National Irrigation Plan to improve irrigation efficiency, infrastructure, and water management in agriculture. The plan includes investments in modernizing irrigation systems and promoting efficient water use.
- Legislative Decree No. 152/2006: This decree, known as the Environmental Code, includes provisions related to water use and protection. It addresses issues such as water quality, conservation, and sustainable use, including in agriculture and irrigation.
- Water Resources Management Plans (Piano di Gestione delle Risorse Idriche - PGRI): Italy has established PGRI at the river basin level to plan and manage water resources sustainably. These plans consider various water uses, including irrigation, and aim to balance water availability with demand.
- Water Pricing and Tariffs: Italy has implemented water pricing mechanisms to incentivize efficient water use in agriculture. Farmers may be subject to tariffs that encourage the responsible use of water resources.
- Reclaimed Water and Wastewater Reuse: Italy has been working on regulations and guidelines for the safe and controlled reuse of reclaimed water and treated wastewater in agriculture, which can help reduce the demand for conventional freshwater sources for irrigation.
- Research and Innovation: Italy invests in research and innovation projects aimed at improving irrigation efficiency, developing smart irrigation technologies, and promoting sustainable water use in agriculture.
- Drip Irrigation and Precision Agriculture: The adoption of drip irrigation systems and precision agriculture techniques has been promoted to enhance water use efficiency in Italian agriculture.
- Agri-Environmental Schemes: Italy participates in agri-environmental schemes that provide financial incentives to farmers who implement environmentally friendly and water-efficient practices in their irrigation systems.
- Monitoring and Data Collection: Italy maintains monitoring systems to assess water availability, quality, and usage, which help in making informed decisions related to irrigation and water management.

In **Spain** there are numerous measures and laws aimed at promoting the efficiency in irrigation, including the use of non-conventional water. The most important are:

- Water Framework Directive (WFD) Implementation: Spain has adopted measures to implement the European Water Framework Directive (WFD), which includes objectives for water quality, water conservation, and sustainable water use, including in agriculture.
- National Water Plan (PGE): Spain's National Water Plan outlines strategies and actions for sustainable water management, including measures related to irrigation efficiency and the use of non-conventional water sources.
- Drought Management Plans: Spain has developed drought management plans to address water scarcity and ensure efficient water use during periods of drought, which can impact irrigation.

- Modernization of Irrigation Systems: Spain has promoted the modernization of irrigation infrastructure, including the conversion of traditional flood irrigation to more efficient methods like drip and sprinkler irrigation.
- Precision Agriculture: Precision agriculture technologies, such as GPS-guided machinery and sensor-based irrigation systems, have been encouraged to optimize water use and improve irrigation efficiency.
- Training and Technical Assistance: Programs have been implemented to provide training and technical assistance to farmers on best practices for efficient irrigation management.
- Treated Wastewater for Irrigation: Spain has encouraged the use of treated wastewater (reclaimed water) for agricultural irrigation through regulations and incentives, reducing the demand for conventional freshwater sources.
- Agri-environmental Schemes: Spain participates in agri-environmental programs that provide financial incentives to farmers who adopt environmentally friendly practices, including water-efficient irrigation.

Jordan has invested in the development of a strong legal and regulatory framework to promote irrigation efficiency:

- Water Authority of Jordan (WAJ) Law: This law establishes the Water Authority of Jordan, which oversees water management in the country, including policies related to irrigation efficiency and water use in agriculture.
- Renewable Energy and Energy Efficiency Law: This law promotes renewable energy projects, including those related to water pumping and irrigation, to enhance energy efficiency in the agricultural sector.
- Drip Irrigation and Modernization: Jordan has encouraged the adoption of modern irrigation systems, including drip and sprinkler irrigation, to improve water use efficiency and reduce water wastage.
- Water User Associations (WUAs): Jordan has established WUAs to empower farmers in managing irrigation systems more efficiently and sustainably.
- Smart Irrigation Technologies: The government has supported the deployment of smart irrigation technologies and sensor-based systems to optimize water use in agriculture.
- Wastewater Reuse: Jordan has implemented regulations and initiatives to promote the safe and controlled reuse of treated wastewater for agricultural irrigation, reducing reliance on conventional freshwater sources.
- Subsidies for Efficient Irrigation: Financial incentives, subsidies, and grants are offered to farmers and agricultural enterprises that invest in water-efficient irrigation technologies and practices.
- Renewable Energy Incentives: Incentives for renewable energy projects, such as solar-powered irrigation systems, have been introduced to reduce the energy costs associated with irrigation.
- Agricultural Development Fund (ADF): The ADF provides financial support and loans to farmers for various agricultural projects, including those focused on improving irrigation efficiency.
- Water Pricing Policies: The government has introduced water pricing policies that encourage efficient water use in agriculture and promote the adoption of water-saving technologies.
- Desalination Projects: Jordan has explored desalination as a source of non-conventional water for irrigation in arid regions.

Lebanon, has a more recently faced the problem of irrigation efficiency but some national measures are in place:

- National Water Sector Strategy (NWSS): Launched in 2012, this strategy aims to ensure the availability of water for all users by 2020 and is in line with the Sustainable Development Goals (SDGs). It emphasizes the importance of the efficient use of water in agriculture, which consumes a significant proportion of Lebanon's water resources.
- Rehabilitation of Public Irrigation Networks: The Lebanese government has been actively working on rehabilitating public irrigation canals and networks to reduce water losses and increase the efficiency of water distribution.
- Water User Associations (WUAs): The promotion of WUAs is one of the tools the Lebanese government is using to involve farmers directly in the management of irrigation water. These associations are meant to improve the efficiency of water distribution and reduce losses.
- Promotion of Drip Irrigation: The government has been promoting drip irrigation systems, which are more water-efficient than traditional methods. There have been incentives and technical support provided to farmers who adopt these systems.
- Treated Wastewater: The NWSS stresses the importance of wastewater treatment and reuse, especially for agricultural irrigation. Several wastewater treatment plants have been planned or are under construction to help achieve this.
- Rainwater Harvesting: Encouraging the collection and storage of rainwater is another method to augment water supply. This can be particularly useful in agricultural areas.
- Desalination: While primarily aimed at augmenting potable water sources, desalination might also offer opportunities for irrigation, especially in coastal areas.

The **Tunisian** government has recognized the importance of promoting efficient irrigation and the use of unconventional water sources in agriculture. Here's an analysis of the measures and commitments of the Tunisian government in these areas:

- National Water Strategy: Tunisia has developed a comprehensive water strategy that focuses on both supply-side and demand-side management. The strategy places emphasis on modernizing irrigation techniques and optimizing water use in agriculture.
- Irrigation Modernization: The government has been investing in modernizing its public irrigation systems to make them more efficient. This includes rehabilitating existing networks and introducing new technologies.
- Promotion of Drip Irrigation: The Tunisian government, recognizing the efficiency of drip irrigation, has been providing subsidies and incentives to encourage farmers to adopt this method.
- Water Pricing: Tunisia has implemented water pricing reforms to encourage the efficient use of water. By pricing water more accurately to its scarcity value, it provides an economic incentive for farmers to use water more efficiently.
- Treated Wastewater: Tunisia has been a pioneer in the region for its use of treated wastewater in agriculture. Several wastewater treatment plants have been built to treat urban wastewater, making it suitable for irrigation purposes.
- Desalination: Given its long coastline, Tunisia has looked into desalination as a means to supplement its water sources. Several desalination plants have been planned, especially for the more arid regions and islands.

- Rainwater Harvesting: Encouraging the collection of rainwater for agricultural use has been another method the government has supported.
- Water User Associations (WUAs): Tunisia has also promoted the establishment of WUAs, which are meant to give farmers a more significant role in the management and distribution of irrigation water, ensuring efficient use.

Based on the information provided above, it is evident that the legal, regulatory, and administrative frameworks are comprehensive and well-developed. Firstly, this underscores the immense relevance of PROSIM project to the political priorities of local partners. On the other hand, it presents an opportunity for local laws and policy makers, at both central and federal levels, to design better policies and implement more appropriate measures grounded in the experimental and practical results obtained from PROSIM.

BENEFICIARIES AND STAKEHOLDERS' PRIORITIES AND NEEDS

The Mediterranean basin, characterized by its semi-arid climate, is particularly vulnerable to the effects of climate change. Rising temperatures, decreasing precipitation, and increasing frequency of extreme weather events intensify water scarcity in the region. Concurrently, the population's growth and a rising demand for food products place even more pressure on already limited water resources. Ensuring sustainable growth in this context necessitates a comprehensive rethinking of water management practices, especially in agriculture, which accounts for a significant portion of water use. Efficient irrigation practices can drastically reduce water wastage, allowing for more crops per drop. Techniques like drip irrigation, rainwater harvesting, and soil moisture management can maximize yield while minimizing water use. Furthermore, non-conventional water sources, such as treated wastewater, saline water, and desalinated water, provide an alternative to the over-extraction of freshwater resources. These sources can supplement traditional water supplies and can be particularly useful for agricultural irrigation, given the right treatment and management.

Considering each single country, specific issues can be highlighted:

1) **Italy**
   - Italy's agricultural sector is a cornerstone of its economy, especially in regions like Puglia and Sicily.
   - Over-extraction of groundwater and surface water for agriculture has led to environmental issues, such as land subsidence and saltwater intrusion in coastal aquifers.
   - There's an urgent need to adopt more water-efficient agricultural practices and explore alternative water sources, especially in the face of increasing drought periods.
2) **Spain**
   - Spain's diverse climatic regions range from very arid areas in the southeast to more humid regions in the north.
   - The country has already experienced severe droughts affecting its agricultural output. Efficient irrigation is not just a choice but a necessity.
   - Spain has been a pioneer in Europe for wastewater treatment and reuse, recognizing the value of this non-conventional water source for irrigation.
3) **Lebanon**
   - With an increasing population and recurrent political and economic crises, water management becomes crucial for Lebanon's stability.

- Over-extraction from the Litani River and other sources has become a pressing concern.
- Given the country's challenges with water pollution, treating and reusing wastewater for agriculture can both alleviate water scarcity and reduce environmental degradation.

4) **Jordan**
   - Jordan is one of the most water-scarce countries in the world.
   - The demand on the Jordan River and the Dead Sea has caused ecological and environmental concerns.
   - Jordan has been investing in desalination projects and wastewater treatment, understanding the importance of non-conventional water sources for its survival.
5) **Tunisia**
   - Tunisia's agriculture is pivotal for its economy and food security.
   - Over-extraction, especially in its central and southern parts, has caused groundwater depletion.
   - Tunisia has been at the forefront in the MENA region in terms of treating and reusing wastewater for irrigation, recognizing the dual benefits of water conservation and pollution reduction.

Common challenges across countries

- Increasing climate unpredictability and heightened risk of crop loss;
- The need to make agriculture more resilient to climate change can only be met by increasing the percentage of irrigated agriculture compared to non-irrigated agriculture;
- The water demand per citizen is increasing in the Mediterranean region, not only in the southern Mediterranean countries but also in the northern Mediterranean countries, and this amplify the competition over different uses of available water.

ANSWER TO EQ1

Is PROSIM strategy aligned with the goals and priorities of key stakeholders and beneficiaries?

All the project partners, stakeholders, and beneficiaries interviewed agreed on the importance of improving irrigation efficiency and the use of non-conventional water sources, as a strategic goal to ensure food security and economic sustainability of agricultural businesses in their area.

The difficulties encountered are:

- The cost associated with water tariffs for irrigation rises with the energy costs and the complexity of collective irrigation systems (indirect costs for water service);
- The amount of water allocated to an agricultural enterprise often represents the limiting factor in the expansion of production and the increase in productivity;
- Climate change makes water resources scarcer, alternative uses increasingly in competition with agriculture, and the need to find alternative sources for irrigation ever more urgent.

