



# PRIMA

PARTNERSHIP FOR RESEARCH AND INNOVATION  
IN THE MEDITERRANEAN AREA

Strategic Research and Innovation Agenda







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2018/2028

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This document has been prepared within the 4PRIMA CSA by a task force composed by Representatives of the Tunisian Ministry of Higher Education and Scientific Research, of the Spanish Ministry of Economy, Industry and Competitiveness, of the French Research National Agency, of the Moroccan Ministry of Higher Education, Scientific Research and Professional Training, Direction of Technology and of the Italian Ministry of Education, University and Research. This document also takes in consideration contributions provided through web consultation and stakeholder fora organised in the frame of the 4PRIMA project.

The valuable contributions from all the members of the PRIMA General Assembly are acknowledged.

A stylized leaf logo consisting of a central stem with several leaves and three pointed shapes at the top, all in a light gray color. The logo is positioned on the left side of the page, partially overlapping a large, light gray circular arc that spans across the middle of the page.

**This publication reflects the consensus reached by the General Assembly of the Partnership for Research and Innovation in the Mediterranean Area (PRIMA).**


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# FOREWORD





Environmental and social changes are deeply affecting Euro-Mediterranean agro-food systems and water resources. Unsustainable agricultural practices, lack of water, over exploitation of natural resources, new lifestyle behaviours (diet, physical activity and socio-cultural) and low profitability of smallholders are challenging the sustainable and healthy development of the Region, with major impacts on our societies.

Over the last years, growing awareness of the challenges related to agro-food systems and water resources in the Mediterranean area have induced EU member states and Southern and Eastern Mediterranean Countries (SEMCs) to work together on several common research initiatives. These initiatives have achieved important results, allowing the creation of a strong network of excellent scientists from both shores of the Mediterranean with a diverse background and reinforcing mutual trust among Countries. Good examples of these initiatives include ARIMNET and ERANETMED, showing effective North-South co-funding, co-decision and coownership.

The increased complexity and multidimensionality of social, economic and environmental implications of agro-food systems and water resources challenges, however, have made policymakers, researchers and stakeholders aware that a more integrated approach to research and innovation has to be adopted in order to effectively tackle Mediterranean challenges.

The strategic value of increasing integration among Euro-Mediterranean and national research programmes and the need for greater investments in research and innovation in the Mediterranean basin were clearly recognized also by the Euro-Mediterranean Conference held in Barcelona in 2012. The Conference, in particular, affirmed the political will to better integrate research and innovation in the Euro-Mediterranean area through a co-designed, co-financed and co-owned EU-SEMCs Joint Programme on commonly agreed topics of mutual interest. On that occasion, the EC suggested the need for an initiative based on Article 185 of the Treaty on the Functioning of the EU (TFEU), in order to define a long-term, strategic and integrated Research and Innovation Programme focused on the implementation of a common strategic agenda and the alignment of the relevant National R&I programmes.

It is within this political context that PRIMA - Partnership for Research and Innovation in the Mediterranean Area - moved its first steps with the general objective "to build research and innovation capacities and to develop knowledge and common innovative solutions for water management and provision and agro-food systems in the Mediterranean region, to make them more climate resilient, efficient, cost effective and sustainable and to contribute to solving water scarcity, food security, nutrition and physical activity, health, well-being and migration problem upstream".

After five years of intense work and thanks to a strong political and technical commitment by all Participating States and EU Institutions, the Initiative is being launched.

PRIMA is built around a common Strategic Research and Innovation Agenda (SRIA), at the basis of its Work Plans and its calls, which will start early 2018.

The PRIMA SRIA is the output of a process encompassing the collection of inputs coming from a wide range of sources, analysis, workshops, stakeholder events involving experts and multiple stakeholders coming from all sectors of society. An on-line public consultation was also carried out during May and June 2017 and a total 861 replies were received from 28 countries. In general, there was a strong support with the present research and innovation needs analysis; as 90% of those who expressed their opinion 80% of the replies considered that this PRIMA SRIA well identifies the most important Mediterranean challenges. Several inputs received during the public open consultation were included in this document.

