AG-WaMED

AG-WaMED | Advancing non conventional water management for innovative climate-resilient water governance in the Mediterranean Area

Grant Agreement Number: Egypt STDF 45878

Deliverable 2.2.2

Final Living Labs Activity Report

Partnership for Research and Innovation in the Mediterranean Area Programme (PRIMA)
The AG-WaMED project has received funding from the PRIMA Programme, an Art.185 initiative supported and funded under Horizon 2020, the European Union's Framework Programme for Research and Innovation. This project also received funding from the Italian Ministry of University and Research (MUR), Science and Technological Development Fund - STDF (Egypt), Ministry of Higher Education and Scientific Research - MESRS (Tunisia), Hellenic Republic, Ministry of Development and Investments (Greece), Agencia Estatal de Investigación (AEI) (Spain) and General Directorate for scientific research and technological development - DGRSDT (Algeria)

This project is part of the PRIMA programme supported by the European Union. Grant Agreement Number No. [Italy: 391 del 20/10/2022, Egypt: 45878, Tunisia: 0005874-004-18-2022-3, Geece: ΓΓΡ21-0474657, Spain: PCI2022-132929, Algeria: N° 04/PRIMA_section 2/2021]

Funded by the European Union

Deliverable Identification

Deliverable No and Title	**D2.2.2 - Final Living Labs activity report**		
Grant Agreement No	Egypt STDF 45878	**Acronym**	AG-WaMED
Project Full title	Advancing non conventional water management for innovative climate-resilient water governance in the Mediterranean Area		
Funding Instrument	Partnership for Research and Innovation in the Mediterranean Area Programme (PRIMA)		
Call	PRIMA CALL SECTION 2 2021 – MULTI-TOPIC		
Work-Package No and Title	Work Package 2: Living Labs for innovative climate-resilient water governance		
WP- Main Beneficiary	ALEXU		
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Task No and Title	Task 2.2 – Final Living Labs Activity Report		
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Status	Draft ☐ Final ☒		
Dissemination Level	Internal ☐ Public ☒		
Reviewed by			
Abstract	The present report is produced as deliverable for task 2.2 of the AG-WaMED project, “Stakeholders analysis and Living Labs creation”. It summarises the activities carried out in the 4 project’s Living Labs (LL), starting from Living Lab creation using RRI approach and world cafe participatory method, along with stakeholder mapping using QH model. Then, results from the four participatory workshops in each LL are presented, and conclusions on the activities are drawn.		
Key words			
DOCUMENT HISTORY			
Planned Release Date	30 June 2025 Rescheduled to 15 August 2025	**Actual Release Date**	29 July 2025
Version	V1	**Released Version No**	V1

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1. Executive Summary

Living Lab Methodology is based on the principles of Responsible Research and Innovation (RRI) method that involves all parties in identifying how research and innovation can benefit society. RRI shares similarities with other innovation concepts, such as transitioning from systems to ecosystems. and other participatory approaches. This is the **first task (T2.1)** associated with **deliverable D2.1.1** in Work Package 2 (Living Labs for innovative climate-resilient water governance, led by **Alexandria University, (ALEXU)**. The Methodology follows the quintuple helix (QH) model to establish a Living Labs (LL) for innovative climate-resilient water governance, based on Stakeholders analysis and mapping, and characterizing the community through analysing the Strengths, Weaknesses, Opportunities, and Threats (SWOT) and Political, Economic, Social, Technological, Legal, Environmental, Ethical, and Citizen-Science-Government-Stakeholder interactions (PESTLEEC) analyses, as well as extracting information from the community through World Café participatory approach and community canvas.

Following the Living Lab Methodology, in each LL a stakeholder mapping and a stakeholder analysis activity has been carried out, which represent the **second task (T2.2)** associated with **deliverable D2.2.1** in work package 2. To do that, ALEXU organized 3-hour participatory introductory session for all the partners back-to-back with the first AG-WaMED project meeting. Following this introductory session, the LL Leaders received by ALEXU an extra 3 training sessions of a total 4 hours for an in-depth introduction to the LL Methodology, as well as to the participatory methods that will be used. Starting from the initial list of stakeholders, key actors representing science, policy, industry and agriculture, and society (QH model) will be mapped. For each LL, the leading partner organizations (UNIFI for Italy, IRA and UTEBESSA for Tunisia / Algeria, UPM for Spain and ALEXU for Egypt) identified, contacted, and mobilized, several key people in the formation of the LLs, which had a gender balance and age-balance, as well as different levels of seniority to co-create socially inclusive policies. A forming workshop organized involving participatory exercises to engage the participants and to create trust among them. Further activities, coordinated with communication and exploitation tasks, aimed at constantly increasing the size of the LL itself.

The third task (T2.3) is concerned with participatory modelling and scenario analysis led by University of Florence (UNIFI). This task is subdivided into 2 sub-tasks, namely **sub-task (T2.3.1) Data collection and scenario analysis** studied the adequacy of the data required for the analysis of modelled scenarios. The partners involved in each LL, together with the available stakeholders, selected and prepared existing data, including hydrological information (surface water bodies, reservoir data, aquifers data, water quality data), agricultural data (resources needed in term of fertilizers, water and energy for crop production), energy data (including production sources and consumption) and socio-economic information (including measures and their effects) to be used with models suggested by the 4 LL namely, SWAT/SWAT+ used by the Egyptian LL, SWAT-WH used by the Algerian/Tunisian transboundary LL, WAPA applied by the Spanish LL, and WATNEEDS utilized by the Italian LL. The results of this activity are reported in deliverable D2.3.1.1. about data required by each model is illustrated in appendix 3-0. **The second sub-task (T2.3.2), Participatory modelling,** associated with modelling suite developed in WP3 was

applied in each LL, starting from the database and the scenarios defined in sub-task 2.3.1, and the relative governance challenges. As a first step in, a calibration phase took place in order to jointly reliable simulations on the present state.
For each LL, a consecutive modelling procedure was carried out: the results of the first modelling, evaluated through the socio-economic and environmental analysis methodology defined in T3.2 (MOP) (D3.2.1). It was discussed in step (i) represented by deliverable D2.3.2.1 and step (ii) represented by deliverable D2.3.2.2 and repeated in an in-person meeting after each to further define water allocation scenarios to be tested in a second step by AG-WaMED project team. In a similar way, step (iii) represented by deliverable D2.3.2.3. The validated optimal plans were used for a financial CBA that demonstrated the usefulness of non-conventional water (NCW) use for economic activities at the catchment scale.

2. Introduction

Severe water scarcity is increasingly affecting different countries in the Mediterranean area, and future climate change projections point to a fast acceleration of the phenomenon. It is expected that all water-demanding sectors, most of which crucial for Northern and Southern Mediterranean economies, will be negatively impacted (MedECC, 2020). In this framework, allocating available water in an equitable way and dealing with consequent water-related conflicts is a challenge that needs to be urgently addressed. A promising option is to experiment and develop the use of Non Conventional Waters (NCW) (wastewater, runoff water harvesting, desalination) and this implies to consider those waters into innovative and adaptive water governance schemes (Qadir et al., 2007; UN-Water, 2020).

The project Advancing non conventional water management for innovative climate-resilient water governance in the Mediterranean Area (AG-WaMED) aims at providing innovative, evidence-based participatory management solutions to water scarcity governance that can be scaled at the Mediterranean level. The project will reach its envisioned objectives through a transdisciplinary approach, integrating the state of the art of land, water and agronomic modelling to support evidence-based water management in four Living Labs (LLs) located in Mediterranean watersheds (including a transboundary case).

A participatory modelling suite will allow the co-definition and co-evaluation of different water allocation scenarios for improving water governance in each LL, taking into account the decisive impact of NCW use to ensure climate-resilient strategies under a climate change vision. A flexible yet comprehensive socio-economic approach procedure will enable the evaluation of such scenarios and will trigger a feedback mechanism to generate an adaptive learning environment in the AG-WaMED LLs. The full process will inform new water allocation models and will produce an innovative framework for improving water governance and for reducing conflicts in water-stressed contexts of the Mediterranean

The project was carried out in four Mediterranean living labs (LLs):

1. Val d'Orcia, Italy,
2. Wadi El Kebir watershed, Algeria/Tunisia,
3. Wadi Naghamish-Alkhair, Egypt,
4. Campo de Cartagena, Spain.

Figure 1 shows the outline of the 4 watersheds where the project is implemented.

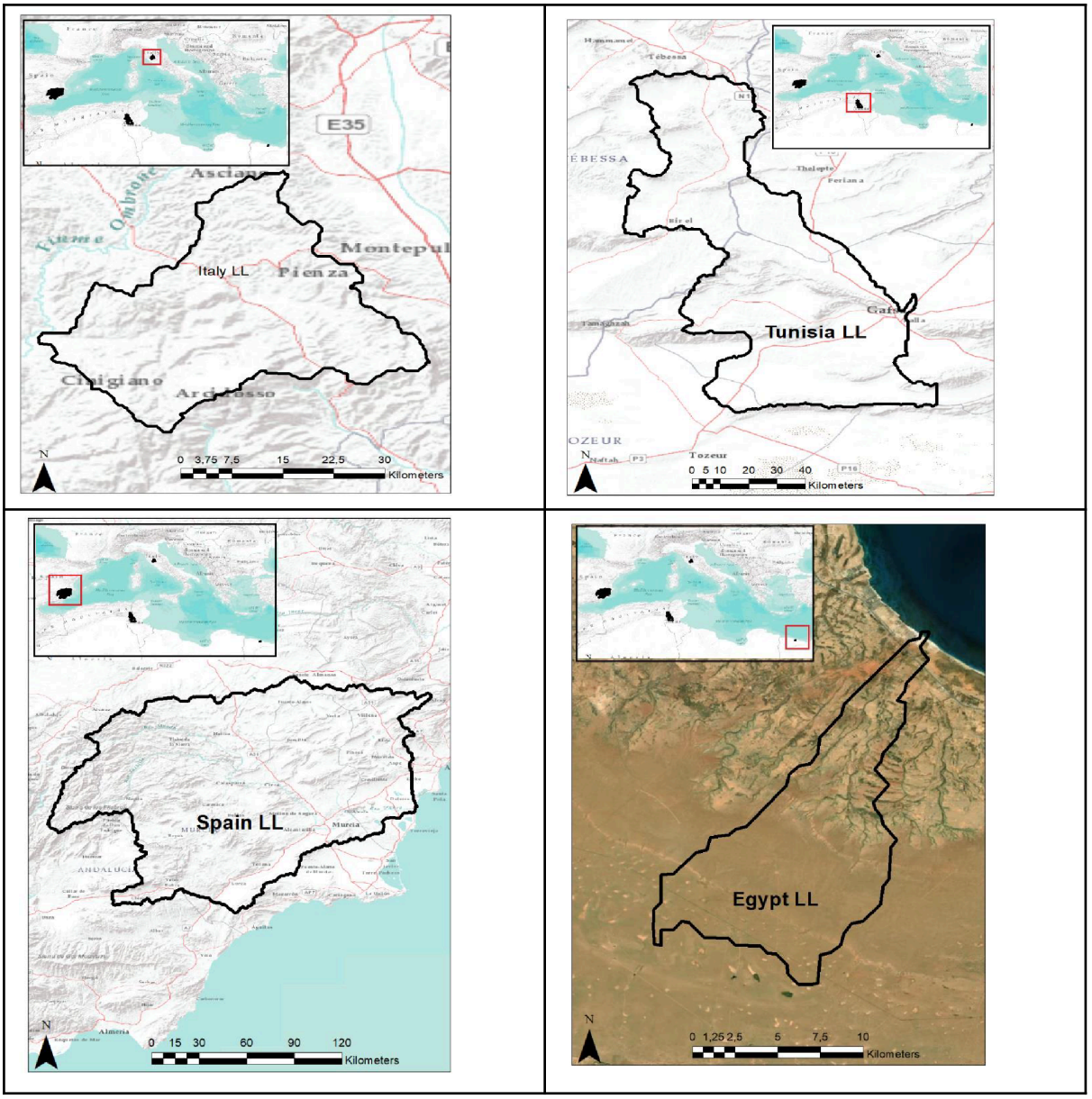

Figure 1: Outline of the 4 watersheds where the project is implemented.