PROSIM is fully responsive to the priorities identified in the policy agendas of the partner countries. The analysis of national and regional legislation has indicated the adaptation of agriculture to climate change, the reduction of water usage, and the increase in efficiency of systems that use it for productive or residential purposes, as two of the most cited cross-cutting aspects in laws and measures enacted by national and local governments. Thus, PROSIM, in addressing these challenges, is completely in line with the commitments of the local administrations that participated in the project.

Does the project strategy work directly toward attaining the objectives?

The theory of change underpinning the project's logic appears strong and credible. The planned activities are grouped into work packages whose outputs are: i) on-field implementation of the best solutions for increasing efficiency in irrigation and allow the use of unconventional water (WP4 and WP5); ii) strengthening the technical skills of local institutions, ensuring their understanding of the urgency to promote investments in efficient irrigation to meet the challenges of climate change and increased agricultural production; this also includes strengthening collaboration between the public and private sectors (WP3); iii) promoting the implemented solutions, fostering awareness among the general public and agricultural entrepreneurs about the opportunities and benefits these entail.

These outputs are entirely consistent with the project outcomes: i) demonstrating the effectiveness of the proposed solutions through their appropriate design and implementation in different environmental and productive contexts; ii) enhancing the skills and motivation of institutional actors, who are responsible for concretizing policies and measures for the adoption of such solutions in the field, also through international cooperation and the sharing of best practices and cutting-edge technologies; iii) supporting the adoption of these solutions by agricultural entrepreneurs. The project outcomes are consistent with the outputs as the planned actions are effective in overcoming the constraints that prevent the diffusion of irrigation efficiency measures in the partner countries: i) lack of awareness of the real results and high technical sustainability of technologies for efficient irrigation and the use of unconventional waters; ii) absence of clear references regarding the return on investment times and hesitation to invest on the part of agricultural entrepreneurs; iii) limited commitment of institutions to concretely promote the adoption of the measures and a general landscape of scant incentives for adoption, both in financial terms and technical assistance; iv) limited availability, in the local market for many countries, of materials, tools, and equipment that make the technical solutions truly functional and durable.

The mentioned outcomes are finally consistent with the general objective of the project which is, in line with the ENI CBC MED call, to contribute to environmental protection, adaptation to climate change, and mitigation in the management of irrigation water through efficiency in water use and the use of unconventional waters.

3.2 EQ2: Efficiency

Are the activities implemented in line with the plans?

Are they implemented and the outputs delivered in a cost-efficient manner?

Although PROSIM was funded by the ENI CBC MED Authority to a consortium of 6 partners from 5 Mediterranean countries, it was actually implemented by 4 partners in 3 countries. The Italian and Lebanese partners did not carry out any of the planned activities in their respective territories.

The Lebanese partner, the Lebanese Ministry of Agriculture (PP2), encountered significant operational difficulties from the early months of the project, due to the precarious stability of the country and the actual inability of local institutions to carry out external programs. A second partner, the Regional Federation of Lebanese Cooperatives in Bekaa (RCFB – PP6), was selected to replace the first, but once the recognition procedures were completed the first tranche of funds was not transferred to the new partner, as they were not able to open the bank account before the project concluded. The Italian

partner, Sicilian Region (PP5), after having participated in the kick-off meeting, did not follow up on the commitments made and remained unreachable for the entire duration of the project.

The same situation occurred during the final evaluation for which no information of any kind was provided regarding the reasons that justified this choice. The complete disappearance of the partner immobilized the funds allocated to the PP5 and did not even allow the procedure for replacing the partner.

The non-participation of 2 out of 6 partners effectively prevented the implementation of field activities in two of the project's target countries (Italy and Lebanon), reducing the project's efficiency both in terms of overall final results and in the time required to address difficulties caused by these absences. However, in Jordan and Tunisia, activities were carried out regularly with good technical and socio-environmental results. Below is a brief analysis of the overall project efficiency (Table 2 and Figure 2) concerning the three countries where the field activities were conducted.

Project outputs	WP	Output indicator(s)	Programme target values* (See Annex 2 of the JOP)	Project target value	Project targets achieved
Cross border training initiatives on WUE and NCWs for partner institutions	WP3	4.1.1.3.d	320	**28**	**110**
Capacity-building training programme on WUE and NCWs use for EAs and WUAs	WP3	4.1.1.3.d	320	**292**	**111**
Joint Letter of Commitment on adoption of WUE and NCWs solutions	WP3	4.1.1.2.b	4	**1**	**0**
Joint Letter of Commitment on adoption of WUE and NCWs solutions	WP3	4.1.1.2.c	12	**7**	**0**
4 Memorandum of Understanding (MoU) on local WRM plans based on public-private cooperation	WP3	4.1.1.2.b	4	**4**	**1**
4 Memorandum of Understanding (MoU) on local WRM plans based on public-private cooperation	WP3	4.1.1.5.f	20	**16**	**5**
Surface (ha) irrigated	WP4	4.1.1.a	400	**91**	**221**
WUE irrigation systems demonstrated	WP4	4.1.1.4.e	8	**2.0**	**2**
WUE technology solutions demonstrated	WP4	4.1.1.4.e	8	**2.0**	**2**
TWW reuse solutions demonstrated	WP5	4.1.1.4.e	8	**1.0**	**1**
Desalination solutions demonstrated	WP5	4.1.1.4.e	8	**3.0**	**3**
Mixed waters solutions demonstrated	WP5	4.1.1.1.a	4	**1.0**	**1**
Mixed waters solutions demonstrated	WP5	4.1.1.4.e	8	**1.0**	**1**

Table 2. Project outputs

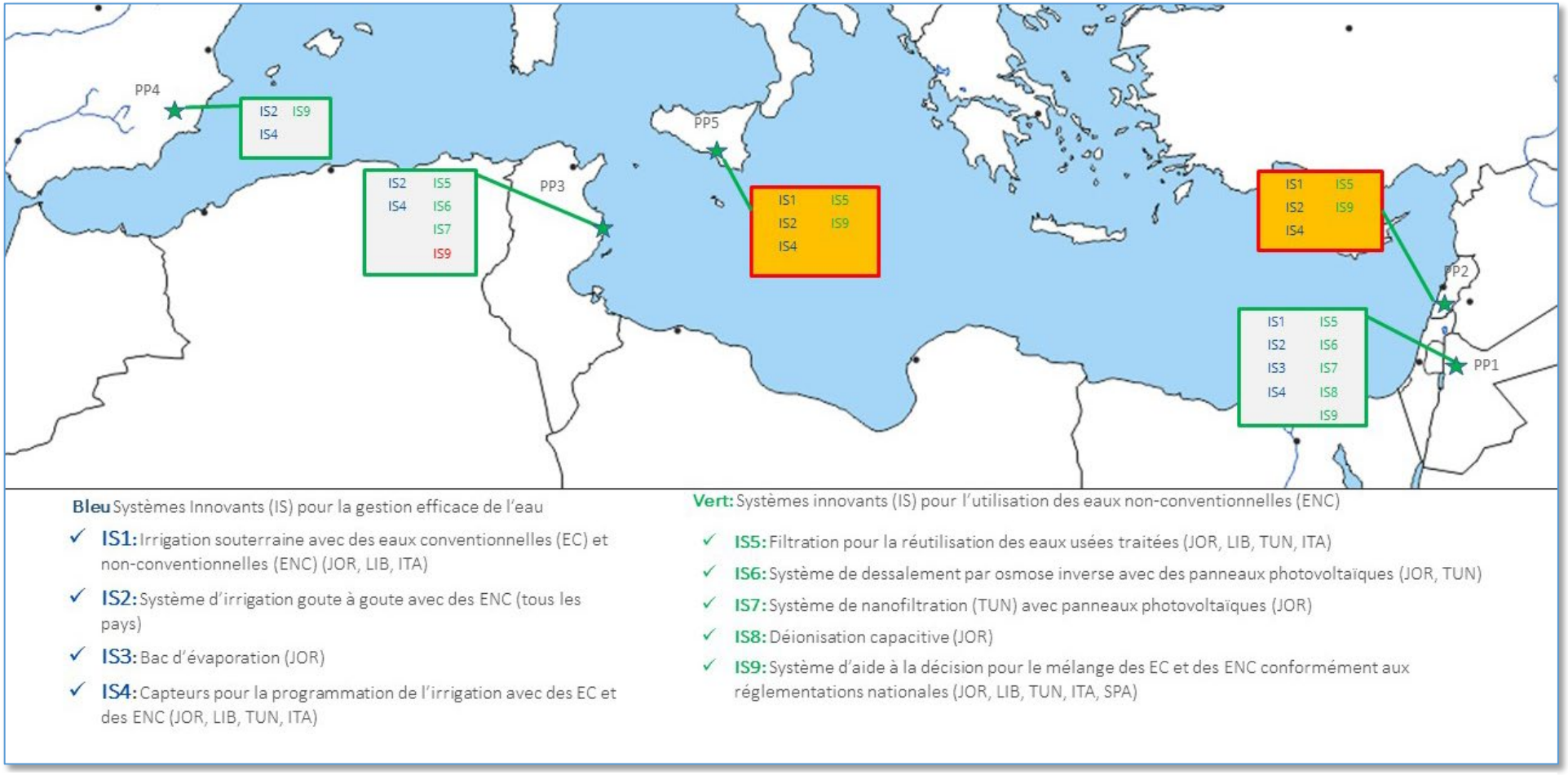


Figure 2. Implemented and planned but not implemented (orange) activities of PROSIM

Jordan

PROSIM in the Jordan Valley has successfully advanced water use efficiency and enhanced agricultural production quality through the deployment of innovative technologies. These include:

- Subsurface and drip irrigation systems, which have increased water use efficiency for both protected and open field farmers.
- Pan evaporation equipment, sensors, and weather stations that fine-tune irrigation to meet precise crop requirements.
- A filtration system and three distinct desalination technologies—Reverse Osmosis (RO), Nanofiltration (NF), and Capacitive Deionization (CDI)—to upgrade irrigation water quality.
- These technologies were trialed on 45 hectares, engaging 110 farmers.

Specifically, in Balqa, Jordan:

- Two solar-powered reverse osmosis desalination plants were established, each with a 10 m^3/h capacity, to combat water salinity and prevent soil degradation. These units are aiding 4 farmers across 4 hectares.
- Soil and groundwater were meticulously analyzed to guide the technical specifications for these plants.
- Four direct beneficiaries were carefully chosen through surveys by the National Agricultural Research Centre of Jordan.
- Balqa's arid conditions, limited rainfall, abundant solar radiation, and brackish groundwater make it an ideal location for PV-RO systems.
- Other water treatment and irrigation techniques such as nanofiltration and wastewater filtration, as well as advanced irrigation control systems, were also implemented in Balqa.

Moreover, the project's partnership with the National Agriculture Research Centre led to:

- The installation of drip irrigation systems in greenhouses and open fields over 15.5 hectares, serving 35 farmers, optimizing water and nutrient delivery to the plant root zone.
- The establishment of evaporation pans covering 11.5 hectares to aid 35 farmers in accurately gauging local evaporation and irrigation needs for vegetable cultivation.
- The installation of two meteorological stations for collecting critical data on temperature, humidity, and precipitation.
- The placement of soil moisture sensors to monitor moisture levels and ensure irrigation is only applied as needed.

Lastly, disc filters were incorporated to treat the water, preventing clogs in irrigation systems, thereby extending their life and reducing maintenance requirements.

Concerning further activities in Jordan was organized dissemination days for sensitizing and informing other farmers. These events are designed to spread knowledge and best practices about new technologies and methods in agriculture, aiming to empower farmers with the information and tools necessary for modern farming.