In the SRIA it clearly emerges that PRIMA's aim is to promote excellent research, to define solutions supporting communities, consumers and enterprises able to deal with challenges in the water and agro-food sectors, and to build cooperation among researchers and innovators. PRIMA would like to contribute to the creation of bridges between the two shores of the Mediterranean.

The SRIA was presented in May 2017 on the occasion of the Malta Euro-Mediterranean Conference, attended by political representatives of Participating States, experts and stakeholder of the whole Region and be endorsed by the Euro-Mediterranean Group of Senior Officials in Research and Innovation in November 2017. This important opportunity highlights the value of PRIMA also in terms of scientific diplomacy.

The SRIA will guide all the actors involved in PRIMA towards the implementation of the Initiative. It will represent the cornerstone in the process of strengthening Research and Innovation efforts, with the final aim of improving health and livelihoods of European and Mediterranean citizens, encouraging economic growth, and inducing more sustainable societies and stability in the Mediterranean area.

**Khaled El-Shuraydeh and Angelo Riccaboni**  
Chairs of PRIMA Consortium





# 1

## Executive Summary

### Who we are

The Partnership for Research and Innovation in the Mediterranean Area (PRIMA) is an Initiative launched by 19 Euro-Mediterranean Countries, including 11 EU States (Croatia, Cyprus, France, Germany, Greece, Italy, Luxembourg, Malta, Portugal, Slovenia and Spain) and 8 non-EU countries (Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Tunisia and Turkey) to participate in a EU joint research and innovation programme.

PRIMA can also count on a number of other countries (including Czech Republic, and Romania) that are already participating in its activities. This strongly structured and long-term committed partnership is working to enlarge the initiative to other interested Countries.

In the legal framework of art. 185 of the Treaty on the Functioning of the European Union (TFUE) this ambitious initiative is set up to build research and innovation capacities and to develop knowledge and common innovative solutions for water management and agro-food systems on both shores of the Mediterranean, inspired by principles of co-ownership, mutual interest and shared benefits across the Mediterranean basin.

### What we do

The Strategic Research and Innovation Agenda aims to set the technical and scientific basis for developing knowledge and common innovative solutions for water management and agro-food systems in the Mediterranean basin. **Three thematic areas** are identified in this framework:



#### MANAGEMENT OF WATER

Integrated and sustainable management of water for arid and semi-arid Mediterranean areas



#### FARMING SYSTEMS

Sustainable farming systems under Mediterranean environmental constraints



#### AGRO-FOOD VALUE CHAIN

Sustainable Mediterranean agro-food value chain for regional and local development.



These three areas, each with specific priorities and thematic/operational objectives, are mutually intercepted and cross-fertilized. Cross-cutting themes that, transversely influence and emerge from the three areas, are identified, explored and developed. Soil sustainability, food security and socio-economic development are included as specific transversal topical areas of research. In addition, cross-cutting technologies and approaches such as ICT and capacity building will be specifically considered. This reveals the strong nexus between sustainable management of water resources, farming systems and agro-food value chains and is the starting point from which further synergies and deeper integration can be achieved.

PRIMA research and innovation activities are underpinned by a strong commitment to national, regional and international networking and are open to combined action, collaboration and synergies among researchers, governmental agencies and private stakeholders. The strategic goal is strengthening innovation capacity, aligning national programmes and critical mass engagement within PRIMA participating countries.

## Where we go

Today's strategy will drive tomorrow's solutions. Research and Innovation are expected to address immediate problems, while at the same time anticipating future needs. Agro-food system and water management areas are not exclusive.

This combined inter-sectorial approach paves the way for strategic long-term expected outcomes, such as knowledge-based job creation, stronger Euro-Mediterranean cooperation, business development and implementation of Agenda 2030 for Sustainable Development.

In line with implementation of Agenda 2030, the Programme will shape an integrated regional system, where sustainable infrastructures are built view to the promoting the well-being and inclusive socio-economic development of Mediterranean society. In this sense, it is the intention of PRIMA to provide opportunities to build stronger bridges and knowledge flows across the Mediterranean shores. More in the long-term, this should help re-inforce social and economic cooperation between Europe and all of Africa and the Middle East.