The project aims to provide innovative, evidence-based participatory management solutions for water scarcity governance. It used a participatory modelling suite to co-define and co-evaluate water allocation scenarios, considering climate-resilient strategies. The process will inform new water allocation models and reduce conflicts in water-stressed Mediterranean contexts.

3. Description of Work Package 2 Deliverables

D2.1.1 Living Labs Methodology (M6)
The deliverable describes the living Lab Methodology, which is based on the principles of Responsible Research and Innovation, and participatory approaches. The document indicates the quintuple helix model and how to establish a Living Labs for innovative climate-resilient water governance, based on Stakeholders analysis and mapping, and characterizing the community through SWOT and PESTLEEC analyses, as well as extracting information from the community through World Café participatory approach using RRI approach.

The Responsible Research and Innovation (RRI) is a collaborative process involving researchers, scientists, and policymakers to create sustainable solutions, services, and products. The RRI Roadmap©™[1] aims to involve diverse stakeholders, improve policymaking abilities, base decisions on scientific results, and make research and innovation relevant for society. It is suitable for organizations addressing societal issues holistically, research and technology organizations, enterprises, government organizations, policy-making organizations, project coordinators, and research and innovation funding organizations. The project focuses on advancing participatory governance for sustainable water allocation in the Mediterranean area, focusing on equitable water governance models, innovative procedures, and promoting the project approach through communication, dissemination, and exploitation.

Figure 2: Components of RRI.

The Concept of Multi-helix Systems: The Smart Quintuple Helix Innovation Systems emphasize environmental and ecological sensitivity in driving knowledge, knowledge

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creation, and innovation, leading to sustainable and sustainable economic growth as shown in figure 3.

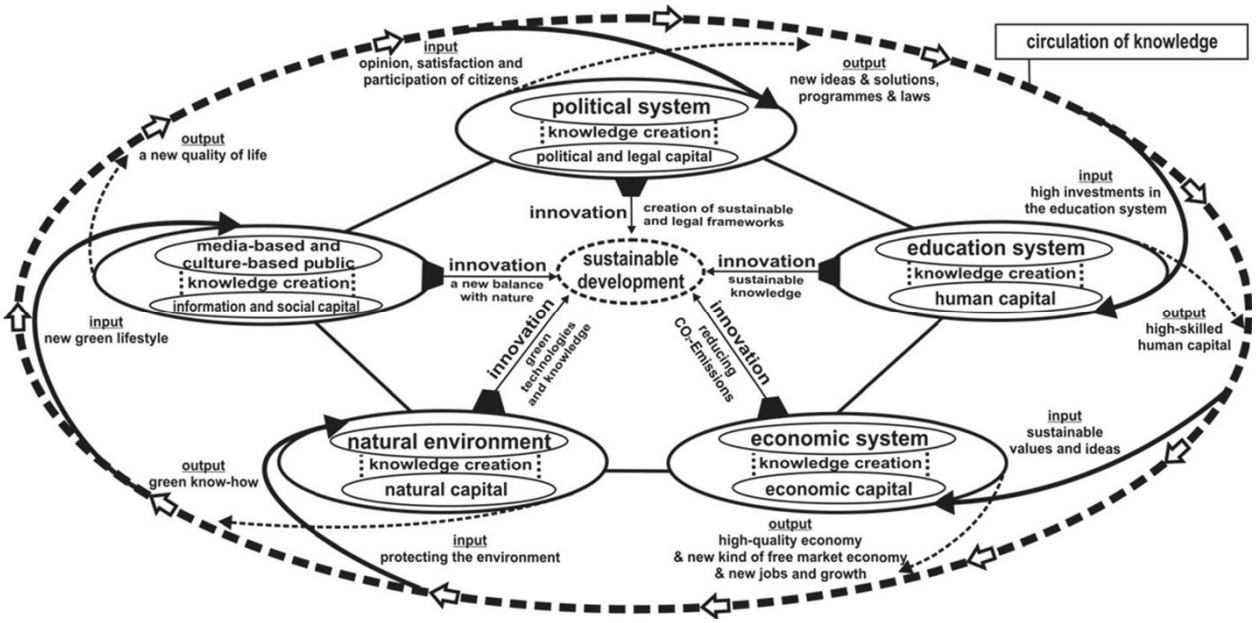

Figure 3: The Quintuple Helix model and its function (functions). Modified from Etzkowitz and Leydesdorff (2000), on Carayannis and Campbell (2006, 2009, 2010), and on Barth (2011).

RRI and Stakeholders: The Perspective of the Helices: The Quintuple Helix model of innovation, which incorporates public or civil society, is more suitable for RRI and citizen participation (table 1).

Table 1: Actors and their roles in RRI.

Actors in Quintuple helix	Research into role of Actor in RRI	Actor defined as in RRI literature	Roles of actor in RRI	Definition of 'Responsible' from this perspective	Social innovations are from this perspective
Universities and research institutions	e.g., Stilgoe, Owen, & Macnaghten, (2013); Carrier and Gartzlaff (2020); Christensen et al. (2020); Nicholls et al. (2015)	Academy University Research centers	Aligning research with societal needs, More emphasis on internal affairs and focus on formalizing this effort in strategies and internal guidelines	Fulfilling societal needs through research and innovation or responsiveness to societal needs	Innovations are not linear processes but complex processes with several loops
Industries and business	e.g., Martinuzzi et al. (2018); Dreyer et al. (2017); Chatfield et al. (2017) Christensen et al. (2020); Nicholls et al. (2015)	Private sector Supply chain Capital Business Support Private sector	Competitiveness in the market, maintain public trust through innovation – more internally focused and more likely to formalize this effort in strategies And internal guidelines	Finding sustainable solutions that are environmentally friendly, ethically acceptable, socially valuable, processes of research and innovation	As offering a model for new roles of business in society
People	e.g., Owen et al. (2013); von Schomberg and Blok (2019); Burget et al. (2017); de Saille (2015); Chatfield et al. (2017); Christensen et al. (2020); Nicholls et al. (2015)	Civil society/ Citizens/user participation NGOs, social media, citizens' initiatives, crowd funding	– continuous engagement and a two-way communication between experts, stakeholders, and citizens. – primarily outward oriented; collaborating with others and hosting science events	Cocreating the future with the public and civil society organizations and deliberate on issues of science and technology	Citizen engagement is widely recognized as a key component to many social innovations, especially within the public sector.
Public policy or agents	e.g., de Saille (2015); EC (2009); Sturgis and Nick (2004); Christensen et al. (2020); Nicholls et al. (2015)	Public authorities Policies, funding, regulation, norms, permissions	Creating new social contract' establishing a 'shared responsibility between science, policy and society', Use funding-specific tools to incentivise responsible practices	Stakeholders should be involved to incorporate relevant ethical and societal aspects into innovation practices and to achieve desirable goals	Social innovation is associated with traditions of welfare reform based on increased efficiency and effectiveness,

Actors in Quintuple helix	Research into role of Actor in RRI	Actor defined as in RRI literature	Roles of actor in RRI	Definition of 'Responsible' from this perspective	Social innovations are from this perspective
Natural Environment	Barth (2011)	Natural Capital New knowledge about nature and a green lifestyle for the media-based and culture-based public.	Communicates to nature that it will be increasingly protected, as lesser exploitation, destruction, contamination, and wastefulness (extravagance) is taking place. Regenerate itself and strengthen its natural capital, and humanity can also learn again and furthermore from nature. (i.e., knowledge creation). This capital should provide incentives on how a green lifestyle can be implemented in a simple, affordable, and conscious way (i.e., knowledge creation). This knowledge creation promotes the necessary social capital of the culture-based public, on which a society depends for sustainable development.	live in balance with nature live a green lifestyle. the media-based public receives a new and crucial function (i.e., information capital), which is spreading through the media the information about a new green consciousness and the new human lifestyle. This social capital, therefore, must pass on information about wishes,needs, problems, or satisfaction of citizens as output into politics or the political system. The know-how output of the media-based and culture-based public serves thereby as new input for the helix of the political system.	Develop regenerative technologies. Use the available, finite resources sustainably and in a sensitive approach. New green knowhow for humans which can provide more environmental protection and a superior quality of life to people. The development of new environmental-friendly technologies can reduce the CO2 emissions more effectively and can aid in diminishing climate change.

Defining 'Responsible' in Responsible Research and Innovation: The Case of Quadruple Helix Innovation in the Energy Sector in the Tampere Region, Yohannes Mehari, Elias Pekkola, Jonna Hjelt, Yuzhuo Cai, Jari Stenvall & Francisco Javier Ortega-Colomer, January 2022

SWOT analysis is a management tool that helps organizations identify strengths, weaknesses, opportunities, and threats. SWOT analysis is essential for job holders, business units, and companies, and is required during various stages of life, such as product

launches, job changes, decision making, personal development planning, and product evaluation (figure 4) .

Figure 4:Components SWOT analysis.

Figure 5: Components PSETLEEC analysis.

PESTLEEC Analysis is a framework that helps organizations monitor external environment factors, identifying threats, weaknesses, strengths, and opportunities. It includes **Political, Economic, Social, Technological, Legal, Environmental, Ethical, and Citizen-Science-Government-Stakeholder interactions**, as shown in Figure 5.

The Community Canvas: The Community Canvas is a framework for organizations to build and enhance communities. It comprises three sections: Identity, Experience, and Structure (Figure 6). The Identity section explores beliefs, the Experience section explores members' experiences, and the Structure section emphasizes operational aspects for long-term stability.