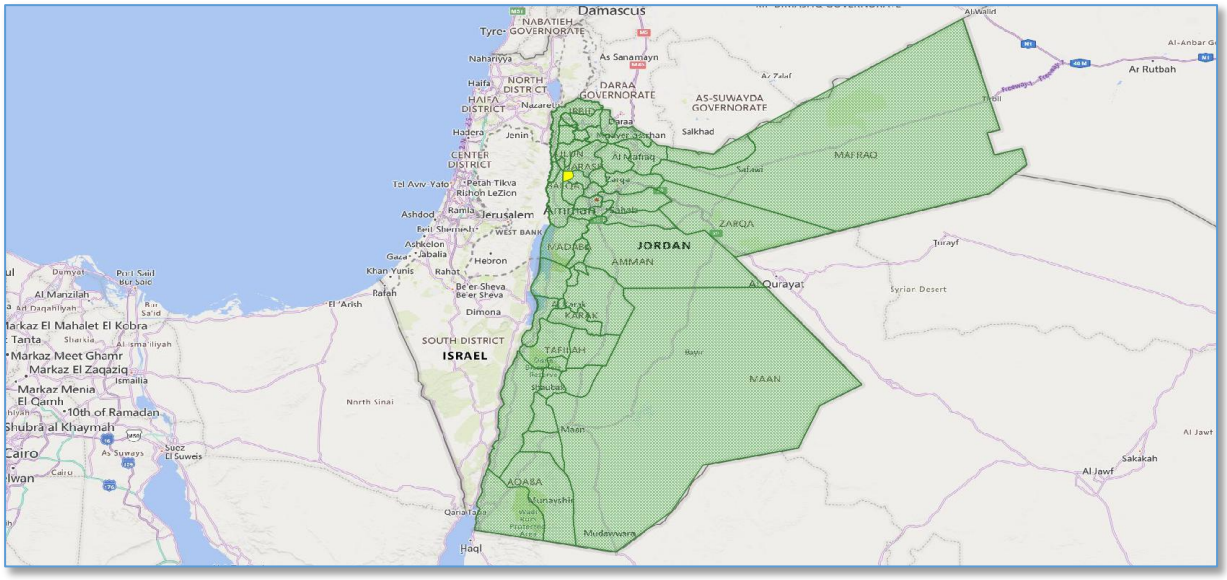


Figure 3. Governorates of Jordan; Balqaa in yellow

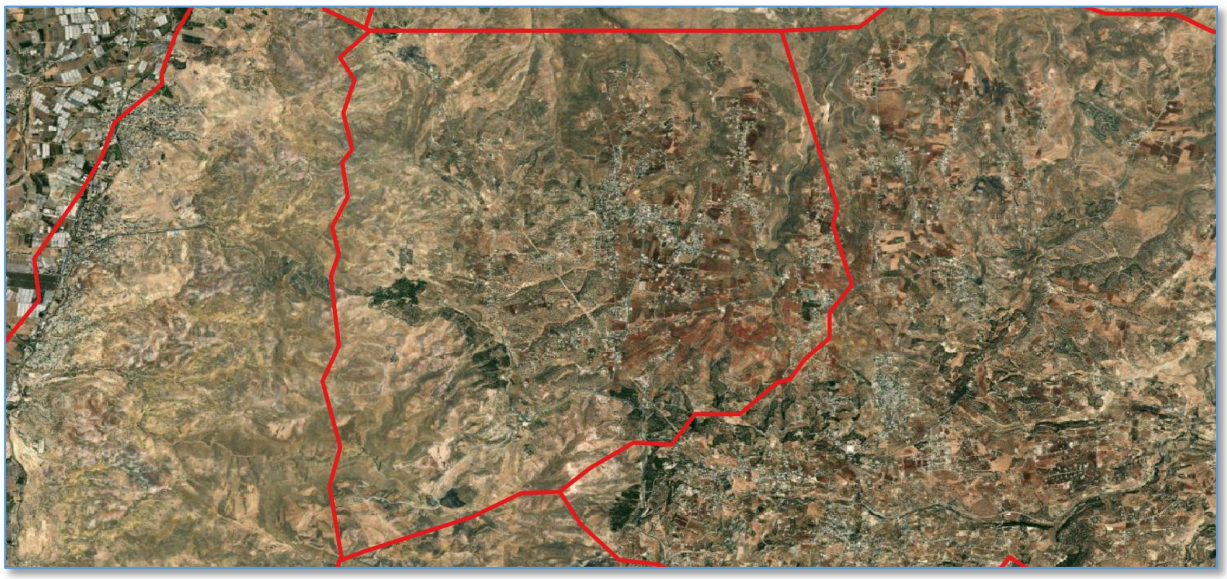


Figure 4. Balqaa Governorate on BIN satellite image

Tunisia

PROSIM was implemented in the Governorates of Nabeul in the north and Mahdia in the central east. The interested Municipalities are: Mahdia and Souassi (Mahdia); Beni Kahlled and Grombalia (Nabeul). The specific localities, are: Beni Khalled Sud (Tomi) تومي بني خلاد القبلية, Nianou نيانو (In Nabeul), Ez-Zahara الزهراء, Hiboun هيبون, Essouassi السواسي (Nabeul). (Figure 5, 6, 7, 8, 9).

- The localized irrigation equipment has been procured for the farmers within the BIR BEN KEMLA irrigated perimeter in the Mahdia governorate. This step involves enhancing irrigation efficiency by supplying advanced localized irrigation systems to the agricultural community, fostering better water management and conservation practices.
- Meteorological stations and soil moisture probes have been demonstrated in Mahdia and Nabeul. This involves showcasing cutting-edge technology that can significantly improve the

precision of irrigation and crop cultivation by providing real-time data on weather patterns and soil moisture levels.

- A water treatment unit using nanofiltration with a capacity of 20 m^3/day has been installed at CFPA SOUASSI MAHDIA. This installation is a stride towards improving water quality and availability for agricultural practices, employing advanced filtration to remove impurities and contaminants from water, ensuring the sustainability of water resources.
- A reverse osmosis water treatment unit has been set up at PPI BIR BEN KEMLA - MAHDIA with a capacity of 800 m^3/day at 200 ppm and 1,000 m^3/day at 1.5 g/l, including a portion of 400 m^3/day funded by the PROSIM project. This project component focuses on providing substantial quantities of desalinated water suitable for irrigation, thus securing a consistent water supply for agriculture while addressing salinity issues.
- A demonstration of an intermediate decision-support system for water mixing (reverse osmosis unit at BIR BEN KEMLA) has been conducted. This involves the implementation of a system designed to optimize water quality for irrigation by efficiently blending various water sources, enhancing the decision-making process for water resource management.
- Dissemination days have been organized for sensitizing and informing other farmers. These events are designed to spread knowledge and best practices about new technologies and methods in agriculture, aiming to empower farmers with the information and tools necessary for modern farming.
- Training of trainers has been carried out for extension agents and water economy units across 24 governorates. This initiative aims to build a network of knowledgeable professionals who can assist in the widespread adoption of water-saving techniques and practices, ensuring a multiplier effect in the transfer of expertise throughout the agricultural sector.

Figure 5. Governorates in Tunisa and Municipalities of PROSIM implementatmentation

Figure 6. Municipalities of Nabeul: Beni Khalled Sud and Nianou

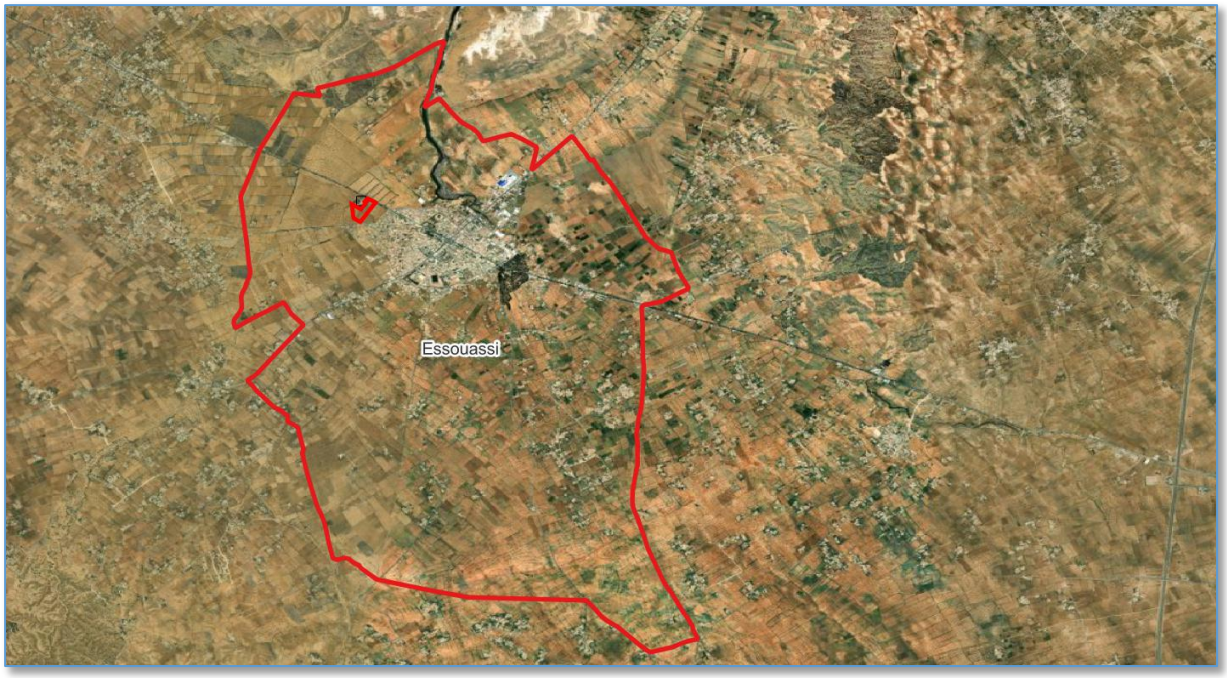


Figure 7. Essouassi, Municipality of Mahdia

Figure 8. Hiboun and Ez-Zahara, Municipalities of Mahdia

Figure 9. Ben Kamla Mahdia irrigated plots: reverse osmosis desalination unit PV powered

Spain

The Centro de Edafología y Biología Aplicada del Segura (CEBAS - CSIC), Spanish PROSIM partner, was responsible to work on the Decision Support System for irrigation water management. The primary objective of this decision support system is to enhance the mixing of various water sources, including Treated Waste Waters, desalinated, and brackish waters, to boost agricultural yields. These water sources are considered non-conventional, supplied after specific processes such as desalination, or are appropriately treated before use in irrigation systems.

An advanced version of the DSS is in the implementation phase is being showcased by CEBAS on a one-hectare plot in Murcia, Spain. Utilizing data from a range of water quality sensors that interface with a software designed for the automated mixing of conventional waters (CWs) and non-conventional waters (NCWs), the system can generate an optimal mix for irrigation purposes in respect to both quality and volume.

According to the initial project plan, an intermediate and simplified DSS should have been demonstrated in Jordan, Tunisia and Italy, as a complementary tool integrated with other innovative solutions to increase water use efficiency.

Unfortunately, the local regulatory frameworks have not allowed the implementation of such a system through collaboration with CEBAS - CSIC, since the current legislation in these countries does not permit the provision of services by private entities that are not registered in the national private sector system. However, through the information sharing and guidance of CEBAS with local partners, a DSS (advanced) was implemented in Jordan and DSS (intermediate) in Tunisa that were realized by third parties involved by the partners.

ANSWER TO EQ2

Are the activities implemented in line with the plans?

The activities planned by PROSIM project were only partially realized. The lack of participation by two partners, the Ministry of Agriculture of Lebanon and the Sicilian Region, has reduced the efficiency of the project in several dimensions and all activities, including the realization of the innovative irrigation systems foreseen by the project were not realized in Italy and Lebanon. This caused a missed opportunity to provide visibility and the possibility of replication in two countries of the consortium, lacking the participation of local partners who could involve the networks of local stakeholders. The 4 MoUs between alliances composed of public and private entities were not signed to seal the commitment to cooperation for implementing efficient irrigation actions (only 1 out of 4).

The DSS, developed by the Spanish partner CEBAS-CSIC, although it reached an excellent level of realization, could not be transferred to the Jordanian and Tunisian partners, due to limitations imposed by the local partners concerning the use of technical solutions created through external services provided by entities not registered in the country. This represented an additional reason for difficulty in creating a proactive consortium capable of fully exploiting the potential offered by an ENI CBC MED project.