## 2

# Challenges in the Mediterranean Area: at a glance

Mediterranean countries share a number of challenges related to geographical and physical features, that make productivity of agricultural and natural ecosystems vulnerable to climate change. Growing competition for freshwater resources for different users and uses is also jeopardizing agricultural productivity and increasing the already high pressure on surface and underground Mediterranean water bodies.



### Climate change

The Mediterranean is one of the most vulnerable regions to climate change and is predicted to become even warmer and drier than it already is. The main effects are regional water shortages, with major impacts on the water quality of surface and underground water bodies and their related ecosystems, agriculture and food security, soils sustainability and crop yields thus reducing the fertile surface area available for food production.

“ Forecasts indicate a Mediterranean temperature increase between 2 and 4°C and a decrease in rainfall between 4% and 30% by 2050. IPCC, 2013<sup>1</sup> ”

Since, as Mediterranean agricultural production covers almost 40% of arable land and since climate considerably affects crop growth cycles, significant climate change will inevitably have serious effects on the economies of countries in which agriculture is the primary sector.

Pressure on water resources will continue to increase with the serious risk of salinization and desertification of large Mediterranean areas.

This is particularly relevant because the difficulties involved in restoring ecosystems productivity once desertification process are initiated.

In the mid-term, adaptation strategies will have to be implemented, but more in the long-term, regional specific plans for mitigating the climate change effects will have to be jointly defined for the entire Mediterranean region under the guidelines of the major global initiatives.

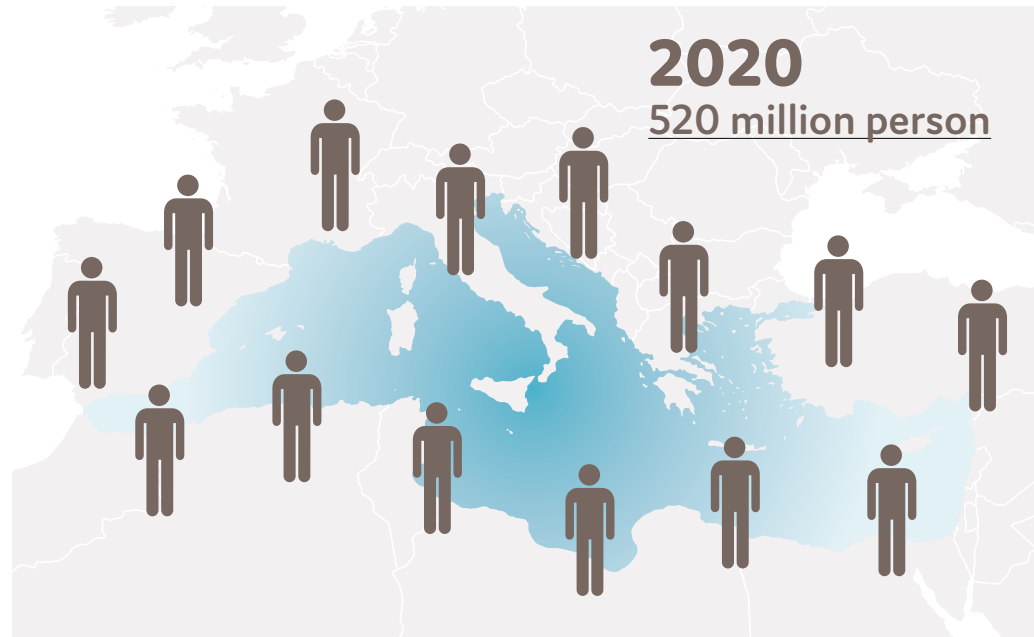




## Population growth and food security

Due to demographic growth, there will be some 520 million persons to feed in the region by 2020 (CIHEAM, 2015)<sup>2</sup>. Mediterranean agriculture is globally less and less able to provide sufficient food for its population. This is particularly crucial on southern shores, where the demographic trend is fast increasing. Several Euro-Mediterranean countries and territories are also relying more and more on international markets to meet basic food needs for their citizens. In the Mediterranean Area, achieving a greater food security (harvest, production, processing and packaging) is by now a major issue for economic, social and political stability.