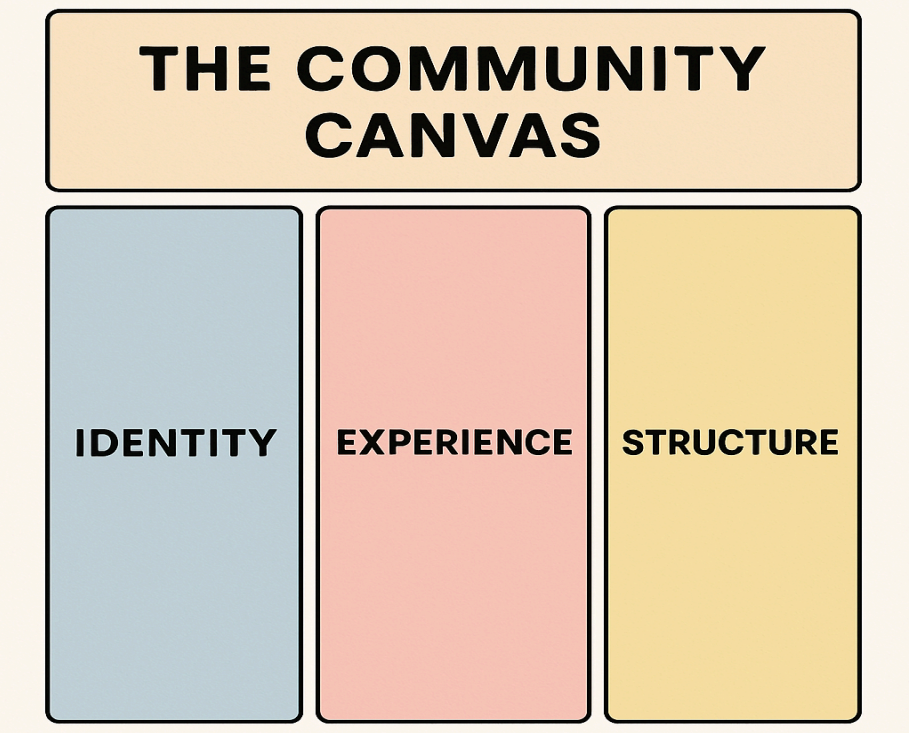

Figure 6:Sections of community Canvas SWOT analysis.

Participatory Approaches used in the RRI Roadmap: The RRI Roadmap employs two participatory approaches: the World Café and the **World Café** Method (Figure 7). The World Café fosters stakeholder engagement, trust, and multidisciplinary collaboration in program development. It encourages collective power for change and is simple to apply, aiming for program development, project definition, research activity, and policy formulation**.**

Figure 7: Guidelines for World Café.

D2.2.1 Consolidated report on Living Lab Stakeholders mapping (M12)
The present report is produced as a deliverable for the D2.2.1 Consolidated Report on Living Lab Stakeholders Mapping. The task provides an overview of the stakeholder mapping, situation analysis, and the first participatory workshop implying the LL methodology.

a- Purpose of the transition vision and action plan

The project aimed to transition towards climate resilience and water management by fostering participatory and equitable water governance models, addressing societal challenges, and ensuring gender equality.
The project outlined eight milestones for organizations to achieve: creating a collaborative environment, inspiring change towards sustainable solutions, stimulating research and innovation, implementing co-defined actions, gaining wide acceptance, and widely applying RRI dimensions as shown in Figure 8.

Figure 8: RRI dimensions.

The Living Labs (LLs) aimed to establish an open, collaborative network of stakeholders to demonstrate the benefits of evidence-based participatory management solutions for water scarcity governance and climate resilience at the Mediterranean level. The AG-WaMED project refers to this change management as the transition towards water governance and climate resilience.

b- Preparing the LL team to apply the methodology

For the purpose of facilitating the preparation and execution of the LL process by the LL Leaders and LL Teams, AG-WaMED partners attended a **3-hour participatory introductory session** and a **4-hour supplementary training session** to prepare and execute the LL process. The introductory session focused on the LL Methodology and various participatory methods, while the supplementary session provided an in-depth introduction.

c- Applying the LL methodology

The LL methodology was used by LL Leaders to engage and motivate stakeholders in their first participatory workshop. They conducted a comprehensive situational analysis,

identifying political, economic, social, technological, legal, environmental, ethical, and citizen factors. AG-WAMED partners assisted the LL-Leader in completing tasks such as SWOT**)**, PESTLEEC, stakeholder analysis, overall stakeholder visualization (figure 9), detailed engagement analysis, motivation story, dialogue creation, grand challenge framing, vision canvas, transition action plan, SMART transition actions, and stakeholder's transition plan.

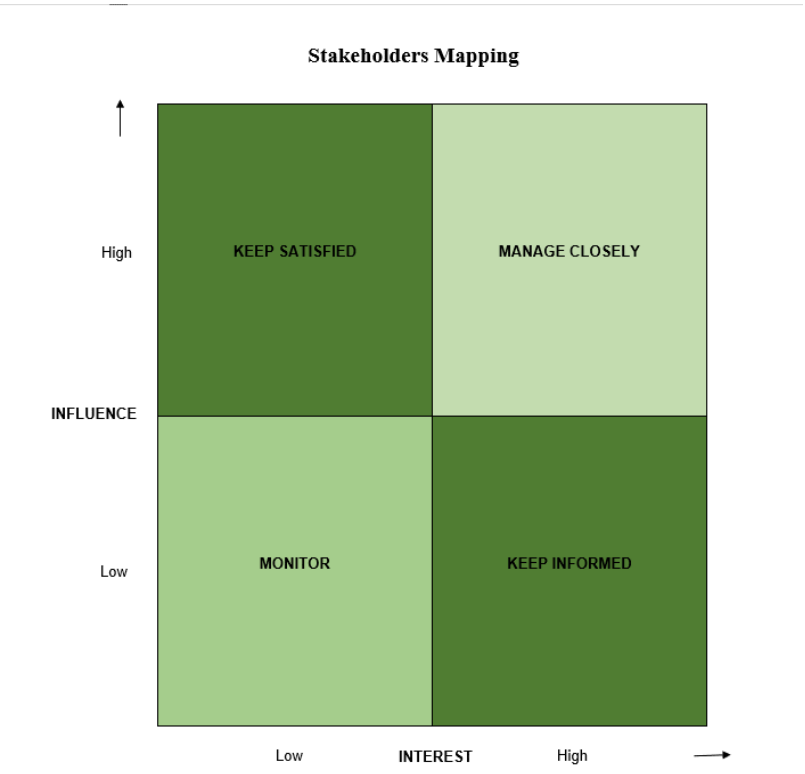

Figure 9: Stakeholder mapping scheme

The LLs workshop organization involved creating a list of survey questions, inviting stakeholders, gathering responses, analyzing the results, and writing a report. The World Café Method facilitates multidisciplinary collaboration and connection in today's issues, aiming to achieve program development, project definition, research activity, and policy formulation. Incentives like gifts, lottery prizes, charity donations, or points accumulation can increase participation.

d- Mapping Current Situation through SWOT& PESTLEEC analysis.

The four LL were analyzed according to SWOT and PESTLEEC methodology. The analysis results are summarized in table 2. Every LL is a unique entity with outstanding characteristics.

Table 2: Analysis results of SWOT and PESTLEEC for each LL.

LLs	PESTLEEC Analysis	SWOT Analysis
Egypt (wadi elkhair LL)	**Political:** Land competition due to limited legal landownership types. The Egyptian government, FAO, and WFP have strengthened policies to improve local life conditions, providing long-term loans for Bedouin breeders. The political environment is stable, and national strategies are being implemented to improve agricultural systems. **Economic:** Bedouin breeders manage sheep, goat, and camel flocks, focusing on fig, olive, almond, and barley crops. They have shifted to urban areas during drought and started new activities like poultry farms and lamb fattening. Family income mainly comes from livestock, agriculture, and off-farm activities, with a focus on economic reform through production programs and entrepreneurship. **Social:** a local population, have been settling in the area since the 1970s, integrating cropping and animal breeding activities. The Egyptian government and world food Program have helped improve women's literacy rates, but illiteracy remains high. Bedouin coping strategies include decreasing flock size, selling lambs and kids, and moving for feed. However, worker quality needs improvement and the number of agricultural cooperatives is low. **Technological:** Bedouins used Roman cisterns, karms, and watering infrastructure like dikes and dams to collect water. Traditional agriculture and animal grazing methods were used until 1984. Drilling failed due to low water resources. Dikes and check dams controlled soil erosion. **Legal:** Land laws faced challenges for Bedouins, who needed permission from their attributed tribe. In 1925, the Gnashat tribe rented the northern Nnagamish Wadi area. In 1972, land was divided among Kenishat, Mawalek, and Gbihat tribes. 1958 and 1960 laws replaced traditional tenure with individual title to desert land. **Environmental:** Climate change and human practices have led to land degradation, water scarcity, and soil erosion in an area primarily containing olives and figs. Controlling stocking	**Strengths:** Bedouin has their own coping strategies with climate change, They are loyal to their land, Varying income sources, Using non-traditional water in irrigation and farming, Diversity of vegetation (olive and fig perennial. water Mellon, barley, and tomato seasonally), Livestock is a source of income for Bedouins, large grazing areas (farming areas), High level of social cohesion. **Weaknesses:** primitive infrastructure, low water availability, land degradation, and lack of healthcare, schools, and agricultural cooperatives. Technological progress is slow, and there is a lack of a local market. Poor governance, dissatisfaction with the government, poor coordination, and financial allocations for natural resource maintenance are also issues. Additionally, there is a lack of technical staff, a natural resources database, pollution, biodiversity loss, reduced environmental awareness, and inadequate programs to educate Bedouins about the valley's development. **Opportunities:** The government is focused on renewable energy, desalination plants, infrastructure improvement, and sustainable agricultural development. They aim to achieve the 2030 Sustainable Development Goals and increase the agricultural sector's contribution to GDP. They are also working towards economic reform, partnering with the private sector, and stimulating investment opportunities in the agricultural sector. The government is also interested in improving worker quality, education, and reducing the development gap between rural and urban areas. **Threats:** soil erosion, degradation of natural rangelands, lack of government spending, lack of sustainable development vision, weak private sector, poor coordination, and high costs of modern technologies. Unsustainable use of

	densities and frequency of grazing is crucial to prevent species loss and vegetation cover deterioration. Reseeding range lands with nitrogen fixers can improve sustainability. **Ethical:** Local citizens are resistant to change, maintaining their traditions and norms. Women in rural Bedouin communities lack contact with men from other communities. Tribes use dykes for personal gain, disregarding farmers' rights and water balance. **Citizen-Science-Government-Stakeholder interactions:** The area has 300 houses, 5 schools, and 2 agricultural cooperatives. Primary schools are in the city, while drinking water comes from cisterns and Alexandria. Garoula village has one health unit, but advanced services require city access. The region relies heavily on governmental subsidies for agricultural inputs and infrastructure.	resources, low underground water stocks, and lack of veterinary services contribute to environmental degradation. Land use laws and regulations also weaken.
Italy (Val d'Orcia LL)	**Political:** The complexity and expense of regulations for water storage structures, the challenges of implementing a common irrigation network, the difficulty in creating a market for water, the lack of long-term planning for water resources, bureaucracy, and the difficulty in obtaining new concessions for water withdrawal. The region is a significant export producer of high-quality foods like wines, olive oil, and cheese, with a significant tourism vocation, and many farms practice agritourism to combine agriculture and tourism**.** **Social:** Farmers often work independently, making collaboration difficult. High touristic presence in summer places pressures water resources. Rural areas are depopulating and older. Farms' actions depend on size, with smaller farms having less investment opportunities. Synergistic water management efforts are needed. **Technological**: Connecting existing water reservoirs could improve water distribution, especially for small farmers without resources. However, this is challenging due to technical and economic reasons. Irrigation systems are now widely used in agriculture, and local water management institutions are planning new reservoirs. Monitoring groundwater quality and quantity is crucial, but selecting locations is challenging. Wastewater use is not feasible for small farms. **Legal:** The complex and expensive regulations for water storage structures, the	**Strengths:** Val d'Orcia is crucial for agriculture and tourism, with farmers implementing climate change adaptation measures and collaborating with research institutions for soil and water conservation techniques. Associations exchange knowledge and resources, and a common water reservoir, San Piero in Campo, is under study. **Weaknesses:** complex regulations for building and restoring irrigation ponds, neglected water reservoir management, high costs, lack of collective irrigation policies, inadequate groundwater monitoring, financial constraints for small farms, difficulties in water structure placement, and soil erosion issues. **Opportunities:** collective irrigation, improved water management, public interest in restoring ponds, rainwater use for fire extinction, Common Agricultural Policy for ecosystem services, and improved drainage water re-use. **Threats:** Recharging upslope water reservoirs, risk of water shortage during summer, water pollution and salinization issues, and lack of coordination between central and local institutions.