On the other hand, it should be highlighted that the activities planned by PROSIM as a whole were largely achieved, thanks to a transfer of funds to the active partners. This made it possible to reach the same number of final beneficiaries, a greater number of hectares covered by the innovative pilot plants, and to obtain excellent results, albeit only in a reduced part of the consortium and in a smaller number of territories than was envisaged by the initial project.

Are they implemented and the outputs delivered in a cost-efficient manner?

Despite the efficiency limits mentioned in the preceding response, and the no-implementation of activities by the Italian and the Lebanese partners, the overall financial resources used to carry out the PROSIM activities have been spent consistently with the budget. The project has undoubtedly encountered challenges as a result of the economic crisis associated with the COVID-19 pandemic, but it has demonstrated an adaptive capacity for the purchase and use of efficient technologies, overall adhering to the commitments made.

3.3 EQ3: Effectiveness

What are the major factors influencing the achievement or non-achievement of the objectives of PROSIM project?

The PROSIM project aimed at addressing critical water management issues in the Mediterranean region through a set of strategic objectives centered around sustainable irrigation practices. The project rationale is based on the following key elements:

- Demonstration of Sustainable Irrigation Solutions

The project intended to showcase innovative irrigation technologies that are more sustainable than current practices. This involves implementing systems that optimize water usage, reducing waste and preserving this vital resource.

A key aspect was to improve water use efficiency. By demonstrating methods that ensure more crop per drop, the project aimed to set a benchmark for water-saving techniques in agriculture.

The project also planned to expand the use of non-conventional water resources, such as treated wastewater or desalinated water, to mitigate the pressure on conventional freshwater sources.

- Adaptation of Technical Solutions to Local Conditions

Recognizing that each area in the Mediterranean has unique environmental, social, and economic conditions, the project emphasized customizing technical solutions. The goal was to ensure that the technologies and methods introduced would be viable and effective in the local context.

By tailoring solutions, the project sought to provide a variety of options that could be adapted by different stakeholders, from small-scale farmers to larger agricultural enterprises.

- Facilitation of Technology Adoption at the Mediterranean Level

The PROSIM project aimed not just to develop and test new technologies, but also to facilitate their adoption across the Mediterranean. This meant addressing barriers to technology transfer and uptake, including training stakeholders and sharing knowledge and best practices.

The project intended to work closely with local farmers, agricultural organizations, and policymakers to ensure that the new irrigation solutions were accessible and could be integrated into existing agricultural practices.

- Involvement and Empowerment of Stakeholders

An important objective was to engage local stakeholders in the project actively. By involving them in the demonstration activities and the development of the solutions, the project aimed to ensure the technologies would be embraced and sustained in the long term.

Empowering stakeholders through training and capacity-building activities was crucial to enable them to make informed decisions about water management and to continue the use of sustainable technologies beyond the project's lifespan.

- Establishment of programmatic alliances

To set up synergies between public and private sectors, pursuing excellence and cooperation in the integrated WRM was one of the project strategies. For this purpose, 4 MoUs were expected to be signed by 4 local alliances interested in investing resources in launching and adopting effective solutions for adaptive irrigation.

PROSIM GOAL AND OBJECTIVES

PROSIM goal is:

- To contribute to environmental protection, climate change adaptation and mitigation in irrigation water management through water use efficiency and use of non-conventional waters.

And the 3 specific objectives are:

- To demonstrate new/enhanced, sustainable irrigation solutions that ensure an increased water-use efficiency and entail a larger use of NCWs, adapt their technical complexity to local conditions and capacities of target areas and make tailored solutions available to stakeholders at Med basin level

- To strengthen cross-border cooperation, capacity building and engagement in sustainable irrigation water management of relevant local institutions and private stakeholders at Med basin level, by sharing and capitalising know-how; providing mutual support in the implementation of innovative solutions;
- To support farmers' adoption of sustainable irrigation water management solutions combining environmental, technical and economic advantages and foster civil society engagement in environmental sustainability at Med basin level.

PROSIM RESULTS

The expected project results versus the achieved results are:

Priority, expected results and indicators					
Priority	**Expected results**	**Expected results indicators**	**Programme target**	**PROSIM target**	**PROSIM result**
B.4.1 - Support innovative and technological solutions to increase water efficiency and encourage use of non-conventional water supply	4.1.1 Increased adoption of innovative sustainable water-efficiency technologies and systems in agriculture by public authorities, specialized agencies and other relevant stakeholders	4.1.1B Number of measures and initiatives to showcase, exchange, test and transfer water management solutions to end-users in the agricultural sector in view of improving water use efficiency and quality and use of non-conventional water resources (NCWR) in agricultural practices	30 measures	10 measures	**10** **measures**
		4.1.1A Surface in ha. of land irrigated with treated wastewater and non-conventional water or equipped with modern and efficient irrigation systems	150 ha.	91 ha.	**221** **ha.**

		4.1.1C Investments in up-scaling of appropriate technologies to increase water efficiency and use of non-conventional water supply systems for irrigation purposes	12 investment initiatives	4 investment initiatives	**1** **investment initiative**

Table 3. Priority, expected results and indicators Vs achievements

Indicator A was exceeded by 230%, indicator B was achieved at 100%, while indicator C can be quantified as 25% achieved. However, according to the ENI CBC MED project Monitoring Plan, indicator 4.1.1.C states: *"This indicator covers the number of documented initiatives supported by private and/or public investments that will enable significant up-scaling of replicable technologies to increase water efficiency and use of non-conventional water supply systems for irrigation purposes. Investments in up-scaling of replicable technologies and replicating interventions will by definition increase the dissemination and deployment of tested and proven technologies and systems."* Moreover, the source of verification for this specific indicator is: "*Information will be provided through project progress reports including reference to official documentation and external sources available on the extent that investments - in a particular replicable technology - have paid off and substantiate the preparation and submission of upscale investment initiatives as mentioned above*". Since the investment has not yet been made, indicator 4.1.1C has not been achieved, not even in the declared unit.

WATER AND ENERGY SAVINGS

The data analysis was performed in detail by the Jordanian partner, the National Agricultural Research Centre of Jordan, which collected and analysed data from 110 farmers. Since these are the only scientifically collected data in the last phase of the project, we refer to them to carry out a concise analysis of the project's effectiveness measured with the ultimate beneficiaries of the activities.

NARC analysis on 110 Jordan farmers

The technologies implemented on 45 ha. for the benefit of 110 farmers are:

- Subsurface and drip irrigation systems for protected and open field farmers;
- Pan evaporation, sensors and weather stations to calibrate the exact irrigation requirement;
- Filtration system and three different desalination technologies (reverse osmosis - RO, nano-filtration - NF, Capacitive Deionization Desalination Plant - CDI) to improve the quality of the irrigation water.

The project yielded significant results through the deployment of sophisticated irrigation systems, incorporating filters, sensors, evaporation pans, and automated fertigation systems, leading to respective water savings of 20%, 10%, 15%, 20%, and 15%. This suite of technological advancements contributed to a notable decrease in water consumption and played a crucial role in preserving this valuable resource. Additionally, the project effectively curtailed water loss, registering minimal figures of 0.1%, and absolute zero in several instances. Enhancements in water use efficiency were marked, with improvements observed between 90% and 95% across the various implemented technologies.

Such advancements in efficiency translated into concrete advantages for the participating farmers, demonstrating the tangible success of the PROSIM project. (Table 4).

Farmers witnessed a boost in yield that varied between 8% and 15%, along with an enhancement in product quality by 5% to 12%. Moreover, the longevity of the network infrastructure expanded, with its lifespan extending from the initial 3-5 years to a full 7 years, thereby guaranteeing a sustainable foundation for ongoing agricultural endeavours. (Table 4).

Criteria	Irrigation system	Filter	Sensors	Evaporation Pan	Automated fertigation system
Water saving	20%	10%	15%	20%	15%
Water loss	0.1%	0	0	0	0
Increase water use efficiency	90%	95%	90%	95%	95%
Increase in production	8%	11%	5%	7%	15%
Increase in quality of products	6%	6%	5%	9%	12%
Network lifespan	3-5years	4-5years	6years	7years	5years
Fertilizers distribution efficiency	100%	100%	100%	100%	100%

Table 4. Benefits from different adopted measures, quantified at field level in Jordan

Building on the progress achieved by the PROSIM project, the introduction of two desalination plants, Al-Karama and Al-Rama, further amplified the benefits. The operation of these facilities led to considerable electricity savings, cutting monthly expenses from 1,000 JOD (1,200 €) to 800 JOD (960 €) for Al-Karama, and from 800 JOD to 600 JOD (720 €) for Al-Rama, respectively (Table 5).

Saving electricity	Saving in Water price	Increase in production	Increase in product quality
1000 JOD/month	800 JOD/month	50-60%	80%
800 JOD/month	600 JOD/month	70-80%	90%

Table 5. Benefits from the desalination plants of Al-Karama and AL-Rama

The desalination plants not only cut down on electricity costs but also achieved considerable reductions in water prices, with Al-Karama seeing savings between 50-60% and Al-Rama between 70-80%. These plants were pivotal in boosting production by 80% and 90%, respectively, securing an augmented water supply for agricultural operations. Consequently, this enabled farmers to enhance their productivity and respond to market demands with heightened efficiency.

ANSWER TO EQ3

What are the major factors influencing the achievement or non-achievement of the objectives of PROSIM project?

Project Goal: PROSIM has taken steps to contribute to environmental protection, climate change adaptation, and mitigation in irrigation water management by improving water usage efficiency and utilising non-traditional water sources. The importance of this contribution will be fully realised only

in the coming years, depending on the number of stakeholders who embrace and apply the identified and promoted best practises. Because the project consortium was only partially active, the initiative's long-term effectiveness in accomplishing its overall goal will surely be weakened and slowed.

Specific objective n.1: the project successfully demonstrated the efficacy of innovative and enhanced sustainable irrigation solutions that not only improved water-use efficiency but also increased the utilization of non-conventional water sources (NCWs). By adopting an adaptive strategy tailored to the environmental and productive contexts, the project's success was cemented in Jordan and Tunisia. The limited data analyses available indicate a significant success of the implemented solutions. However, further data collection and comparative analysis of these solutions may yield new and insightful observations.

Specific objective n.2: consultations with project partners have highlighted the high quality of actions taken within each individual country context, yet a lack of interaction between partners was evident. Several factors contributed to the poor achievement of the second specific objective, including a project consortium that was weakened by the non-participation of 2 out of 6 partners, effectively excluding two countries (Italy and Lebanon) from the network; operational difficulties imposed by the COVID-19 pandemic and the scaling back of exchange programs that included travel between countries; and the rapid turnover of 5 project coordinators, which slowed down management and decision-making processes.

Specific objective n.3: the third objective, in terms of the actual reach of PROSIM among farmers, was fully achieved. The adoption of the proposed solutions was done with awareness and thoughtful consideration, yielding excellent results, particularly during the final phase of the project. Furthermore, during the evaluation, interviewed farmers in Tunisia (10) and in Jordan (18) reported not only that the solutions are performing exceptionally well but also that they have been receiving visits from other farmers and associations keen to replicate these solutions in their own operations.

3.4 EQ4: Impacts

What is PROSIM project's likely contribution to the overall objective of ENIC CBC MED funding line?

To what extent the project benefited the target beneficiaries, directly or indirectly and a larger number of people in the sector and/or region?

PROSIM CONTRIBUTION TO THEMATIC OBJECTIVE B.4: ENVIRONMENTAL PROTECTION, CLIMATE CHANGE ADAPTATION AND MITIGATION

PROSIM project aligns with Thematic Objective 4 of the ENI CBC MED call, which aims to enhance environmental protection as well as climate change adaptation and mitigation. Effectively, the project proposes efficient solutions across the three specific aspects of the thematic objective: i) It promotes environmental protection by safeguarding water resources, a central element for the ecological

balance of environmental systems, through reduced water usage. This is achieved by improving irrigation efficiency and enabling the mixed use of different water sources. Without adequate technological solutions, such resources (e.g., saline and wastewater) would remain untapped. ii) The project introduces innovative irrigation solutions that decrease water losses and greatly increase efficiency. By ensuring the same irrigation capacity with less water, the project supports climate change adaptation efforts. iii) Lastly, by utilizing photovoltaic solar energy to power desalination plants, the project contributes to reducing greenhouse gas emissions, thus aiding in climate change mitigation.