“ The Mediterranean population has grown by 10% in the last ten years, and is expected to grow by about 7% in the next ten years, reaching 560 million people in 2030. CIHEAM, 2015<sup>3</sup> ”



## Water scarcity and overexploitation of natural resources

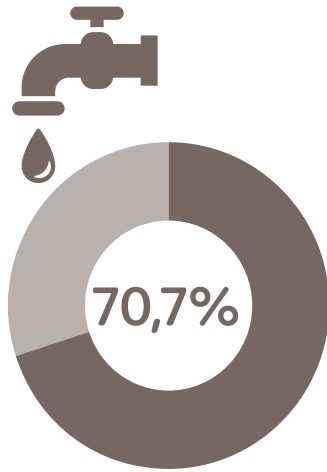
Mediterranean water resources are limited and often of low quality, fragile and unevenly distributed in space and time. Developing tourism, industry and irrigated land are putting pressure on water resources by generating competition for water between agriculture, drinking water and other uses (such as tourist-related activities). Under the arid and semi-arid conditions of the Mediterranean basin, the various forms of land degradation, particularly erosion and salinization, are sharply felt.

“ While water availability in the region has been declining steadily since the late 1950s, water demand has doubled during the second half of the twentieth century to reach 280 billion m<sup>3</sup> per year for all riparian countries in 2005. UNEP/MAP/Plan Bleu, 2008<sup>4</sup> ”

Agriculture is the main water-consuming sector, being responsible for about 70.7% of freshwater withdrawals, accounting for 45% in the North and 82% in South and East and weighs heavily on fertilizer consumption, estimated at 141.3 kg/ha. FAO and CIHEAM, 2015<sup>5</sup> ”



141.3 kg/ha  
fertilizer consumption



**Agriculture is the main water-consuming sector**



## Sustainable Agriculture

Agriculture is a major economic sector in terms of its capacity to generate employment and income for a large fraction of the Mediterranean population. In most southern Mediterranean countries (Morocco, Egypt, Turkey and Tunisia), it is already providing employment for 20 to 30% of the population<sup>6</sup>.

“ Agricultural production in MPCs is typically between 10% and 20% of GDP, compared with 3% in Euro-Mediterranean ones. It accounts for more than 20% of employment on average, compared with 4% in Europe<sup>7</sup>.

”

However, past increases in agricultural production have often been achieved through intensification and heavy reliance on external inputs. It is required to reconcile an economically sustainable agriculture practice with safeguarding the environment and avoiding overexploitation of natural resources.

20-30%



employment of the population in southern Mediterranean countries





## Agro-biodiversity loss

The genetic diversification of food crops and animal breeds (agrobiodiversity) is declining rapidly. Many local varieties are being replaced by a small number of improved non-native varieties. Climate change is expected to speed the loss of agrobiodiversity as certain areas become unsuitable for less tolerant varieties.

“ The Mediterranean basin is recognised as a biodiversity hotspot: its flora diversity has an outstanding 15,000 to 25,000 species, 60% of which are unique to the region<sup>8</sup>. It is estimated that only 10% of the crop varieties cultivated in the past are still being farmed<sup>9</sup>.

About 18% of Mediterranean species are threatened with extinction, and it is estimated that only 5% of the original vegetation remains relatively intact in the Mediterranean region.

FAO, 2013<sup>10</sup> ”



18%  
of Mediterranean species  
are threatened with  
extinction



## Reinforcing Mediterranean lifestyle: diet, physical activity, socio-cultural

“ Data show high levels of excess weight and obesity in most of the countries. In Egypt, up to 74%-86% in women and 69%-77% in men are overweight.<sup>11</sup>

Overweight and obesity rates in Mediterranean countries continue to rise.

WHO, 2011<sup>12</sup>

The prevalence of inactivity in Egypt among young population is around 85%.

WHO, 2014<sup>13</sup>

Thus, changes in lifestyle behaviours such as nutrition and diet are urgently needed to.

WHO, 2017<sup>14</sup> ”

Many countries in the Mediterranean area are in fact deviating from Mediterranean lifestyle. This is due to changes in behaviours, urbanization and development of food chain based on imported raw materials that have led to a change in food diets and inactivity. This has led to growing of rates in chronic diseases related with unhealthy diet and insufficient physical activity.