Spain (Campo de Cartagena LL)	need to locate and regularize unregistered wells, and the lack of reporting of abandoned ponds in private fields hinder water availability. Additionally, current regulations require owners to treat removed sediments as "special waste." **Environmental:** The dispute between local government and farmers over riverbank maintenance is causing flooding risks, The UNESCO protected site which faces overexploitation of groundwater, potential challenges to water recharge due to climate change, and potential soil erosion issues. **Ethical:** **Citizen-Science-Government-Stakeholder interactions:** Disagreements exist between local water management authorities and citizens regarding new storage structures, farmers' willingness to collaborate, and environmental concerns about riverbank maintenance. Water management institutions are interested in using University of Florence water modelling results, but lack of communication among stakeholders hinders effective management. **Political:** The central government opposes irrigated agriculture due to environmental issues, while regional and local governments support it for economic growth and productivity, but citizens lack perception of environmental protection policies' effectiveness. **Economic:** Irrigated agriculture is crucial for economic prosperity in the region, generating significant economic activity in transport, processing, marketing, and supplies. Agriculture is the main export source and is subsidized by local economies. The Community of Irrigators of Campo de Cartagena's irrigated land and farms are valued at 2,000 and 5,000 million euros, respectively. **Social:** The area has a deep-rooted irrigation culture, with many families owning farms and participating in agricultural cooperatives and communities. Irrigators have a strong social force and influence political decisions, and institutional governance for water management is strong. **Technological**: Irrigated agriculture in the area is highly technified, utilizing advanced technologies for improved water use efficiency, with farmers possessing extensive knowledge in production management and participating in research projects.	**Strengths:** Optimal water use, Subsidy-free agriculture, High contribution to local domestic product, High contribution to international trade, Well-developed hydraulic infrastructure, Well organized irrigation cooperatives, Competent public institutions, Cost-effective decision making, Excellent water management skills, Well-developed agroindustry in the region, International market penetration, Rainwater harvesting implemented long ago, Adequate governance, Sound financial resources, Engagement of stakeholders and participation in decision making, Availability of water and environmental data, Good technological and research centers. **Weaknesses:** Relevant water quality problems, Dependence on external water resources, Risk of environmental degradation, Intensive use of fertilizers, Aquifer overexploitation, Cost of water is not uniform for all farmers, High energy consumption, Lack of political support for agriculture, Lack of knowledge to diagnose environmental problems, Desalinated water needs to be mixed with other sources, Water transfer resources are not reliable, Lack of public funding for entrepreneurship, Lack of participation on

Algeria /Tunisia (Wadi El Kebir LL)	**Legal:** The Spanish legal system for water is advanced, with most declared in public domain. Access to water requires concessions, and non-conventional resources are subject to administrative concessions. Basin unity principles apply, and river basin management plans were established before the Water Framework Directive. User participation is encouraged. **Environmental:** Irrigated agriculture is controversial due to resource pressure, environmental effects, and desertification. It's essential for arid climates, but pollution from fertilizers, CO2 fixation, and energy consumption are issues. Despite the potential for water recycling, environmental degradation in Mar Menor persists. **Ethical:** Agriculture offers economic benefits, employment, and benefits less educated social classes. It's an important source of immigration**,** and irrigated agriculture is effective in addressing rural population issues. **Citizen-Science-Government-Stakeholder interactions:** The government's policies are insufficiently addressing farmers' needs, with media primarily focusing on environmentalist complaints, and farmers' associations are establishing social media presence to voice their opinions. **Political:** The sustainable management of water resources is hindered by international and national policies, lack of local specificity, contradictory laws, weak local political intervention, bureaucracy, and policies that do not consider current circumstances. Additionally, there is a lack of marketing policies for agricultural products and by-products, limits due to civil society intervention, and the absence of incentive policies for at least three decades. Decentralization trends and development projects are also needed. **Economic:** the agricultural sector faces challenges due to low income, inflation, production costs, market access, and a subsistence economy, Development projects, economic adaptability, and migrant remittances are essential for rural households to diversify income sources and strengthen agricultural activities. However, a subsistence	decision making in the River Basin District that supplies the water transfer. **Opportunities:** Improved water use efficiency, Enhanced technologies for optimal water management, Development of new irrigation techniques, Recycling of urban water, Promotion of new desalination plants, Combine renewable energy with desalination, Interconnect water sources and demand nodes, Open markets for water rights exchange, Improve methodologies for environmental flow definition, Improve stakeholder participation in environmental decision making, Research on use of desalinated water in agriculture, Non-conventional water resources are in the political arena. **Threats:** Reduced natural water availability due to climate change, Growing water scarcity, Increased water demand for urban consumption, Increased water demand for tourism, Increased water demand for recreation (golf courses), Fluctuating costs of energy, Frequent regulation changes, Increased production costs, Lack of knowledge on how to achieve sustainability, Environmental regulation is only applied to domestic producers, not to imports, Complexity of international markets**,** Lack of commitment to productive agriculture at the European level, Agriculture has to buffer irregular water supply**.** **Strengths:** Migrant remittances strengthen agricultural activities, while farmers' knowledge in resource conservation and water saving is crucial. Civil society, local consolidation systems, recharge dams, deep groundwater, good water quality, water and soil conservation structures, scientific results, and farmer loyalty are also important factors. **Weaknesses:** The challenges faced in managing water resources in rural areas include lack of coordination among local institutions, low involvement of politicians, bureaucracy, and limited financial resources. These issues limit the purchase of agricultural equipment, inputs, and water. Additionally, the local subsistence economy does not guarantee sustainability. Demographic changes, land fragmentation, social conflicts, migration, and abandonment of agricultural land also contribute to these issues. Traditional

	economy and lack of sustainability are also significant issues. **Social:** social cohesion, civil society, demographic changes, land fragmentation, conflicts, migration, abandonment of agricultural land, high age of land users, low education, and erosion of indigenous knowledge. It also highlights the importance of local know-how, limited intellectual level, and rural-urban migration. **Technological:** Lack of new technologies and renewable energies in traditional agriculture, challenges in introducing technologies, and lack of marketing strategies hinder agricultural productivity. However, there is a growing trend to integrate technology, internet, and machinery in agricultural production, and opportunities to learn from successful experiences in water management and local product promotion. **Legal:** Current national regulations lack sustainability in water resource management due to poor communication, hindered efficient use in agriculture, high costs for supplementary irrigation, and groundwater prohibition. The European Commission has adopted a Mediterranean agenda to strengthen regional cooperation for water resource management and renewable energy use. Learning from successful national measures and implementing sustainable regulations, state flexibility, and standardization of wastewater use are essential. **Environmental:** Climate change impacts include water shortage, groundwater degradation, dry years, erosion, and local issues. National policies, watershed development strategies, and local expertise in resource conservation and water saving are needed. **Ethical:** Lack of respect for laws and development actors, Lack of transparency between the actors involved, Problem of vandalism (theft of material), Religious attachment (equitable distribution of water resources) **Citizen-Science-Government-Stakeholder interactions:** The sustainable management of water resources is hindered by political constraints, poor governance, conflicting relations, and a lack of organization. The decision-making process is dominated by certain actors, exclusion of users, and lack of a diversified civil society. The state encourages	agriculture, lack of innovation, and poor communication of information further exacerbate the problem. Water shortages, groundwater degradation, and succession problems further exacerbate these issues. Conflicting relations and conflicts between actors further complicate the situation. Additionally, there is a lack of organization connecting and relaying actors in the expansion perimeter. **Opportunities:** the existence of incentive policies, decentralization trends, development projects, agricultural promotion policies, water saving policies, and innovation in water management. It also highlights the need for learning from successful experiences in similar contexts and the European Commission's agenda for the Mediterranean. The text also discusses state flexibility in amending or rectifying laws, climate change adaptation policies, watershed development strategies, wastewater use, renewable energy generation, aquifer recharge capability, and maintenance and improvement of existing infrastructure. The text also emphasizes the importance of learning from successful examples in water management and promotion. **Threats:** The sustainable management of water resources is hindered by international and national policies, local specificities, contradictory laws, and lack of commercialization and marketing policies. Inflation, production costs, social transition, lack of innovation strategies, and legal inadequacies also contribute to the issue. Local land governance systems complicate access to natural resources, leading to social injustice and environmental degradation. Fiscal policies and groundwater prohibitions also hinder efficient water use. Climate change impacts, political context, and legislation contribute to soil losses and climate variability. Addressing these issues is crucial for sustainable water resource management.

	improving the role and autonomy of non-governmental organizations through decentralization policies.	

e- Classify stakeholders according to QH model, numbers, and Gender Stakeholder attended the first workshop were

Table 3: Total number of participants in the first workshop and their classification.

LLs	Total No of Participants	male	female	QH systems	No of participants according to QH model subsystems
Egypt (wadi elkhair LL)	23	22	1	Education/science system	7
				Economic system	3
				Political system	2
				Media-based and culture-based public	8
				Natural environment	3
Italy (Val d'Orcia LL)	18	10	8	Education/science system	5
				Economic system	7
				Political system	0
				Media-based and culture-based public	4
				Natural environment	2
Spain (Campo de Cartagena LL)	47	39	8	Education/science system	10
				Economic system	20
				Political system	4
				Media-based and culture-based public	6
				Natural environment	7
Algeria/Tunisia (Wadi El Kebir LL)	43	33	10	Education/science system	24
				Economic system	4
				Political system	5
				Media-based and culture-based public	1
				Natural environment	9

f- Stakeholders Mapping for Living Labs:

The stakeholder mapping in Egypt (figure 10) concludes that there are revealed critical gaps in gender representation within water governance structures, particularly in Water User Associations. While technical agencies and donors hold high influence, local women farmers—despite being key water managers—remain underrepresented. These insights will inform the co-design of inclusive irrigation strategies, ensuring that gender equity and sustainability are embedded in both policy and practice. The stakeholders mapping shows 3 stakeholders **KEEP SATISFIED** means they might include actors who could sway decisions but need strategic updates, not constant input, 4 stakeholders **MONITOR** means they could be citizen groups who care deeply and can help with outreach or implementation, 6 stakeholders **KEEP INFORMED** means they aren't central now but could become relevant later, 9 stakeholders **MANAGE CLOSELY** means they identified as core partners or high-impact community leaders.