PROSIM CONTRIBUTION TO THE PRIORITY B.4.1: SUPPORT SUSTAINABLE INITIATIVES TARGETING INNOVATIVE AND TECHNOLOGICAL SOLUTIONS TO INCREASE WATER EFFICIENCY AND ENCOURAGE USE OF NON-CONVENTIONAL WATER SUPPLY

The technological solutions proposed have many innovative aspects in the realm of irrigation management in the Mediterranean. While these solutions, when considered individually, are already well-established and recognized – as for example in Jordan a country at the forefront of water conservation and optimization of water use for productive purposes — the project has taken a novel approach by integrating multiple solutions in real-world contexts, with proper design for local production units, and conceived for a total management by local producers. This integration has allowed for the calibration of the proposed solutions within their working framework and the design of new solution models by leveraging the combined advantages of multiple systems, resulting in a synergy of benefits previously unexplored.

Additionally, the use of renewable energies (PV systems) has played a crucial role, solidifying the centrality of the now widely promoted water-energy-food Nexus concept, which is guiding a segment of the ecological transition of rural economies. By tapping into renewable energy sources, the project underscores the interconnectivity of resource management, ensuring that the optimization of water usage does not come at the expense of energy efficiency or food production sustainability, thereby contributing to the broader objectives of environmental sustainability and climate resilience.

HOW PROSIM IS ALIGNED TO EXPECTED RESULT N. 1: INCREASED ADOPTION OF INNOVATIVE SUSTAINABLE WATER-EFFICIENCY TECHNOLOGIES AND SYSTEMS IN AGRICULTURE BY PUBLIC AUTHORITIES, SPECIALISED AGENCIES AND OTHER RELEVANT STAKEHOLDERS

Indicator 1: Surface in ha. of land irrigated with treated wastewater and non-conventional water or equipped with modern and efficient irrigation systems.

PROSIM contributed significantly to the indication n.1 of the Result n.1 under Priority B4.1 of the call for proposals. While the ENI CBC MED Programme value goal is 400 hectares, PROSIM alone was able to achieve 221 hectares, or nearly 52% of the total surface area.

Indicator 2: Number of measures and initiatives to showcase, exchange, test and transfer water management solutions to end-users in the agricultural sector in view of improving water use efficiency and quality and use of non-conventional water resources in agricultural practices.

PROSIM realized on ground 10 demonstration sites, to showcase innovative water management solutions, specifically:

- 2 Water Use Efficient (WUE) irrigation systems demonstrated: Underground irrigation with conventional (EC) and non-conventional (ENC) water (IS1 – Jordan) and Drip Irrigation System with NCW (IS2 - Jordan, Spain and Tunisia);
- 2 WUE technology solutions demonstrated: Evaporation Pan (IS3 – Jordan); sensors for irrigation scheduling with CWs and NCWs (IS4 – Jordan, Tunisia);
- 1 TWW reuse solutions demonstrated: Filtration for reuse of treated wastewater (IS5 – Jordan);
- 3 Desalination solutions: Reverse osmosis desalination system with photovoltaic panels (IS6 – Jordan, Tunisia), Nanofiltration system (TUN) with photovoltaic panels (IS7 – Jordan, Tunisia), Capacitive deionization (IS8 – Jordan);
- 2 Mixed water solutions demonstrated: Decision support system for mixing CWs and NCWs in accordance with national regulations.

Indicator 3: Investments in up-scaling of appropriate technologies to increase water efficiency and use of non-conventional water supply systems for irrigation purposes.

As stated before, the project succeeded in getting a Memorandum of Understanding signed in Jordan between the public and commercial sectors. The alliance expressed interest in making longer-term commitments to achieve this goal, although without allocating financial or technological resources to replicate PROSIM successes.

IMPACTS MEASURED THROUGH CONSULTATION WITH PROJECT STAKEHOLDERS

Local Institutions

Local partnering institutions, in Jordan and Tunisia, recognise PROSIM as an extension and qualitative upgrade of the work done during the ACCBAT project's implementation. PROSIM has elevated the standard of actions undertaken and the benefits provided to local producers. The ability to operate at such a high degree of excellence in terms of on-the-ground solutions has raised the standard for the quality of irrigation systems throughout the country and provided a crucial tool for promoting these solutions to all agricultural producers across the country. This progress not only signifies a step forward in agricultural practices but also serves as a benchmark for future initiatives aimed at sustainable water management.

Farmers

During the external evaluation, thanks to the support provided by Ms. Dhouha Attafi in Tunisia and Mr. Amer Sweity in Jordan, meetings were held with 10 and 18 beneficiary farmers, respectively, who had engaged in activities carried out during the project. When visiting the farmers, questionnaires were administered: these were designed to achieve a multifaceted understanding of the project's impact on the agricultural sector. The first objective was to gauge any technical difficulties the farmers faced when implementing, managing and using the new solutions. Understanding these challenges is crucial for refining the technology and providing adequate support to the users. Secondly, the questionnaires attempted to determine how the innovative solutions provided had enhanced the productive potential of farming enterprises, including alterations to their production models. This aspect of the evaluation was directed at measuring the capacity of the interventions to not only integrate into existing farming practices but also to potentially transform them for higher efficiency and productivity. Lastly, an important facet of the questionnaires, was to gather feedback on the

differences in income for the agricultural entrepreneurs. This economic perspective would provide concrete data on the financial benefits that the project had yielded for those at the heart of the farming industry, thereby allowing for an assessment of the economic sustainability and the long-term viability of the introduced solutions.

The questionnaires provided valuable insights into the effectiveness of the interventions and highlighted the real-world changes experienced by the agricultural communities involved. The feedbacks of the questionnaires can be conceptualised in few points:

- The technical solutions implemented by the project, most of which have been recently released and operational, are all functioning and managed competently. This demonstrates that the beneficiaries are highly aware of the opportunities presented by these solutions.
- The improved irrigation efficiency allows beneficiaries to expand the irrigated areas in their farmland. Although there has not yet been enough time to implement the business growth fully, many beneficiaries plan to extend the cultivation of more profitable crops, as they can rely on reduced risk of poor or failed harvests due to water scarcity.
- It is premature for analysing data on the agricultural entrepreneurs' income since the technical solutions were implemented in the final stage of the project. Certainly, it would be extremely beneficial to conduct an economic analysis in the next 2 or 3 years to adequately assess the changes in the income levels of the farming households. By undertaking such an analysis after an appropriate period has passed, it will allow for a comprehensive examination of the long-term economic effects of the project. This will help in understanding how the implementation of these technical solutions can lead to sustainable growth and prosperity for the farmers, potentially transforming their standard of living and economic stability. Such insights would not only validate the success of the project but also inform the development and implementation of future initiatives.
- Efficient irrigation systems and the treatment plants for saline and wastewaters are significantly enhanced by the installation of photovoltaic systems used for their power supply. For those who use efficient irrigation systems but still need to draw energy from the electrical grid, or worse, from more expensive private sources, the cost of energy can be quite substantial and, in some cases, becomes a limiting factor in production. The decision to implement photovoltaic plants to supply clean energy to the treatment, filtration, and irrigation systems is undoubtedly a winning choice and a lesson learned that should be adopted as a permanent standard. This approach not only reduces the dependency on non-renewable energy sources but also aligns with the principles of sustainable agriculture, providing a blueprint for energy management in rural settings. By harnessing solar power, these systems exemplify a shift towards more environmentally friendly and economically viable farming practices.

ANSWER TO EQ4

What is PROSIM project's likely contribution to the overall objective of ENIC CBC MED funding line?

PROSIM has made a significant impact, as measured by the absolute indicators of the project. Specifically, efficient irrigation systems have been implemented over a total area of 221 hectares, which amounts to half of the total expected coverage for all projects funded by ENI CBC MED. Similarly,

10 efficient irrigation solutions, based on the use of both conventional and non-conventional water sources treated with advanced treatment systems, have been installed in real-work contexts.

However, one of the key components of the project, which was aimed at engaging the private sector, has been less effective due to a variety of reasons that have been previously analysed. The successes in the technological implementation stand in contrast to the challenges encountered in the private sector engagement, highlighting the complexities involved in integrating such innovative practices into established agricultural and business routines, especially when they should be triggered by public investments and incentives.

The extensive adoption of these irrigation systems demonstrates a notable advancement in agricultural technology within the project's scope, reflecting a substantial step toward more sustainable and resource-efficient farming practices. While the less successful institutional engagement provides valuable lessons for future projects, the need for more targeted strategies to effectively involve private stakeholders should be emphasized.

To what extent the project benefited the target beneficiaries, directly or indirectly and a larger number of people in the sector and/or region?

PROSIM has provided substantial benefits to all the farmers reached by the project's actions. Based on the information obtained through consultations with local producers in Tunisia and Jordan, the advantages are tangible and quantifiable and represent a key element for planning, in the coming months, an expansion of the business with a consequent increase in incomes.

3.5 EQ5: Sustainability

What was put in place by the project to ensure the sustainability of the expected project outcomes?

TECHNICAL SUSTAINABILITY

The technical sustainability of the project is anchored in the technical expertise of local partners and the support they have provided during the implementation of the pilot activities. Qualified supervision by technical personnel has enabled farmer associations and those responsible for managing and maintaining the facilities to gain the necessary skills to minimize operational risks. Although the facilities have only recently become operational, the initial phase, which is often the most critical due to the lack of prior experience, has been successfully navigated. All the prerequisites for optimal management and maintenance of the facilities have been observed during field visits conducted in Jordan and Tunisia by local representatives. The key aspects for long term technical sustainability are:

- Local Expertise and Support: The project's technical sustainability is heavily reliant on the skills and ongoing support of local partners. This local involvement is crucial for ensuring that the project is appropriately adapted to the specific context and needs.
- Qualified Supervision and Training: The role of skilled technical personnel in supervising and training the local farmer associations and maintenance staff is emphasized. This training is

critical for ensuring that the local teams can independently manage and reduce operational risks.

- Successful Navigation of Initial Phase: The project has effectively overcome the initial, most challenging phase, marked by a lack of previous experience. This success indicates robust planning and adaptability in the project's execution.
- Evidence of Effective Management: The positive findings from field visits in Jordan and Tunisia suggest that the facilities are being well-managed and maintained. These visits serve as important checks to assess the ongoing viability and success of the project.

Overall, the description underscores the importance of local expertise, effective training, and continuous monitoring in ensuring the technical sustainability of development projects.

FINANCIAL SUSTAINABILITY

The financial sustainability of the project appears robust for several reasons, as detailed in the provided information:

- Efficient Water Management for Increased Productivity: The interventions carried out in the field have ensured efficient water management for irrigation. This efficiency is crucial because it directly leads to increased productive capacity. The availability of both conventional and unconventional water sources has allowed for the expansion of irrigated land in each productive unit. This expansion is significant because it directly correlates to increased agricultural output;
- Tangible Increase in Farmers' Income: With the improved irrigation and increased agricultural land, farmers benefiting from these services will likely experience a tangible increase in their incomes. This boost in revenue is vital for the project's financial sustainability because it means the farmers are more likely to be able to afford future regular and extraordinary maintenance costs of the irrigation systems and of the eventually supplied PV system;
- Use of Photovoltaic Renewable Energy: The incorporation of photovoltaic renewable energy sources in the project has led to a reduction in energy costs associated with operating the irrigation systems. This cost reduction is significant in enhancing the financial sustainability of the project. By lowering operational costs, the project becomes more economically viable in the long term;
- Addressing Maintenance Needs: The increased income for farmers implies an increased capacity to meet future maintenance needs. Financial sustainability is not just about immediate benefits but also ensuring that the project can be maintained and operated effectively over time.