### overweight

74-86% women  
69-77% men



## Mediterranean agro-food value chains

Mediterranean agro-food value chains suffer from inappropriate logistic infrastructure, and a lack of safety, quality and traceability standards. Supply irregularity, low rates of innovation and management, and poor marketing and communication skills make difficult for businesses (especially SMEs) to meet consumer requirements. This renders local products uncompetitive with respect to imported products, creating dependence on international markets. Improved food processing, including innovative packaging, could make local products more competitive and create new trade opportunities.

“ In developing countries, 40% of food losses occur at the post-harvest and processing level, while in industrialized countries more than 40% of the losses occur at the retail and consumer level.   
FAO, 2011<sup>15</sup>

Agricultural and food imports into the Mediterranean area have increased dramatically in recent decades. Imported cereals have doubled in the last 20 years.   
FAO and CIHEAM, 2015<sup>16</sup> ”



Together these issues constitute a key cause of instability and internal as well as external **migration**: farming families move to cities and part of the population migrates, especially towards Europe.





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Note:

<sup>1</sup> IPCC 5<sup>th</sup> Assessment Report (2013) "The Physical Science Basis". Available online at: <https://www.ipcc.ch/report/ar5/wg1/>

<sup>2</sup> CIHEAM (2015), "Statistical review 2015". Available online at: [http://www.ciheam.org/en/data/2015\\_statistical\\_review](http://www.ciheam.org/en/data/2015_statistical_review)

<sup>3</sup> CIHEAM (2015), "Statistical review 2015". Available online at: [http://www.ciheam.org/en/data/2015\\_statistical\\_review](http://www.ciheam.org/en/data/2015_statistical_review)

<sup>4</sup> FAO and CIHEAM (2015) "Mediterranean food consumption patterns Diet, environment, society, economy and health". Available online at: <http://www.fao.org/3/a-i4358e.pdf>

<sup>5</sup> FAO and CIHEAM (2015) "Mediterranean food consumption patterns Diet, environment, society, economy and health". Available online at: <http://www.fao.org/3/a-i4358e.pdf>

<sup>6</sup> FAO and European Bank for Reconstruction and Development (2015) "Key trends in the agrifood sector - Egypt, Jordan, Morocco and Tunisia". Available online at: <http://www.fao.org/3/a-i4897e.pdf>

<sup>7</sup> Impact Assessment Research Centre and Institute for Development Policy and Management (2005), "The evolving economic, social and environmental conditions in Mediterranean partner countries".

Available online at: [http://trade.ec.europa.eu/doclib/docs/2010/april/tradoc\\_146106.pdf](http://trade.ec.europa.eu/doclib/docs/2010/april/tradoc_146106.pdf)

<sup>8</sup> IUCN (2008) "The Mediterranean: a biodiversity hotspot under threat". Available online at:

[https://cmsdata.iucn.org/downloads/the\\_mediterranean\\_a\\_biodiversity\\_hotspot\\_under\\_threat\\_factsheet\\_en.pdf](https://cmsdata.iucn.org/downloads/the_mediterranean_a_biodiversity_hotspot_under_threat_factsheet_en.pdf)

<sup>9</sup> Millstone, E. and Lang, T. (2008) "The atlas of food". Second edition. London, Earthscan.

<sup>10</sup> FAO (2013) "The state of Mediterranean forests 2013". Rome.

<sup>11</sup> <http://www.emro.who.int/health-topics/obesity/>

<sup>12</sup> WHO (2011), "Non communicable diseases country profiles 2011. Global report". Available online at:

[http://www.who.int/nmh/publications/ncd\\_profiles2011/en/](http://www.who.int/nmh/publications/ncd_profiles2011/en/)