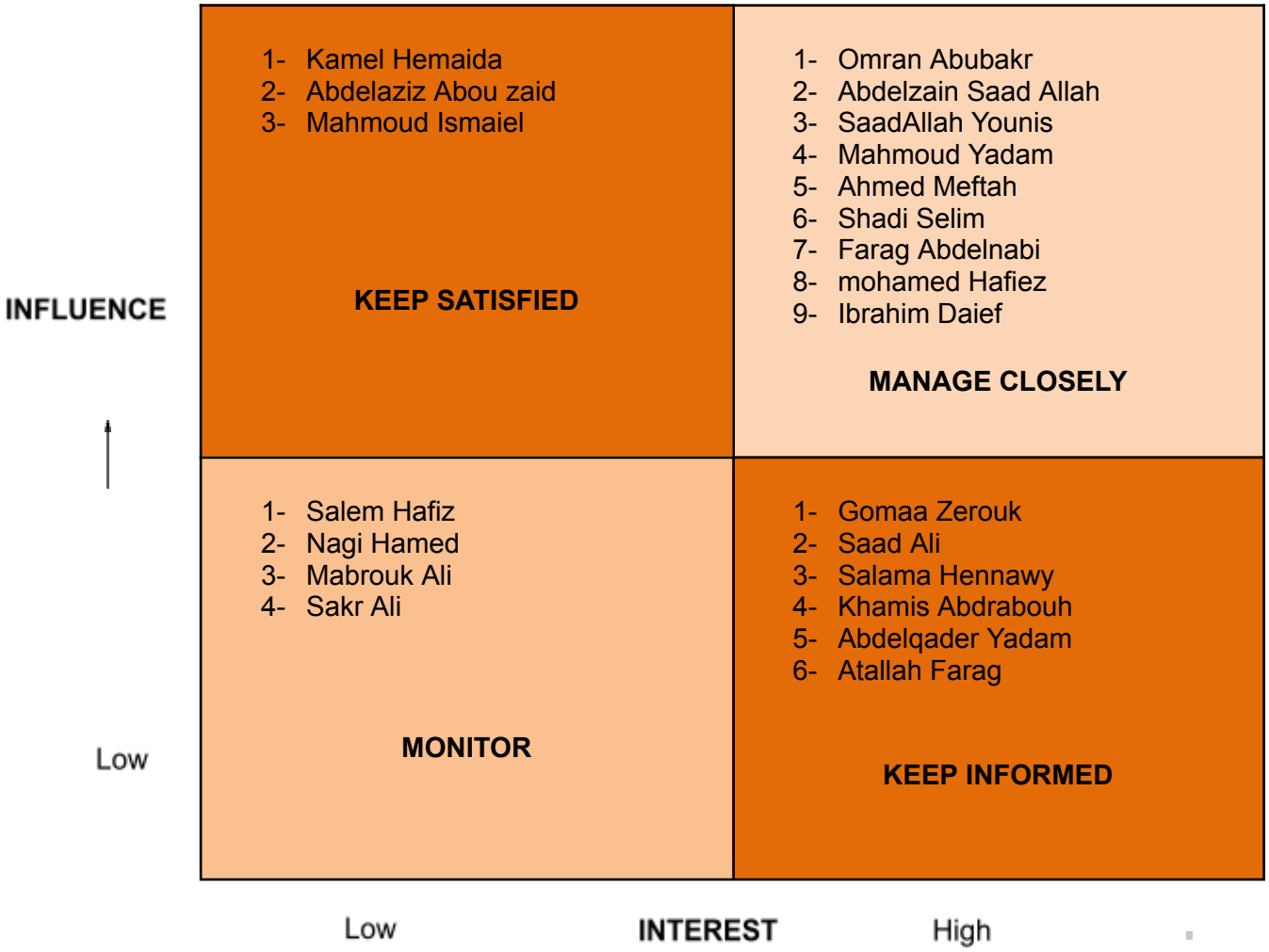

Figure 10: Stakeholders Mapping for Egyptian Living Lab.

The stakeholder mapping in Spain (figure 11) revealed a dynamic and multi-sectoral landscape, with strong participation from government ministries, rural development agencies, academic institutions, and civil society organizations. the mapping also highlighted gaps in representation among women-led local community groups. These insights underscore the need for more inclusive engagement strategies and participatory governance frameworks. The stakeholders mapping shows 6 stakeholders **MANAGE CLOSELY** means they identified as core partners or high-impact community leaders, 6 stakeholders **KEEP SATISFIED** means they might include actors who could sway decisions

but need strategic updates, not constant input, 8 stakeholders **MONITOR** means they could be citizen groups who care deeply and can help with outreach or implementation, 9 stakeholders **KEEP INFORMED** means they aren't central now but could become relevant later.

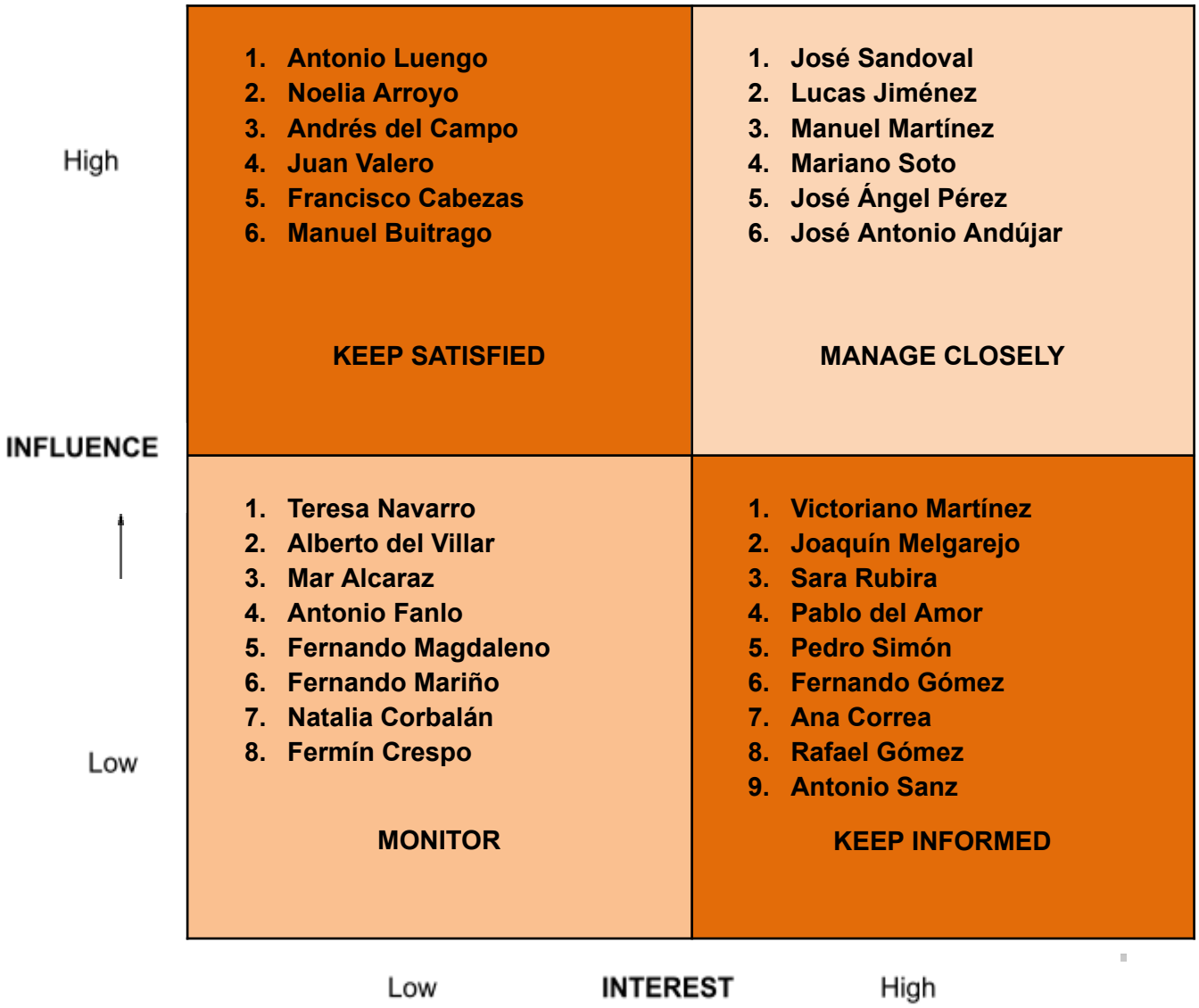

Figure 11: Stakeholders Mapping for Spanish Living Lab.

g- Main Results for the Living Labs:

The LL showed many results include:
(Egypt) Egypt needs desalination units for saline wells, which require high capital. Training for farmers on pesticide usage and machinery is needed to improve land use and productivity. Wastewater treatment plants should be moved to the south to address leaking problems and improve health. Introducing new plant species and species to farmers, establishing concrete dikes, and providing solar-based desalination units are also needed. Financial aid from organizations like FAO, USAID, and GIZ can help establish these units. A wholesale market in Matrouh city can be established, and a general water line can be provided. Water quality testing and funding for water purifying units and solar energy units can help improve the situation. Despite water scarcity, locals are hesitant to use clay water due to religious and environmental concerns.

(Italy) Italy emphasizes the need to consider multiple water uses, including agriculture, tourism, environment, and domestic use, as well as protected areas and ecosystems' water requirements. Surface water bodies should be maintained without affecting riparian ecosystems. Water resources modelling can help institutions conduct environmental evaluations, implement groundwater recharge interventions, and build new water reservoirs. However, selecting the right locations for these reservoirs is challenging. Public institutions should encourage farmers to restore ponds and foster collaborations. Climate change may challenge water structures recharge, and water allocation conflicts may occur. Long-term planning and a common irrigation system are proposed for increased water availability.
(Spain) The Campo de Cartagena area in Spain contributes 2,600 M€ to agricultural activity, with the Levante region producing 71% of vegetables and 25% of fruit. Irrigation communities in the area primarily use Tagus-Segura water transfer and non-conventional resources. However, these systems are highly technical and consume less water than the Spanish average. The Tagus-Segura aqueduct has a theoretical water supply of 400 hm3, but 200 hm3 is currently received. The Segura basin has 85,000 hectares irrigated, and desalination plants are not enough to cope with the reduced water supply. Production costs for fruit and vegetables have risen, and treated water could supply 12% of irrigation demand in Murcia.
(Algeria and Tunisia) are needed to work on various plans to improve water resources and agricultural practices. These include reforestation of small watersheds, using organic carbon to improve soil quantity, developing erosion models, and utilizing halophyte plants for soil preservation and water quantity. Additionally, improve soil fertility, establishing and developing drainage networks, raising awareness of farmers and industries, improving water quality, and encouraging startups for water-saving software, updating laws concerning water exploitation by drilling, encouraging surface water irrigation, and creating cooperatives for specialized farmers, developing a dynamic database of water resources, artificial recharge, and evaluating resource losses and needs, developing saltwater treatment plants, monitoring water quality, and constructing bridges to limit runoff water, promoting water policies, and managing brush water.
The LL indicated that the Mediterranean regions faces various challenges, including environmental stresses, the effects of climate change, governance gaps, economic and physical limits, social and participative obstacles, and technological and data issues all provide hurdles to Mediterranean water management. Major challenges include water scarcity and uneven distribution, the effects of climate change, and environmental degradation. Governance mechanisms are fragmented, and policy enforcement is poor. Economic and infrastructure restrictions include out-of-date water systems, inadequate investment in water services, and inefficient farming methods. Tokenistic participation, cultural and linguistic diversity, and unequal distribution of water supply access are all examples of social and participative barriers. To address these challenges, Mediterranean countries are prioritizing transformative water governance, regional collaboration, and inclusive stakeholder platforms.