The project's financial sustainability is underpinned by efficient water management leading to increased agricultural productivity, higher income for farmers, and reduced operational costs through the use of renewable energy. These factors collectively contribute to a model where the project is not only self-sustaining but also capable of supporting the ongoing maintenance and operational costs, thereby ensuring its long-term viability.

POLITICAL-INSTITUTIONAL SUSTAINABILITY

Active partners in the PROSIM initiative are qualified stakeholders, capable of ensuring the policy uptake of the proposed solutions. In Jordan, NARC has already undertaken initiatives to replicate the

project's results and has presented these solutions as strategic to other donors. A similar development has occurred in Tunisia, where the Ministry of Agriculture has established a second desalination plant using the same design as the one created for the PROSIM project. Additionally, in Tunisia, there has been interest and visits from other donors looking to fund irrigation efficiency projects, drawing inspiration from the PROSIM experience.

However, as previously mentioned, the absence of two partners has led to significant deficiencies. These deficiencies are evident in terms of replicability, impact on political and programmatic levels, and visibility within European and Mediterranean contexts. The lack of these partners not only affects the direct outcomes of the project but also hampers its broader influence and potential to serve as a model for similar initiatives in the region.

The sustainability of the **network** established for PROSIM implementation is uncertain. As mentioned earlier, the lack of participation from two partners weakened the connections among the remaining partners. Furthermore, the COVID-related difficulties to carry out planned visits, trips, and missions, which would have involved experts and farmers, adversely affected the development of vital interpersonal relationships crucial for the endurance of such international networks. There were some instances of interaction and sporadic communication among experts from different countries; however, these were irregular and relied on individual initiative, proving insufficient to guarantee the network's ongoing activity. The possibility of reinvigorating these relationships exists but likely hinges on the introduction of new funded projects that could rekindle interest in the network by aligning it with common goals.

ANSWER TO EQ5

What was put in place by the project to ensure the sustainability of the expected project outcomes?

The active project consortium has implemented concrete measures to ensure the sustainability of the initiative, focusing on the quality of the installations, the ownership by the end beneficiaries, and the transfer of skills in the management and regular maintenance of the facilities. This approach is central to their working methodology. Additionally, the local partners have quickly internalized the outcomes of PROSIM, presenting them to their network of local stakeholders, starting with institutional donors, as a priority investment in the agricultural sector and in adapting to climate change. This approach highlights several key aspects:

- Emphasis on Quality and Ownership: The consortium prioritizes high-quality installations and ensures that the final beneficiaries have a sense of ownership. This strategy is vital for long-term project success, as it encourages local engagement and commitment;
- Skill Transfer for Sustainability: A key element of the consortium's strategy is to transfer essential skills in managing and maintaining the facilities to local stakeholders. This empowerment ensures that the project's benefits continue beyond the initial implementation phase;
- Local Partners' Engagement with Results: The rapid adoption and promotion of PROSIM's results by local partners underscore the initiative's relevance and effectiveness. By presenting these results to a broader network of stakeholders, the project gains additional support and recognition;
- Alignment with Broader Goals: Positioning the project's outcomes as priorities for investment in the context of agricultural development and climate change adaptation aligns the initiative

with broader, globally relevant objectives. This alignment increases the project's appeal to institutional donors and enhances its potential impact.

Overall, the consortium's approach demonstrates a comprehensive understanding of the key factors required to achieve sustainable and impactful project outcomes.

3.6 EQ6: Added Value

How did the implementation of PROSIM ensure complementarities and generate synergies with other programmes and stakeholders at local, national and European level?

What are the strengths and weaknesses of having the EU implement the project?

PROSIM was designed on the base of the outcomes, evidences and results of a previously implemented project: Adaptation to Climate Change through improved water demand management in irrigated agriculture by introduction of new technologies and best agricultural practices (ACCBAT), implemented by a consortium led by ICU and funded by ENPI CBC MED (European Union) 2007 – 2013 in the period 2012-2015. PROSIM, in particular, adopted the Irrigation Water Quality Index developed to evaluate TWW quality according to national legislations and crop requirements.

A second project inspiring PROSIM is Adaptation to Climate Change of the Mediterranean Agricultural Systems (ACLIMAS), funded under the Programme SWIM Programme funded by the European Union. In this case PROSIM benefitted from the experience gained in the field of technical solutions and practices related to water management and agriculture production (e.g. agro-meteorological stations, other Excel-based irrigation scheduling tool).

Spain

In Spain, a series of integrated and strategic approaches has been adopted to enhance irrigation efficiency in agriculture and to address the challenges posed by climate change. These approaches are manifested through a combination of legislative measures, infrastructure modernization, educational initiatives, and collaboration with various stakeholders.

Legislation at both national and regional levels forms the backbone of Spain's efforts. The Spanish Water Law and the National Irrigation Plan are notable examples, providing guidelines and standards for sustainable water management in agriculture. They set the legal framework for irrigation practices, focusing on water conservation and efficient usage.

Significant investment has been made in modernizing the irrigation infrastructure. This involves transitioning from traditional flood irrigation systems to more efficient methods, such as drip and sprinkler systems. The modernization efforts are not only technologically driven but also supported by governmental incentives. These incentives, often aligned with water pricing strategies, encourage farmers to adopt water-saving technologies.

Various projects, often in collaboration with academic institutions, aim to develop new irrigation technologies and practices. These projects are supported by both national funding and contributions from the European Union, particularly under the Common Agricultural Policy (CAP) and the European Agricultural Fund for Rural Development (EAFRD).

Educational programs are implemented to train farmers in efficient irrigation practices and climate-smart agriculture. These programs are designed to facilitate the practical application of research findings and technological advancements in everyday agricultural practices.

Spain has also been proactive in integrating renewable energy sources, like solar or wind power, into its irrigation systems. This integration not only improves efficiency but also reduces the carbon footprint of irrigation practices.

In terms of climate change adaptation, Spain is focusing on developing drought-resistant crop varieties and implementing soil moisture conservation techniques. This approach is complemented by the use of advanced weather forecasting and climate modeling to optimize irrigation schedules.

The country's approach to water management is also characterized by public-private partnerships. These collaborations between the government and private sector entities are crucial in financing and implementing innovative irrigation solutions, leveraging private investment and expertise.

Furthermore, Spain adopts a river basin management approach, considering the needs of all users in a particular basin. This approach ensures a more holistic and sustainable management of water resources, aligning with both national priorities and European Union directives.

Overall, Spain's multifaceted approach, underpinned by legislative frameworks, financial investments, and a collaborative strategy, reflects a comprehensive effort to address the dual challenges of improving irrigation efficiency and adapting agriculture to the impacts of climate change, hence demonstrating an optimal framework to integrate PROSIM results.

Jordan

In Jordan, a country characterized by scarce water resources, the government and various organizations are actively engaged in enhancing the efficiency of irrigation in agriculture and adapting to the challenges posed by climate change. This effort is being driven through a combination of legislative actions, innovative projects, and comprehensive strategies.

One of the key legislative frameworks guiding these efforts is the Jordanian Water Strategy, which sets out the nation's approach to water management, including the efficient use of water in agriculture. This strategy is supported by specific laws and regulations focusing on water conservation and sustainable agricultural practices. These laws not only establish guidelines for water usage but also encourage the adoption of modern, water-efficient irrigation methods.

Significant financial resources have been allocated towards upgrading and modernizing Jordan's irrigation infrastructure. This involves shifting from traditional irrigation methods to more advanced and water-efficient systems like drip irrigation. The government, often with financial assistance from international donors and organizations, invests in such infrastructure projects, recognizing the critical role of efficient water use in the country's agricultural sustainability.

Moreover, Jordan is engaged in several research and development initiatives aimed at improving irrigation efficiency. These projects, often in collaboration with international research institutions and funded through a mix of national budgets and external grants, focus on developing technologies and practices suited to the region's arid conditions.

Education and capacity building are also key components of Jordan's strategy. Training programs for farmers and agricultural workers are implemented to ensure the widespread adoption of efficient irrigation techniques and practices. These educational initiatives are crucial in promoting sustainable water use and are often supported by government funding.

To address the challenges of climate change, Jordan has been focusing on the development of climate-resilient agricultural practices. This includes exploring drought-resistant crop varieties and implementing soil moisture conservation techniques. These efforts are often part of larger, climate change adaptation programs funded by the government and international entities.

Public-private partnerships play a significant role in Jordan's approach to irrigation efficiency and climate change adaptation in agriculture. These collaborations enable the pooling of resources and expertise, enhancing the effectiveness of irrigation projects.

Additionally, Jordan's approach to water management is characterized by integrated water resources management (IWRM), which considers the various demands on water resources and aims to manage them sustainably.

In summary, Jordan's approach to optimizing irrigation efficiency and adapting its agricultural sector to climate change involves a mix of legislative measures, infrastructure upgrades, research initiatives, educational programs, and collaborative strategies. Backed by both national and international funding, these efforts reflect the country's commitment to addressing its unique environmental challenges and ensuring the sustainability of its agricultural sector and the huge potential of using PROSIM outcomes in the next future.

Tunisia

In Tunisia, a range of ambitious projects has been launched by the national government and local authorities, aiming to enhance irrigation efficiency in agriculture, leverage renewable energy sources for irrigation, and adapt to the challenges posed by climate change. These initiatives reflect a comprehensive approach, blending traditional agricultural practices with modern technology and sustainable methods.

One of the prominent projects involves the modernization of the irrigation infrastructure across various regions. This project is centered on transitioning from conventional irrigation methods to more water-efficient systems, such as drip and sprinkler irrigation. The focus is to maximize water usage efficiency, thereby conserving scarce water resources while ensuring optimal agricultural productivity.

Another significant initiative in Tunisia is the integration of renewable energy, particularly solar energy, into the agricultural sector. This involves the installation of solar-powered irrigation systems, which not only reduces the dependency on fossil fuels but also decreases the cost of irrigation for farmers. These solar-powered systems are particularly beneficial in remote and rural areas, where access to the electrical grid can be limited.

In response to the growing challenges of climate change, Tunisia has also embarked on several climate adaptation projects. These include the development of drought-resistant crop varieties and the implementation of soil and water conservation techniques. These projects are designed to make the agricultural sector more resilient to climate extremes, such as prolonged droughts and unpredictable rainfall patterns.

Furthermore, the Tunisian government has been actively pursuing public-private partnerships to implement these projects. By collaborating with private entities and international organizations, Tunisia is able to pool resources and expertise, enhancing the scope and impact of its initiatives. These partnerships often involve not only direct investment in infrastructure but also in research and development, ensuring that the adopted practices are sustainable and effective in the long term.

Capacity building and training programs for farmers are also a critical component of Tunisia's strategy. These programs aim to educate farmers on efficient irrigation practices, the use of renewable energy

in agriculture, and adaptive techniques to mitigate the impacts of climate change. By empowering farmers with knowledge and skills, these programs ensure the sustainability and effectiveness of the implemented projects.

Overall, Tunisia's approach to enhancing irrigation efficiency, incorporating renewable energy in agriculture, and adapting to climate change involves a blend of infrastructure development, technological innovation, strategic partnerships, and educational initiatives. These efforts not only aim to ensure the sustainability of the agricultural sector but also contribute to the broader goal of environmental conservation and resilience. In such a framework, PROSIM results will be used and amplified through transfer and continuous learning processes.

ANSWER TO EQ6

How did the implementation of PROSIM ensure complementarities and generate synergies with other programmes and stakeholders at local, national and European level?

What are the strengths and weaknesses of having the EU implement the project?

PROSIM is a mature project in the sense that it integrates current technologies to provide new and totally relevant solutions for varied usage settings. These solutions are mostly based on past projects funded by the European Union, including the ENI CBC MED and SWIM programmes, as well as the governments of the PROSIM partner nations. This provides another option for monetization and large transfer to the real productive sector. As a result, PROSIM is not a standalone project, but rather a path of experience acquisition and experimentation that has generated significant outcomes for years.