<sup>13</sup> WHO Database data 2014

<sup>14</sup> WHO Database data 2017

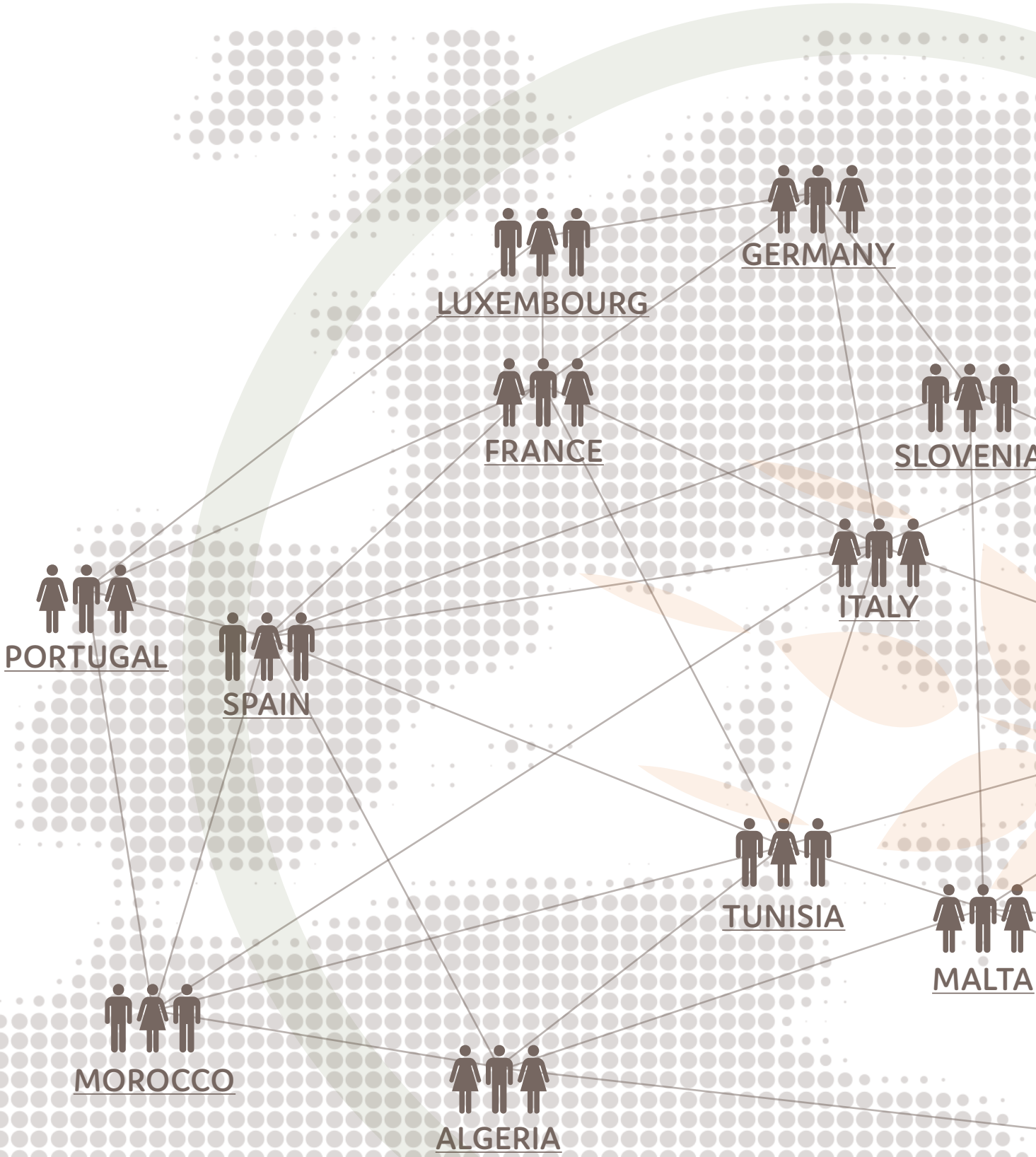
<sup>15</sup> FAO (2011) "Global food losses and food waste. Extent, causes and prevention". Rome.

<sup>16</sup> FAO and CIHEAM (2015) "Mediterranean food consumption patterns Diet, environment, society, economy and health".