D2.3.1 Consolidated AG-WaMED database (M12)

The present report describes the contents of the Deliverable 2.3.1 - Consolidated AG-WaMED database, gathering all the available data for each LL to run the selected models namely, SWAT/SWAT+, WAPA, and WATNEEDS. These data constitute the basis for the project's modeling activities. IT is reserved exclusively for users in possession of access details". Currently, the files are stored in the Google Drive folder "Task 2.3.1" which is the task relevant to this deliverable, where a folder for each country has been created. In each country folder there is a folder for each kind of input data listed below.
The database was structured with the logic of having a uniform data format. Since the deliverable refers explicitly to data for modeling, it was decided to store data in the format required as an input to the models. Such formats are computationally parsimonious and suitable for manipulation in all the common GIS / modeling / data management platforms.
It is very important to keep all the raster data used in different models in the same geographical coordinate system (UTM).

The data required by SWAT/SWAT+ model is represented by the following variables:
DEM: digital elevatoin model in raster format
Land use map: current land use classes in raster format or vector shapefile format
Soil map: current soil classes in raster format or vector shapefile format
Climate: climate variables (precipitation (in mm), temperature (usually in °C), relative humidity (in %), wind speed (in m/s), solar radiation (W/m2).
Outlet: a .shp of the gauging stations and outlets or a .csv file with the coordinates
Flow: csv files with date and observation (should be speicied as daily or monthly observations)
Non-Conventional Water (NCW): Description of the water harvesting/NCW interventions with coordinates.

The data required by WAAPA model is represented by the following variables:
DEM: Elevations in raster file forma. WAAPA, requires a hydrologically conditioned DEM.
Flow accumulation: It is derived from DEM, and is also used to obtain the drainage network
Drainage direction: it is derived from the hydrologically conditioned DEM
Runoff: it is usually a raster file format
Population density: is in a raster file format
Irrigated areas: it is a multilayer raster containing information on percentages of irrigated surface against the total area and the water source used for irrigation
Dam and reservoirs locations: provided as vector file .shp with attribute table or as simple location file according to the data source

The data required by WATNEEDS model is represented by the following variables for all LL:
Potential evapotranspiration: It is a raster file. It is also used to calculate actual evapotranspiration together with crop coefficients and growing periods and soil information
Precipitation at daily resolution: in raster file format or it can be provided as .txt or .csv
maximum soil moisture storage capacity and maximum infiltration rate: It is provided as a raster file
Crop coefficients, growing period, crop-specific rooting depths and critical depletion factors: provided as raster files
Crop distribution: it can be either .shp file with attributes or raster file with a lookup table

D2.3.2.1 Consolidated report on LL scenario modelling #1 (M20)

The report is produced as a deliverable for task 2.3 of AG-WaMED, Participatory modelling and scenario analysis (part 1). The task provides the reporting of the **second participatory modeling workshop,** held in each AG-WaMED LL. The workshops' main objective was to present the project's modelling activities to stakeholders and to receive feedback from them on the presented activities and how to proceed.

The workshops were held in the period May-June 2024. To promote the participation of as many stakeholders as possible, the Egyptian and the Algerian/Tunisian LLs hosted two workshops each. The shared, general objective of the second workshop was "to present the modelling activities in the LL and to receive feedback about the analyses performed, the data used, and the scenarios analyzed/to be analyzed". The outputs of the first round of agro-hydrological and socio-economic modelling activities were presented by the project teams and discussed with the invited stakeholders who provided feedback on how to proceed and eventually modify the modeling activities. Depending on each LL, SWAT+, MODFLOW, WATNEEDS and SIMPA models were used for agro-hydrological modeling while Multi-Objective Programming (MOP) was used. The participatory methodology was left as flexible as possible on purpose, to allow each partner to better fit with the needs and characteristics of each LL. A total of 100 stakeholders participated in the second workshops of the AG-WaMED project, and table 4 illustartes the gender distribution of participants. It seems that the percentage of female representation was improved compared to that of the first workshop shown in table 3

Table 4: Gender distribution of participants in the second workshops for each LL.

Workshop	Total	male	%	female	%	LL
2	21	15	71	6	29	Egypt
2	21	15	71	6	29	Italy
2	15	14	93	1	7	Spain
2	43	27	63	16	37	Algeria/Tunisia

Table 5 summarizes the main outcomes of the workshops in each LL and for each model presented. According to the LL, model, type of stakeholders and other characteristics, the feedback greatly varied. The suggestions of the stakeholders will be taken into account to further improve the models, which will be presented and discussed further in the next participatory workshop. A crucial and transversal comment from the participants was to consider the governance issues which are, in most cases, the main barrier for the adoption of non-conventional water technologies.

Table 5: Summary of the main outputs of the second workshops for each LL.

Second workshop	Italian LL	Spanish LL	Egyptian LL	Algerian/Tunisian LL
SWAT/ SIMPA/ MODFLOW model presented	X	X	X	X
SWAT/ SIMPA/ MODFLOW model feedback	(SWAT) Positive evaluation, even if using additional data to refine the small agricultural reservoirs representation was recommended	(SIMPA) Positive evaluation, but it is not useful to estimate water availability in the LL. To use the model to evaluate rainwater harvesting, it is suggested to apply it at daily scale.	(SWAT) Few stakeholders understood the modelling processes, but they could not comment on the outputs as they were not familiar with them	(SWAT) Positive evaluation, but need to integrate climate change scenarios, soil water conservation techniques, flood management, land use/land cover changes. (MODFLOW) Despite the relevance of the outputs, it requires improvements related to the transboundary aquifer system description with accuracy, irrigation, cost-benefit analysis, etc.
WATNEEDS model presented	X	X	X	
WATNEEDS model feedback	Quite positive evaluation, meaning that the model can roughly represent cropping patterns but not with great accuracy	The model can roughly represent cropping patterns and it is fine where there are no other datasets, but in the LL there is more precise data	Few stakeholders understood the modelling processes, but they could not comment on the outputs as they were not familiar with them	
LP, PP, MOP model presented	X	X	X	
LP, PP, MOP model feedback	Concerns about many aspects that should be clarified, such as the too simplified representation of farms, the type of subsidies, and the fact that it won't be possible to increase vineyards area.	Need a more sophisticated model to obtain useful outputs, by considering the cost of water for each different source, environmental and other restrictions, priorities, supply patterns etc.	Feedback specific for each scenario presented	

Willingness of stakeholders to participate in further activities	X	X	X	X

Despite the challenges and limitations, the LL leaders of the AG-WaMED project and their teams successfully carried out the second participatory workshop. The participation was overall satisfactory (total of 100 participants) and stakeholders who participated in the workshop generally were actively involved and confirmed the usefulness of the participatory approach. The feedback on the models was very diverse, but in general, we can affirm that this first co-modelling approach proposed with these workshops and presented in this deliverable was extremely useful. Despite the common methodology, the outcomes of the four workshops were drastically diverse. This remarks the importance of maintaining the methodologies as flexible as possible. As written in the project proposal, this second workshop will be followed by two other in-presence workshops. One could be held in winter (around November 2024) and the final one in spring (around March 2024). Hence, two additional rounds of models set-up and feedback by the stakeholders are envisioned. Given the different models' applications in the LLs, in the next weeks, we will evaluate how to best proceed at the AG-WaMED project level and for each LL. The modelling efforts and the next steps will be soon resumed and coordinated in the PA3.1.2.1 "Complete watershed models for each LL round #1".

D2.3.2.2 Consolidated report on LL scenario modelling #2 (M28)

This deliverable reports the preparatory activities and the outputs of the third participatory workshop in each of the project LL: Italy, Spain, Egypt and the transboundary Algerian/Tunisian. The preparatory activities revolved around framing the general objective and the methodology and the framing of the AG-WaMED activities within the RRI Roadmap©TM. The workshops were held in the period November- December 2024. The shared, general objective of the third workshop was to present the first draft of a Integrated Watershed Management Plan (IWMP) created within the project per each LL and to receive feedback about it. The participatory methodology was left as flexible as possible on purpose, to allow each partner to better fit with the needs and characteristics of each LL. Table 6 indictae the gender distribution of paricipants in the 4 LL's. A total of 59 stakeholders participated in the third workshops of the AG-WaMED project.

Table 6: Gender distribution of participants in the third workshops for each LL.

Worksho p	Total	male	%	femal e	%	LL
3	14	9	64	5	36	Egypt
3	21	15	71	6	29	Italy
3	9	7	78	2	22	Spain
3	15	8	53	7	47	Algeria/Tunisi a

Table 7 summarizes the main outcomes of the workshops in each LL. According to the LL, type of Non-Conventional Water (NCW), type of stakeholders and other characteristics, the feedback greatly varied. The suggestions of the stakeholders will be taken into account to further improve the IWMP drafts, which will be presented and discussed further in the next participatory workshop

Table 7: Summary of the main outputs of the third workshops for each LL.

Third workshop	Italian LL	Spanish LL	Egyptian	Tunisian/Algerian
Feedback on the IWMP	Positive, in line with stakeholders' objectives and interests. Main suggestions regard the inclusion of phytodepuration wastewater as additional NCW source and possible solutions to the lack of funds for irrigation reservoirs creation and restoration. The main challenges remain the complex legal/administrative procedures and the lack of collaboration between the institutions involved in water management.	Positive, the involved stakeholders agreed on the importance of having a plan to address water resource management, especially for irrigated agriculture in a situation of scarcity, potentially aggravated by climate change. Main suggestions regard the improvement of runoff management also through rainwater harvesting. Precision agriculture techniques should also be promoted as well as the desalination of brackish water. The main challenge is the cost of water.	All participating stakeholders agreed with the vision and objectives of the plan but they stressed the need for coordination among stakeholders including governmental and non governmental organizations and farmers involved in water management and water use. The need for implementation of appropriate soil and water conservation techniques and of adequate, supported regulations is also recommended.	Positive, the stakeholders agree with the proposed scenarios and suggest to adapt the IWMP to the current water management plans and to include a water quality assessment.
Willingness of stakeholders to participate in further activities	yes	yes	yes	yes

D2.3.2.3 Consolidated report on LL scenario modelling #3 (M34)

This the final deliverable in WP 2. Workshop 4 draws on previous activities of the project and in particular on the previous deliverables of the same task in which the second and third participatory workshops were described. Hence, in this document we just briefly update the final version of the methodology inspired by the RRI Roadmap©™ adopted in the AG-WaMED project. After that, we describe the preparation of the participatory workshop in a dedicated online meeting among LL leaders. Finally, in the results section, we describe (i) the implementation of the workshop with information about participants, agenda, participatory tools applied, objectives etc. and (ii) the analysis of the outcomes in terms of stakeholders feedback. Results are reported individually for each LL.