The role of the European Union as the main donor of the initiative is to make funds available for accompanying actions, in support of physical/structural realizations on the ground and advocacy with institutional representatives in the country. The funds under direct management of local partners are oriented towards specific sectors of intervention and rarely include integrated interventions on: pilot actions on the ground, training, visibility, and policy uptake.

3.7 EQ7: Replicability and Scaling Up

Are PROSIM partners in the position to ensure funding at the national level to ensure the continuity of this project's activities?

How could this consolidate the activities in phase 2?

Spain

Replication and scaling up perspectives

Spain, with its unique geographical and climatic conditions, has a compelling need to invest in enhancing the efficiency of agricultural irrigation and in the utilization of non-conventional water resources to meet the irrigation demand. The nation is characterized by a varied climate with arid and semi-arid regions, particularly in the south, where water scarcity is a critical issue. Traditional irrigation methods in these areas often result in high levels of water loss through evaporation and runoff, which is unsustainable given the limited water availability.

As a leading agricultural producer in Europe, Spain faces the challenge of maintaining agricultural output to meet both domestic and export market demands. This necessitates a more judicious use of water through the adoption of advanced irrigation technologies that ensure water reaches the crops with minimal waste. Technologies like drip irrigation systems and soil moisture sensors are examples that can dramatically improve water use efficiency.

The country's agriculture sector must also contend with the increasing unpredictability of rainfall patterns due to climate change. Droughts have become more frequent and severe, directly affecting water reservoirs and the availability of surface water for irrigation. This volatility drives the need for alternative water sources to ensure a reliable supply for agricultural use.

Utilizing non-conventional water resources, such as treated wastewater, offers a dual benefit. It not only provides an additional water source for irrigation but also helps in mitigating the impacts of wastewater discharge into the environment. Spain's investment in water treatment and reuse infrastructure demonstrates a commitment to sustainability and resource conservation.

Furthermore, the pressure on Spain’s water resources is not solely from agricultural demands but also from the needs of its population and the thriving tourism industry. This multiplicity of demands necessitates a strategic approach to water management where agricultural irrigation must become significantly more efficient to coexist with the country’s other water needs.

In conclusion, Spain's investment in improving irrigation efficiency and employing non-conventional water resources is driven by the necessity to sustain its agricultural productivity while managing the complex challenges posed by water scarcity, climate change, and competing demands for its water resources. This integrated approach towards water management is pivotal for Spain to secure its agricultural future and maintain ecological balance.

Available funding for further consistent investments

In Spain, the quest to enhance agricultural irrigation efficiency and adapt to climate change is supported by a variety of funding mechanisms. These financial supports come from both national and European Union (EU) sources, demonstrating a collaborative effort to address these pressing issues.

- EU Common Agricultural Policy (CAP) funds: Spain receives a significant amount of funding from the CAP, which it utilizes for rural development programs. These funds are often allocated towards improving irrigation infrastructure, adopting water-saving technologies, and training farmers in best practices for water management.
- The European Agricultural Fund for Rural Development (EAFRD): This fund supports projects that improve the resilience of agriculture to climate change, which includes funding irrigation systems that are more water-efficient and that reduce dependency on erratic rainfall.
- The Life Programme: The EU’s funding instrument for the environment and climate action, which includes projects focused on water and irrigation within its remit. This can fund pilot projects that demonstrate new approaches to water management in agriculture.
- National funds from the Spanish Government: Various national initiatives and programs provide subsidies and loans to farmers and agricultural organizations to modernize irrigation systems. The Spanish government may also offer tax incentives for investments in technologies that contribute to water efficiency.
- Regional funds: Spain's autonomous communities have their own funding schemes that are specifically tailored to the unique environmental and agricultural needs of their regions. These funds can be quite substantial and are often used to supplement EU funding, especially in regions that are heavily reliant on agriculture.

- Private financing and Public-Private Partnerships (PPPs): These are increasingly becoming popular for larger, more commercial farming operations. These partnerships can include investments in infrastructure that have both public and private benefits, such as water storage and delivery systems.
- Research and innovation grants: Universities and research institutions in Spain may receive grants for developing innovative technologies in irrigation. These grants can come from national science and innovation programs or from EU research funding streams like Horizon Europe.

Each of these funding mechanisms plays a crucial role in supporting the transition to more efficient and climate-resilient agricultural practices in Spain. They collectively help to implement sophisticated irrigation systems, promote the adoption of best practices, and ensure that the agriculture sector can adapt to and mitigate the effects of climate change.

Jordan

Replication and scaling up perspectives

Jordan is grappling with the critical issues of irrigation efficiency and climate change adaptability in the face of its stark water scarcity and the anticipated impacts of global warming on its predominantly arid climate. The efficiency of irrigation across Jordan is a mosaic of old and new: some regions still rely on traditional methods like flood irrigation, which leads to considerable water wastage, while others have shifted towards more water-conserving techniques such as drip and sprinkler systems. These modern methods have significantly improved efficiency by minimizing evaporation and directing water right to the roots of plants.

As for adapting to the changing climate, Jordan has taken significant strides. The country has been implementing various initiatives and formulating policies aimed at conserving water and enhancing irrigation efficiency. This includes the introduction of water-saving technologies, bolstering the infrastructure for water storage and conveyance, and employing treated wastewater for agricultural purposes. These steps are vital components of Jordan's strategy to adapt to the changing climate.

The government of Jordan, often with the backing of international entities, has launched multiple programs aimed at better management of water resources and preparing the agriculture sector for the anticipated adversities due to climate change. Efforts such as water harvesting and the cultivation of drought-resistant crops are integral to these initiatives.

In the domain of research and development, Jordanian institutions are making headway in developing crops that can withstand heat and water scarcity, and they are exploring practices that conserve soil moisture. The promotion of climate-smart agricultural practices is also a focus of this research.

Despite these proactive measures, Jordan is confronted with immense challenges. The country's water resources are limited, and there is an ever-increasing demand from a growing population. Climate change adds to the severity of these challenges by disrupting rainfall patterns, escalating the occurrence of droughts, and inducing temperature extremes. These climatic shifts place additional strains on Jordan’s agricultural systems.

In sum, while Jordan is making progress with irrigation efficiency and is actively working towards enhancing its resilience against climate change, the road ahead is fraught with substantial challenges. Innovation, coupled with the effective implementation of policies and international support, is paramount for the sustainability and security of Jordan's water and agricultural systems in the light of climatic changes.

Available funding for further consistent investments

In Jordan, which is one of the world's most water-scarce countries, improving the efficiency of irrigation in agriculture and enhancing climate change adaptability are critical concerns. To address these, several financial mechanisms and support programs have been established, often with the aid of international cooperation. Here's an outline of some key initiatives:

- Jordan Renewable Energy and Energy Efficiency Fund (JREEEF): While primarily focused on energy, JREEEF also supports initiatives that integrate energy efficiency into water pumping and distribution for irrigation, which can indirectly improve irrigation efficiency.
- Water Authority of Jordan (WAJ): WAJ has various programs for water-saving in agriculture, including funding mechanisms for modernizing irrigation systems.
- The United States Agency for International Development (USAID): USAID has funded projects in Jordan that aim to improve water management in agriculture, both to increase efficiency and to adapt to climate change.
- Global Environment Facility (GEF): Through various projects, the GEF has provided financial support for enhancing water efficiency and addressing the impacts of climate change in Jordan's agricultural sector.
- European Bank for Reconstruction and Development (EBRD): EBRD offers funding and support for projects that improve the resilience of the agricultural sector against climate change, which includes efficient irrigation practices.
- Climate Investment Funds (CIF): The CIF, through its Pilot Program for Climate Resilience in Jordan, has focused on improving the country's water sector, including irrigation.
- Green Climate Fund (GCF): GCF invests in projects that foster climate resilience, which can encompass improved irrigation and water use efficiency in agriculture.
- National Adaptation Plans (NAPs): Funded through various global climate funds and international aid, NAPs include components for adapting agricultural practices, such as irrigation, to the realities of climate change.
- Private Sector Engagement: Public-private partnerships are also a key avenue for financing irrigation efficiency, where private investment is leveraged for modernizing infrastructure and practices in agriculture.
- Microfinancing for Farmers: Small-scale financing programs are available for individual farmers or cooperatives to adopt water-saving technologies and practices.

These mechanisms typically provide a mix of grants, loans, and technical assistance to support farmers and governmental bodies in implementing efficient water management and irrigation systems, improving Jordan's agricultural sustainability and resilience to climate change.

Tunisia

Replication and scaling up perspectives

Tunisia faces pressing reasons to enhance its agricultural irrigation efficiency and adapt to climate change. These imperatives stem from a combination of environmental, economic, and social factors.

Firstly, the country is experiencing increasing water scarcity, a situation exacerbated by climate change. As temperatures rise and precipitation patterns become more erratic, the availability of water, especially for agriculture which is a major consumer of water resources, becomes critical. Improving irrigation efficiency is therefore essential to ensure that the limited water resources are used as effectively as possible.

Secondly, the agricultural sector in Tunisia is a significant contributor to the national economy and livelihoods. A large portion of the population relies on agriculture for employment and income.

However, the sector is vulnerable to climate variability and water scarcity. Enhancing irrigation efficiency can lead to more stable agricultural production, ensuring food security and stable incomes for those dependent on agriculture.

Moreover, there are environmental implications. Inefficient irrigation practices can lead to the degradation of land and water resources, including salinization and depletion of aquifers. By adopting more efficient irrigation methods, Tunisia can mitigate these environmental impacts, preserving its natural resources for future generations.

Additionally, there's the need for resilience against climate change. As global temperatures continue to rise, the frequency and severity of droughts and extreme weather events are likely to increase. By improving its irrigation systems and adapting its agricultural practices, Tunisia can better withstand these changes, safeguarding its agricultural output and rural communities.

Lastly, the global push towards sustainability and international commitments to combat climate change also drive Tunisia's need to enhance its agricultural practices. By aligning its agricultural sector with sustainable practices, including efficient water use and climate-smart agriculture, Tunisia not only contributes to global environmental efforts but also positions itself favourably in the international community.

In summary, the combination of water scarcity, economic dependence on agriculture, environmental concerns, the need for climate resilience, and alignment with global sustainability trends makes it imperative for Tunisia to improve its agricultural irrigation efficiency and adapt to the changing climate.

Available funding for further consistent investments

In Tunisia, the enhancement of irrigation efficiency in agriculture and the adaptation to climate change are supported through various financing mechanisms. These mechanisms aim to secure water resources, improve agricultural productivity, and build resilience against the adverse effects of climate change.

- The Green Climate Fund (GCF): Tunisia has accessed funding from the GCF for projects aimed at enhancing the adaptive capacity of the agricultural sector to climate change. This includes investments in efficient irrigation systems and sustainable water management practices.
- Global Environment Facility (GEF): The GEF provides grants to projects that address environmental issues with global significance, including climate change. Tunisia has benefited from GEF projects aimed at promoting water efficiency and supporting sustainable agriculture.
- Adaptation Fund: This fund finances projects that help vulnerable communities in developing countries adapt to climate change. In Tunisia, such funding may be directed toward modernizing irrigation infrastructure to cope with increasing water scarcity.
- African Development Bank (AfDB): The AfDB offers loans and grants for projects that improve water management and agricultural practices, which includes funding for the development of efficient irrigation systems that can adapt to varying climatic conditions.
- Bilateral cooperation and development aid: Tunisia receives aid from various countries that support its efforts to modernize its agricultural sector. This aid can include technical assistance and financial support for water-saving irrigation technologies.
- National Investment Plans: The Tunisian government has its own investment plans and initiatives that include budget allocations for agriculture and water resource management. These plans focus on upgrading irrigation infrastructure and promoting efficient water use in the agricultural sector.