Available online at: <http://www.fao.org/3/a-i4358e.pdf>

# 3

## Overview of PRIMA

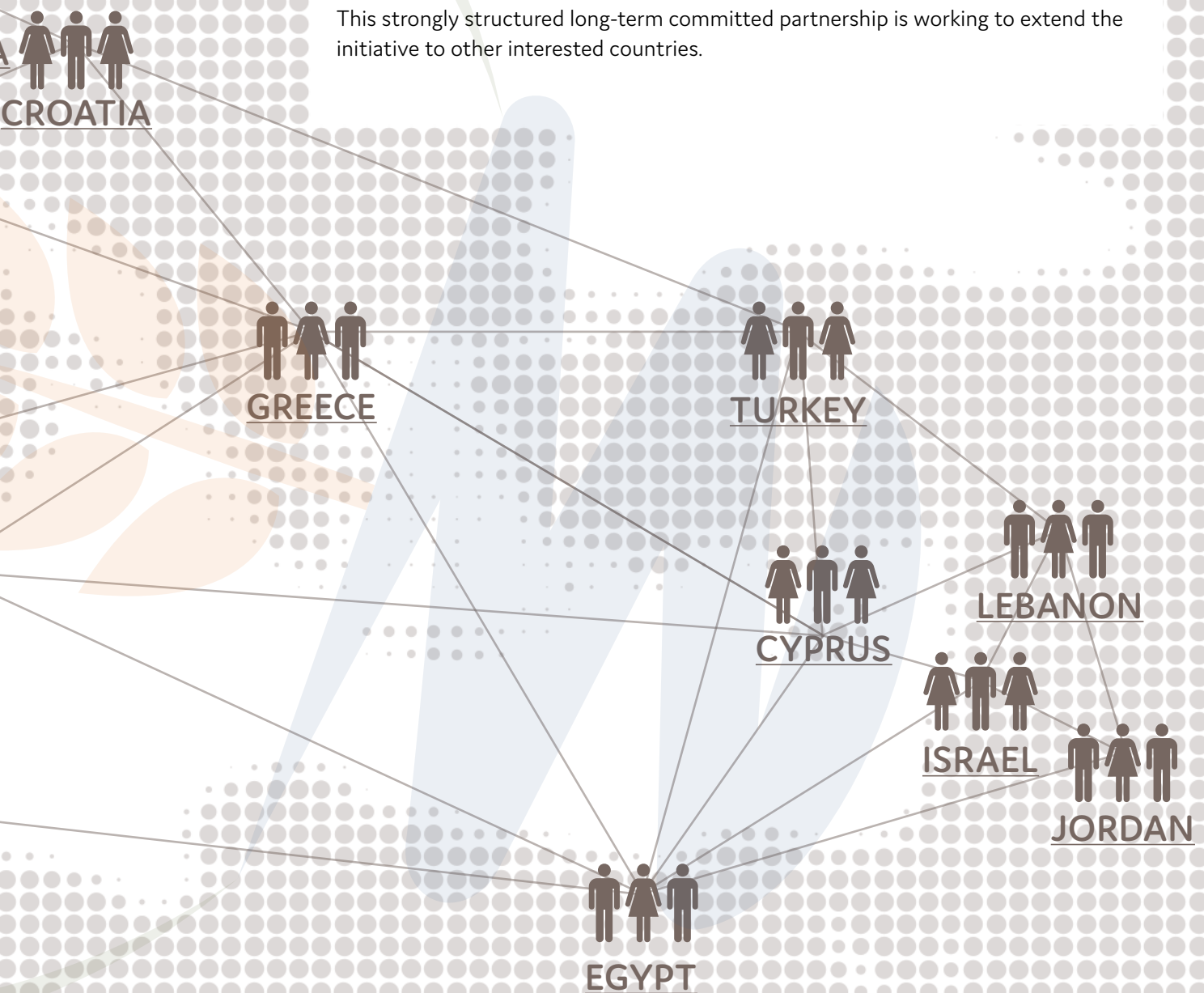


Launched as an immediate follow-up to the 2012 Barcelona Euro-Mediterranean Conference, the Partnership for Research and Innovation in the Mediterranean Area (PRIMA) is a Public-Public Partnership in research and innovation in the Mediterranean area in line with the principles of co-ownership, mutual interest and shared benefits.

The PRIMA initiative acts under the legal framework of Article 185 of the Treaty of the Functioning of the European Union, allowing EU participation in research programmes undertaken by the EU and Associated Member States in a framework of complete integration and alignment of national research policies at scientific, management and financial level on specific topics identified in a strategic and long-term perspective. In order put its programme into effect, PRIMA operates through an Implementation Structure in Barcelona, in charge of managing the initiative and implementing a common integrated long-lasting strategic research and innovation agenda.