The final version of RRI roadmap©™ in the AG-WaMED project

In D2.3.2.2 we presented how the RRI Roadmap©™ was used within the AG-WaMED project. While confirming the general structure of that proposal, we made slight changes regarding milestones 5, 6, 7 and 8 to better adapt the methodology to the latest project activities. In particular, in milestone 5 (co-design) we now include (1) all the co-modelling activities (for example validation of model set up, definition of scenarios and so on), (2) the co-definition of vision, goals and objectives and (3) the identification of scientific information gaps and ways to address it. Hence, milestone 5 was mainly addressed in the second participatory workshop. In milestone 6, we consider the activities: (1) preparation of the integrated watershed management plan (mostly accomplished before and during the third workshop) and (2) definition of a preliminary Action Plan as part of the IWMP (Part II) (to be better defined and improved in the fourth workshop). This latter Action Plan should be then the focus of the fourth workshop, even if each LL has its own peculiarities. Milestone 7 - Measure and adjust - includes the activities: (1) implement the Action Plan, evaluate its implementation between now and the end of the project, adjust the Plan and (2) evaluate co-modelling outputs. Finally, milestone 8 - intensify - now specifically refers to (1) the definition of an exit strategy and (2) dissemination of results, search for additional funding opportunities, involvement of more actors, and the scale-up of solutions. Table 8 reports the links between the milestones of the RRI Roadmap©™ and the proposed methodology of the participatory co-modelling in the AG-WaMED project, updated from the version presented in D2.3.2.2.

Table 8: The eight milestones and the respective parts of the project in which they are implemented, together with general activities carried out in the workshops.

RRI Roadmap©™ milestone	**Workshop number or period of the project**	**Related activities**
1. Identify needs	Project conceptualization, #1 workshop, iterative	- Current situation analysis (with SWOT, PESTLEEC analyses) - Stakeholder analysis (with Quintuple Helix Model analysis) - Needs analysis
2. Motivate change	Whole project and #1, #2 and #3 and #4 workshops	
3. Engage	Whole project and #1, #2 and #3 and #4 workshops	
4. Ideate and frame	#1 and #2 workshops	- Generate and discuss future scenarios for NCW management
5. Co-design	#2 workshop	- Co-define common vision for the future (adjusted in following workshops) - Identification of scientific information gaps and ways to address it - Data collection - Co-modelling activities (validation of model set up, definition of scenarios)
6. Co-construct	#3 and #4 workshops	- Prepare the integrated watershed management plan - Define a preliminary action plan to implement the measures identified in the Plan
7. Measure and adjust	After #4 workshop	- Implement the Action Plan, evaluate its implementation between now and the end of the project, adjust the Plan - Evaluate co-modelling outputs
8. Intensify	Starting from #4 workshop	- Define exit strategy - Disseminate results, seek for additional funding opportunities, involve more actors, scale-up solutions

This deliverable reports the preparatory activities and the outputs of the fourth participatory workshop in each of the project LL: Italy, Spain, Egypt and the transboundary Algerian/Tunisian. The preparatory activities revolved around framing the general objectives and the methodology. The final complete methodology related to the RRI Roadmap©™ was also defined. The workshops were held in the period April-May 2025. The shared, general objectives of the fourth workshop were to (1) finalize and capitalize on project activities and (2) create an outcome beyond the project. Each LL had specific objectives tailored to the local context and the activities carried out so far. The participatory methodology was left as flexible as possible on purpose, to allow each partner to better fit with the needs and characteristics of each LL. A total of 122 stakeholders (table 9) participated in the fourth workshops of the AG-WaMED project.

Table 9: Gender distribution of participants in the fourth workshops for each LL.

Workshop	Total	male	%	female	%	LL

4	14	9	64	5	36	Egypt
4	22	14	64	8	36	Italy
4	57	42	74	15	26	Spain
4	29	18	62	11	38	Algeria/Tunisia

Table 10 summarizes the main outcomes of the workshops in each LL. While finalizing the activities in the LL for the last months of the AG-WaMED project, each LL also reflected on how to proceed the activities in the future to continue fostering the use of non-conventional waters as a response to water scarcity in the Mediterranean.

Table 10: Summary of the main outputs of the third workshops for each LL.

Fourth workshop	**Italian LL**	**Spanish LL**	**Egyptian**	**Tunisian/Algerian**
Main topics	Discuss measures of the IWMP and their actualization	Update on modelling activities, present WMP and discuss future strategies	Finalize and agree the Watershed Management plan, as well as their suggestion about the priorities of implementing different activities	Presentation of updated IWMP, modelling updates (MODFLOW & SWAT), discussion of implementation pathways and future strategy
Feedback from stakeholders	Most of the measures proposed in the plan are interesting and useful, but it is important to show practical examples and start to put into practice the knowledge that already exists.	Interested in the analysis of operating rules of the water transfer, agreed with the water management plan measures, but warned that financial issues are a risk.	The management plan is suitable for the study site, and the participants are willing to support its implementation. The put stress on the availability of financial aids to carry out different activities	Participants valued use of modelling tools, supported inclusion of NCW solutions. Emphasis was placed on the need for support to implement selected measures. Concerns about institutional coordination.
Future of the LL	Continue the activities considering the LL in a case study in new research projects	Although the outlook is bleak due to reduction of water availability, there is a strong commitment to continue working on these issues	The LL is set and ready to implement different activities to increase water availability, and combat climate chage	Participants showed interest to continue collaboration. Plans to seek funding and partnerships to scale up successful actions.

4. Conclusion

The participatory methodology applied in the AG-WaMED project allowed a significant stakeholder engagement in the four LL. The total number of participants in the four

workshops in the four LL amounted to 412 (Table 11, to be noticed that most participants participated in more than 1 workshop). This huge involvement, added to other means of getting feedback from participants, was crucial to develop the work behind the deliverables of WPs 3, 4 and 5. In all the four LL, we noticed an overrepresentation of males compared to females (Table 11, 12). This is the reason why we add an appendix to this deliverable to investigate the role of women in agriculture in the four LL trying to understand the reasons for their lower participation to the project activities.

Table 11: The participants in the four workshops of the AG-WaMED project.

N workshop	Gender	Algeria/Tunisia	Egypt	Italy	Spain	Total
1st workshop	female	10	1	8	8	27
	male	33	22	10	39	104
	total	43	23	18	47	131
2nd workshop	female	16	6	6	1	29
	male	27	15	15	14	71
	total	43	21	21	15	100
3rd workshop	female	7	5	6	2	20
	male	8	9	15	7	39
	total	15	14	21	9	59
4th workshop	female	11	5	8	15	39
	male	18	9	14	42	83
	total	29	14	22	57	122
Total	female	44	17	28	26	115
	male	86	55	54	102	297
	total	130	72	82	128	412

Table 12: The total number of participants with the share of women participating.

	Algeria/Tunisia	Egypt	Italy	Spain	Total
female	44	17	28	26	115
% total	33.8	23.6	34.1	20.3	27.9
male	86	55	54	102	297
% total	66.2	76.4	65.9	79.7	72.1
total	130	72	82	128	412

5. Appendix

The purpose of this section is to analyze the gender distribution in project activities and to understand its dynamics in light of the initial condition within the four Living Labs.

Stakeholders' analysis and mapping

As mentioned in D2.2.1, stakeholders involved in the project were required to represent "organizations from the water management and climate resilience sectors, as well as representative organizations focused on the natural ecosystem and environment, economic context, and social environment."

During stakeholder engagement, the team considered several factors: each stakeholder's influence over the project, their level of interest, decision-making authority, the extent to which they would be impacted by the project, what they regarded as important in relation to their professional role, and the ways in which they could contribute to project outcomes.

In line with the quintuple helix model, stakeholders were expected to come from the spheres of education, economy, and politics, as well as from media- and culture-based publics and the natural environment.

As previously mentioned, the main topics addressed during the workshops were related to the agricultural and environmental sectors, areas in which the most prominent positions are predominantly held by men across all LL regions. This context made it particularly challenging to identify and recruit female stakeholders, resulting in an imbalanced distribution of women and men during the workshops, as illustrated in Figure A1, which presents the percentage of female participants in each workshop.

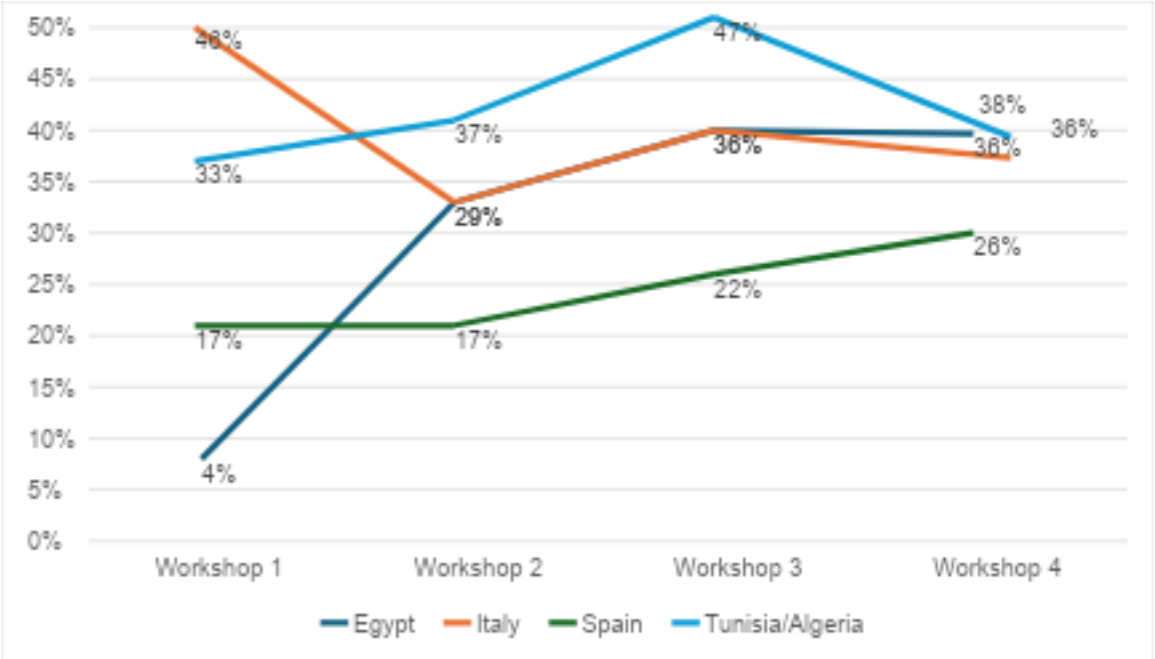

Figure A1: Women's participation in the workshops.

Although the percentage of women never reached 50% of participants in any of the workshops, several noteworthy trends can be highlighted:

- In Egypt, where participation by women was particularly low at the outset (with only one woman attending the first workshop), the dedicated efforts of the project team, such as targeted invitations, resulted in over 30% female representation by the final workshop.
- In Italy, the percentage of women participants consistently remained above 29% throughout all workshops.
- In Spain, while female participation never reached 30%, there was an increase of nearly 10 percentage points between the first and the last workshop.
- In the Tunisia and Algeria LL, the share of female participants was always above 30%, reaching 47% during the third workshop. This marked the highest proportion, even though overall attendance at that session was relatively low, suggesting a greater consistency in female participation. A similar observation can be made for the first workshop in the Italian LL, where women comprised 44% of attendees out of a total of only 18 participants (see Table 11 and 12).

In general, considering 30% as the minimum threshold for gender representation, understood as the critical mass necessary to ensure effective and influential participation in decision-making processes, rather than merely formal inclusion (Beijing Platform for Action, 1995), Spain is the only country that never reached this minimum level in any of the workshops.