- Public-Private Partnerships (PPPs): Tunisia is increasingly engaging in PPPs to mobilize private sector expertise and investment in the agricultural sector. These partnerships may involve the development of infrastructure for irrigation and the adoption of advanced technologies for better water management.
- Local financial institutions: Banks and other financial institutions in Tunisia offer loans and credit facilities to farmers and agricultural businesses to invest in modern irrigation systems and technologies that can reduce water consumption and enhance productivity.

Through these diverse funding sources, Tunisia is working to ensure that its agricultural sector becomes more efficient in water use and more resilient to the impacts of climate change. These efforts are crucial for the sustainability of agriculture in the context of Tunisia's water-scarce environment.

ANSWER TO EQ7

Are PROSIM partners in the position to ensure funding at the national level to ensure the continuity of this project's activities?

In countries that have implemented project activities, there exists a broad and sophisticated range of financing schemes. This diversity not only provides substantial opportunities for the continuation of existing initiatives but also supports the replication of these actions in different regions of the country and in similar contexts. Such financial frameworks are instrumental in sustaining the momentum of projects and expanding their impact across various areas.

How could this consolidate the activities in phase 2?

The partners of PROSIM are highly aware of the importance of increasing investments to enhance the efficiency of agricultural irrigation and to reduce the energy demand of pumping and distribution systems, especially those powered by fossil fuels. This awareness, coupled with the ability to channel the available financial resources in the countries, is crucial for consolidating the actions implemented for the project. It also plays a central role in spreading good practices and knowledge that have emerged from these efforts. This synergy of awareness, investment, and resource allocation is key to the success and impact of the project's initiatives.

3.8 EQ8: Project capacity to deal with risks/prevention and adaptation

How did you modify the action plan to address unforeseen risks?

What solutions did you implement to navigate challenges during the project's execution?

PROSIM faced various difficulties in carrying out the activities, which brought to light just as many risks both in terms of project consortium (internal) and those belonging to the broader work context (external).

Internal

- The first aspect concerns the aforementioned problem of the non-participation of the Italian and Lebanese partners. The risk associated with this constraint was the loss of cohesion and determination of the entire partnership. Fortunately, the remaining four partners managed to develop an alternative program and to replace the initial Lebanese partner with a second entity, certainly determined, motivated, and qualified to carry forward the activities in the

country: unfortunately, the timing did not allow for the real implementation of activities in Lebanon. As for the Sicilian Region, the disappearance of the partner, on all levels of communication, did not even allow for the initiation of the replacement procedure nor the modification of the project budget in favour of the active partners, resulting in both managerial and financial damage.

- Some partners have mentioned the difficulties generated by the rapid turnover of 5 project managers from ICU over the course of the activity implementation. The risk associated with this dynamic was that project leadership would lose credibility in some way; however, given the competencies expressed by the project managers, the succession of a significant number of coordinators resulted in limited management delays and did not undermine the strength of the active project consortium.
- The third point regarding internal consortium issues is the difficulty faced by local partners in adopting the decision support system developed by the Spanish partner, due to limitations related to the procedures of public bodies in the involved countries. This issue precluded the consortium from using the same decision support system aimed at the optimum management of conventional and unconventional water resources, potentially decreasing the benefits of collaborative cooperation. Fortunately, the companies responsible for constructing the facilities later provided technical partners with access to simple yet effective decision support and data analysis systems. This allowed for the full operation of the systems, but not the exchange of data through a common platform. This risk, which later became an operational problem, could have been avoided with a prior analysis of the operational contexts of the involved entities and identification of the constraint to use services from companies registered within the country, which would have led to a revision of the project's action plan. Therefore, it is suggested that in the future, an action plan detailed with local partners should be shared to analyse the actual feasibility of the proposed actions.

External

- The challenges posed by the COVID-19 pandemic, with restrictions on movement, travel, and meetings, put the planned exchange activities at risk. In this context, the adoption of remote working methods ensured a functional and cost-effective way of working, which did not overly impact the success of PROSIM.
- As a consequence of the COVID-19 pandemic, the subsequent economic crisis and the rising market prices for planned equipment posed a significant risk of not being able to implement the activities without reducing their scale. Despite these challenges, the consortium succeeded in achieving a greater number of outputs, irrigating more than twice the number of hectares compared to the initial commitment. This concretely demonstrates the commitment and motivation of the PROSIM partners to maximize the benefits for agricultural producers and their ability to embrace and overcome challenges.

ANSWER TO EQ8

How did you modify the action plan to address unforeseen risks?

The action plan should have been amended to ensure the effective use of available funds for priority actions. Unfortunately, this was not achieved due to the non-participation of the Sicilian Region and the Lebanese Ministry of Agriculture, which led to their allocated funds being locked without actual utilization. The delayed replacement of the Lebanese partner did not resolve the issue due to the impending completion of the project. However, the request for a procedure of amendment presented by ICU for redesigning the actions for the 4 active partners, was rejected by the Managing Authority and never initiated. Instead, financial resources were effectively reallocated to accommodate the

travel restrictions imposed by the COVID-19 pandemic, allowing for the implementation of a greater number of field installations.

What solutions did you implement to navigate challenges during the project's execution?

The project consortium has managed external risks well, integrating risk reduction measures into the daily implementation of activities. However, in terms of internal risks, the complete absence of the Italian and Lebanese partners was not addressed with the same determination and effectiveness. Given the total lack of commitment to the project and even communication with the LB and other project partners, the LB could have pursued the termination of a partner's participation in the project as stipulated between the LB and partners in the Grant Agreement under paragraph 11.3 and reported below:

11.3 Termination of a partner's participation in the project: *In duly justified cases, the participation of a partner in the project may be also terminated by the LB acting on behalf of the partnership. To this purpose, the LB shall communicate to the MA the reasons for the termination of its participation and the date on which the termination shall take effect, as well as a proposal on the reallocation of the tasks of the partner whose participation is terminated, or on its possible replacement. The proposal shall be sent at least 30 days before the termination is due to take effect. If the MA agrees, upon approval of the Joint Monitoring Committee, the Contract shall be amended according to Article 9.*

4. Conclusions

PROSIM addresses a key priority in adapting agriculture to climate change: optimizing irrigation, enhancing its efficiency, and reducing competition for water with other human needs.

Its approach is based on: i) extensive development of pilot plants in real-world production contexts, using technologies that increase irrigation efficiency and allow the use of saline and wastewater to relieve pressure on water resources; ii) sharing smart approaches to irrigation optimisation, based on decision support systems and data-driven planning; and iii) involving local governments and prioritising investments to boost agricultural efficiency.

PROSIM is a project that combines novel ideas with established methods and technologies. It is mature in the manner it leverages proven, tested solutions, which are frequently established under prior projects sponsored by ENI CBC MED (ACCBAT) or national funds of partner nations, but it is also innovative in its pursuit of maximum benefits, minimal environmental impacts, and financial sustainability.

Unfortunately, not all partners demonstrated the same level of commitment, limiting the project's international breadth and future political and institutional consequences, particularly in terms of potential replication in the countries initially identified. Because of the absence of the Sicilian Region and the Lebanese Ministry of Agriculture, these territories were barred from reaping the benefits of PROSIM, and the late identification of a second Lebanese partner could not compensate due to the project's nearing closure. As a result, not all financial resources were spent, and consortium management suffered as a result.

Nonetheless, the project achieved significant field results, establishing facilities that ensure efficient, safe, and environmentally friendly irrigation for 221 hectares of agricultural land in Tunisia, Jordan, and Spain. For many farming families, these installations have drastically altered their potential for productivity. The photovoltaic-powered desalination facilities had the greatest impact, significantly enhancing local production assets and affecting farmers' medium-to long-term plans and investments. It's crucial to emphasize the importance of consolidating the water-energy-food nexus approach as a

model for ensuring efficient supply of quality irrigation water and renewable energy for water production and transmission, thereby ensuring food security, robust market access, and long-term agricultural development.

5. Recommendations

As described in the replicability section, financing channels for replicating the technical solutions provided by PROSIM project are numerous and diversified in Tunisia and Jordan. These channels can cover not only the costs of field installations, but also all of the associated operations required for integrating solutions into local contexts and assuring optimal facility management and maintenance.

Therefore, systematically collecting field data is crucial: this data can further reinforce the validity of the proposed solutions from both a technical perspective—in terms of efficiency, durability, and effectiveness—and an economic-financial standpoint, by measuring over time how the introduced solutions enhance and stabilize the incomes of farming families and farmers' associations.

Collecting and analysing market data will enable for the correct calculation of the project's return on investment time. This will provide social parties with a strong argument for negotiations with institutional and political entities to obtain incentives, benefits, and technical assistance essential for the effective replication of these solutions in similar contexts.

PROSIM's approach, which integrates photovoltaic renewable energies with desalination facilities, makes it easier to conceptualise and transfer a work model based on the water-energy-food nexus. This approach is useful in directing rural development strategy towards investments in infrastructure that not only enable efficient irrigation with otherwise unusable water sources (such as salty or wastewater), but also consistently use renewable energies. When energy is produced by standalone systems, these can ensure the energy independence of the facilities from power interruptions, and secondly, help contain costs in an era where energy is becoming an increasingly expensive yet essential commodity. Additionally, this approach aims to keep production costs low along with minimizing environmental impacts. PROSIM's experience underscores that meeting primary needs through innovative but sustainable solutions fosters processes of structural and sustainable growth. This demonstrates the feasibility and effectiveness of such integrated approaches in addressing complex challenges in rural development.

In the end, it seems reasonable to suggest a later analysis of the impacts on farmers' ability to produce during a time when these will be noticeable. The majority of the systems have just recently released, making it impossible to accurately estimate how relevant the solutions are for the recipients' incomes at the time of the external evaluation. Given the significance of this data for informing local and international policies, a thorough measurement in two or three years will undoubtedly yield valuable insights.

Annexes

Annex 1. List of analyzed documents

- Call for proposals for standard projects - ENI CBC Mediterranean Sea Basin Programme 2014-2020.
- Current state of Mediterranean water resources and future trends under climatic and anthropogenic changes; Marianne Milano, Denis Ruelland, Sara Fernandez, Alain Dezetter, Julie Fabre, EricServat, Jean-Marie Fritsch, Sandra Ardoin-Bardin and Gaëlle Thivet; 2016.
- Exploring Irrigation and Water Supply Technologies for Smallholder Farmers in the Mediterranean Region; Pereira, D.; Leitao, J.C.C.; Gaspar, P.D.; Fael, C.; Falorca, I.; Khairy, W.;Wahid, N.; El Yousfi, H.; Bouazzama, B.; Siering, J.; et al.. Sustainability 2023, 15, 6875. https://doi.org/10.3390/su15086875
- Improvement of irrigation efficiency; https://climate-adapt.eea.europa.eu/en/metadata/adaptation-options/improvement-of-irrigation-efficiency
- Indicative monitoring and evaluation plan - ENI CBC Mediterranean Sea Basin Programme 2014-2020 – Annex 2.
- Joint Operating Programme (JOP) - ENI Mediterranean Sea Basin CBC Programme 2014-2020.
- Mediterranean irrigation under climate change: more efficient irrigation needed to compensate for increases in irrigation water requirements; M. Fader, S. Shi, W. von Bloh, A. Bondeau, and W. Cramer; March 03, 2016.
- PROSIM project proposal documents (narrative and financial) and progress reports.
- Strategic Environmental Assessment - screening procedure - Mediterranean Sea Basin Programme, 2014 – 2020.
- Water and energy footprint of irrigated agriculture in the Mediterranean region; A. Daccache, J. S. Ciurana, J. A. Rodriguez Diaz and J. W. Knox. 15 December 2014.

Annex 2. Photographs

(taken by Ms Dhouha Attafi during field survey)

Photograph 1. Drip irrigation in a greenhous in Tunisia

Photograph 2. Ms Dhouha Attafi during farmers' interview

Photograph 3. Drip Irrigation systems, assembling joint

Photograph 4. Owner of the greenhouse with drip irrigation system

Photograph 5. Desalination plants in Tunisia, control panel

Photograph 6. Weather station used to inform the irrigation procedures based on real needs

Photograph 7. Water storage tank for desalinated water.