Women's Participation: Self-Assessment

At the conclusion of the four workshop cycles, the Living Lab teams were invited to carry out a structured self-assessment on women's participation. This reflective exercise aimed not only to better understand the patterns and quality of women's engagement in each context, but also to stimulate a critical appraisal of gender dynamics during stakeholder involvement. The assessment was coordinated by a gender expert contracted by the University of Florence, and took the form of an online questionnaire addressed to the core project partners responsible for coordinating the activities in each Living Lab.

The questions explored several dimensions, including whether specific actions had been taken to promote women's participation (e.g., targeted invitations, flexible scheduling, support for work-life balance), and whether gender-differentiated needs and priorities were raised either by participants or by the project team in the definition of improved water allocation strategies.

The self-assessment revealed diverse practices and challenges across contexts:

- In Egypt, although discussions were largely focused on technical aspects of water management, and gender-specific needs were not overtly expressed, actions had been taken to engage more women through outreach and tailored invitations. This translated into a marked improvement in female participation over time.

- In Italy, women's and men's views were reportedly accorded equal value, and speakers for the workshops were selected with gender balance in mind. However, the low presence of women in managerial roles (particularly in water and agriculture) remained a barrier.

  Another barrier was identified in the dimension of female-led farms, which are generally smaller than those led by men. Owners of small farms, in fact, reported difficulties in attending the workshops due to their workload. To mitigate this problem, the management plan was shared with small farmers (>10) via mail to receive their feedback.

- In Spain, entrenched gender disparities in management positions (particularly in the water, agriculture, and political sectors) made it particularly difficult to recruit female stakeholders. Female participation never reached the critical threshold of 30%, but the team acknowledged these structural challenges and the regional context, where agriculture is strongly male-dominated.

- In Tunisia and Algeria, gender norms were particularly visible in participatory dynamics. In early workshops, women were often reluctant to speak up, especially when disagreeing with male counterparts. In response, the team adapted its facilitation strategy by arranging face-to-face or separate meetings with women, which helped capture more candid and representative input. These adaptive methods emerged from a growing awareness that equal presence is not always equal participation.

National Gender Statistics in Agriculture and Decision-Making

To offer a deeper, data-driven perspective on gender distribution and dynamics within the AG-WaMED LL, the following section integrates relevant national statistics for Egypt, Italy, Spain, and Tunisia/Algeria. These figures contextualize the project's findings and self-assessment, showing structural challenges and recent trends at both the sectoral and governance levels.

In Egypt, women contribute significantly to agricultural labor, making up about 43% of the sector's workforce (FAO, 2021). Despite this, their roles are overwhelmingly characterized by low visibility and low power. Women are primarily engaged as unpaid or seasonal laborers, with very limited access to land ownership and decision-making positions. In fact, only about 5.2% of agricultural land in Egypt is owned by women, which is below the average for the Arab region (FAO, 2015).

The educational system tells a more optimistic story, with nearly half of graduates in agriculture and related sciences being women (49.4% in 2016) and a significant proportion of graduates in STEM fields (36,9%) (World Bank). However, this progress in formal education is not yet mirrored by professional advancement within the sector. Deeply ingrained cultural norms, legal barriers, and practices often prevent the effective implementation of gender equality laws and hinder meaningful participation of women in strategic and decision-making roles. This disconnect between qualification and influence suggests that closing the gender gap in Egyptian agriculture will require targeted policy and social change in addition to educational opportunity (Tag, 2024).

Italy presents a case of gradual but steady progress. In 2016, women made up about 30% of the agricultural workforce, and 31.5% of farm managers (ISTAT, 2022), reflecting a slow but measurable climb from 30.7% a decade earlier (Corsi et al., 2024). However, the reality beneath these figures is nuanced. Female farm managers typically oversee smaller holdings (on average, 7.7 hectares compared to 12 hectares managed by men) (ISTAT, 2022).

Despite some improvements, women are still a distinct minority in managerial and high-level decision-making positions, both in the agricultural sector and in water management structures. These patterns persist despite Italy's relatively high level of female parliamentary representation (36.3%) *(Inter-Parliamentary Union)*, suggesting that while gender equity in politics has seen meaningful gains, structural barriers remain entrenched in specific economic sectors, particularly agriculture.

Spain's gender distribution in agriculture is shaped by a complex interplay of historical and social factors. Women hold 29% of farm management positions (a notable increase from 22% in 2009), reflecting progress prompted by policy interventions and public awareness campaigns. Yet, the sector remains highly masculinized, especially in certain regions, which restricts both recruitment and advancement opportunities for women. In the Murcia region, women manage just 25% of all farms (CaixaBank Research, 2023).

Leadership roles in agri-food cooperatives are male-dominated, with women holding just under a third of these posts. Despite an impressive rate of female representation in the national parliament (44.6%) (Inter-Parliamentary Union), the translation of such political gains into sectoral leadership is still limited. Cultural expectations and structural practices in rural areas continue to constrain women's access to both land and leadership.

In Tunisia, the absence of sex-disaggregated data remains a major obstacle to fully understanding the specific roles and contributions of women in the agricultural sector (Najjar et al., 2019). Nonetheless, insights from the gender survey in Najjar's study highlight that rural women tend to work longer hours than men, frequently balancing a range of paid and unpaid tasks across agricultural, domestic, and community spheres.

The challenge deepens when considering land ownership with only 6% of agricultural land held by women, and access to critical resources like credit, technology, and leadership positions within cooperatives remains highly unequal (Najjar et al., 2019).

Though legislative reforms and policy initiatives abound, and Tunisia boasts one of the highest shares of women in national parliamentary seats in the MENA region (33.6%), these advances are slow to filter down to local and sectoral governance. In both Tunisia and Algeria, strong gendered norms still regulate women's participation in public life and decision-making, particularly in rural areas, where spousal permission may be required for women to engage in professional opportunities. The persistence of such social norms continues to shape the lived experience of women, challenging efforts toward full and equitable participation across all levels of the agricultural and water management sectors.

In Algeria, approximately 7.3% to 7.5% of agricultural holdings are headed by women, usually managing plots ranging from 1 to 5 hectares. Cultural expectations and male dominance in rural contexts discourage women from pursuing larger or commercial farming activities (Arab Land Initiative, 2024).

Tunisia and Algeria report notably high percentages of female graduates in STEM fields yet fail to achieve corresponding gender parity in the labor market. For example, in 2018, women made up 54.4% of STEM graduates in Tunisia and 58.2% in Algeria (World Bank). These rates are among the highest globally and far exceed those found in many wealthier, more gender-equal societies.

However, this strong representation of women in STEM education does not translate into equal employment opportunities or outcomes. In both Tunisia and Algeria, female STEM graduates encounter significant barriers during the transition to work: labor force participation among educated women remains low, and unemployment rates for women, particularly in STEM and technical fields are substantially higher than for men *(Ahmaid, 2021)*.

Across the four countries analyzed, the availability of sex-disaggregated data for managerial roles in the water sector remains extremely scarce. Reliable figures are available only for Italy and Spain, while most North African contexts lack systematic or recent data due to limited gender-sensitive monitoring frameworks.

In Italy, recent sectoral breakdowns indicate women occupy about 24% of top management positions (including CEOs) and rising shares in senior management (34%), though the water sector (grouped with electricity and gas) ranks among the lowest for female representation (Rome Business School, 2024).

In Spain, studies and company surveys reveal women's representation in management within the water sector typically ranges from 21% to 28% (Barmatec, n.d.).

For Tunisia, Algeria and Egypt, robust, gender-disaggregated managerial data are not available at national level. Government and international agency reports highlight that the absence of such data is itself a major barrier to monitoring and advancing gender equality in the water sector (FAO, 2014).

References

Ahmaid, I. (2021). *What stands behind the balanced ratio of male/female students in the Algerian STEM education despite the country's low gender equity?* (Master's thesis, University of Agder, Department of Global Development and Planning). University of Agder Repository. Retrieved July, 2025, from https://uia.brage.unit.no/uia-xmlui/handle/11250/2828260

Arab Land Initiative. (2024, agosto). Algeria Land Sector – Snapshot. Arab Region Programme on Good Land Governance. Retrieved July, 2025, from https://arablandinitiative.gltn.net/sites/default/files/2024-08/docs/algeria-land-sector-snapshot.pdf

Barmatec. (n.d.). *Important role of women in the water sector – past, present and future*. Smart Water Magazine. Retrieved July, 2025, from https://smartwatermagazine.com/news/barmatec/important-role-women-water-sector-past-present-and-future

CaixaBank Research. (2023, 18 ottobre). *What does the latest agricultural census tell us about Spanish farms?* CaixaBank Research. Retrieved July, 2025, from https://www.caixabankresearch.com/en/sectoral-analysis/agrifood/what-does-latest-agricultural-census-tell-us-about-spanish-farms

Corsi, A., & Misuraca, R. (2024). *The production gender gap among Italian farm operators* (Working Paper 202409). Department of Economics and Statistics Cognetti de Martiis, University of Turin.

European Parliament, Policy Department for Citizens' Rights and Constitutional Affairs. (2019, May). *The professional status of rural women in the EU* (Study No. PE 608.868). Publications Office of the European Union. Retrieved July, 2025, from https://www.europarl.europa.eu/RegData/etudes/STUD/2019/608868/IPOL_STU(2019)608868_EN.pdf

Food and Agriculture Organization of the United Nations (FAO). (2014). *Le rôle des femmes dans la gestion des ressources en eau en général et de l'eau agricole en particulier* (Phase 1). AQUASTAT, FAO. Retrieved July, 2025, from https://openknowledge.fao.org/server/api/core/bitstreams/600bea31-d6b0-4d7e-bd2b-e49c607d3de6/content

FAO (2015) *Country Gender Assessment of the Agriculture and Rural Sector: Egypt*. Rome: Food and Agriculture Organization.

FAO (2021) *Country Gender Assessment of the Agriculture and Rural Sector: Egypt* (CGA-ARS). FAO. https://doi.org/10.4060/cb7438en

Inter-Parliamentary Union. (n.d.). *Parline: The IPU's open data platform on national parliaments*. Retrieved July, 2025, from https://data.ipu.org/

Istituto Nazionale di Statistica (2022). Le donne nell'agricoltura Italiana. ISTAT. Retrieved July, 2025, from https://www.istat.it/.../censimento_agricoltura_manzi.pdf

Najjar, D., Oueslati, D., Benghanem, H., Werner, J., & Baruah, B. (2019, December). *Gender and agriculture in Tunisia: A brief country report*. International Center for Agricultural Research in the Dry Areas (ICARDA) / CGIAR. Retrieved July, 2025, from MEL-CGIAR repository

Rome Business School. (2024, 12 febbraio). *Gender Gap and Work in Italy*. Rome Business School Blog. Retrieved July 2025, from https://romebusinessschool.com/blog/gender-gap-and-work-in-italy/

Tag, N. (2024, July 15). *Gender bias has an impact on women's participation in Egypt's STEM sector*. Egyptian Streets. Retrieved July, 2025, from https://egyptianstreets.com/2024/07/15/gender-bias-has-an-impact-on-womens-participation-in-egypts-stem-sector/

World Bank. (n.d.). *Female share of graduates, World Bank Gender Data Portal*. Retrieved July, 2025, from https://genderdata.worldbank.org/en/indicator/se-ter-grad-fe-zs