PRIMA can currently count on the participation of 19 Euro-Mediterranean countries, including 11 EU-countries (Croatia, Cyprus, France, Germany, Greece, Italy, Luxembourg, Malta, Portugal, Slovenia and Spain) and 8 non-EU countries (Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Tunisia, Turkey).

This strongly structured long-term committed partnership is working to extend the initiative to other interested countries.



# 4

## Vision and Objectives

### “ Vision

**Inclusive, healthy and prosperous Mediterranean societies through innovative solutions in agro-food and water systems, contributing, by the end of the programme, to sustainable use of natural resources, economic growth and stability.**

Natural resources within Mediterranean agro-food and water systems managed in an integrated and sustainable way, in line with the objectives set by Agenda 2030 for Sustainable Development;

Mediterranean agro-food value chains enhancing development and competitiveness of business actors, creating employment and generating sustainable growth while maintaining and restoring ecosystem services under current and future climate change;

All Mediterranean populations having access to healthy, safe and affordable agro-food products.

### Mission

To achieve, support and promote integration, alignment and joint implementation of national R&I programmes under a common research and innovation strategy to address the diverse challenges in water scarcity, agriculture, food security. ”



INNOVATIVE SOLUTIONS FOR  
WATER MANAGEMENT,  
FARMING SYSTEM  
AND AGRO-FOOD VALUE CHAIN



ECONOMIC GROWTH  
COMPETITIVENESS



DIET/HEALTH/WELL-BEING



MIGRATION

### 4.1 General goals

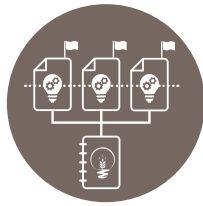
The general objectives of PRIMA are to build research and innovation capacities and to develop knowledge and common innovative solutions for agro-food systems, to make them sustainable, and for integrated water provision and management in the Mediterranean area, to make those systems and that provision and management more climate resilient, efficient, cost-effective and environmentally and socially sustainable, and to contribute to solving water scarcity, food security, nutrition, health, well-being and migration problems upstream.

The development of **innovative solutions** will improve the efficiency and sustainability of agro-food production and processing systems and water provision in the Mediterranean basin, and stimulate a more sustainable and competitive industry, able to promote good health and lifestyles, well-being and economic growth.

PRIMA addresses key priorities identified through the EU's Research and Innovation policy dialogue with countries of the Southern Neighbourhood and constitutes a milestone towards creation of a Common Knowledge and Innovation Space (CKIS) and development of a Common Mediterranean Research and Innovation Agenda.

## 4.2 Specific objectives

In order to contribute to the general objective, PRIMA shall fulfill the following **specific objectives**:



### **ALIGNMENT OF NATIONAL R&I PROGRAMMES**

Orientation of relevant national research and innovation programmes towards the implementation of the strategic agenda.



### **CRITICAL MASS OF ACTORS AND RESOURCES**

Involvement of all relevant public and private sector actors in implementing the strategic agenda by pooling knowledge and financial resources to achieve the necessary critical mass.



### **STRENGTHENING R&I CAPACITIES**

Strengthening of the research and innovation funding capacities and of the implementation capabilities of all actors involved including SMEs, academia, non-governmental organisations and local research centres.



## 4.3 Thematic areas

PRIMA identified **8 operational objectives** grouped under **3 thematic areas**, which constitute the backbone of the PRIMA Strategic Research and Innovation Agenda.

The three areas will focus on:



### MANAGEMENT OF WATER

Integrated and sustainable management of water for arid and semi-arid Mediterranean areas



### FARMING SYSTEMS

Sustainable farming systems under Mediterranean environmental constraints



### AGRO-FOOD VALUE CHAIN

Sustainable Mediterranean agro-food value chain for regional and local development.

While specific areas of activities are suggested under each of these thematic areas, PRIMA will promote research and innovation actions addressing the entire agro-food chain and its links with water as an input for agriculture and food production but also as a crucial element for ecosystem function and restoration. Under this approach, PRIMA recognizes the strong nexus between sustainable management of water and food production and processing, considering additional inputs such as soils and energy because of their importance in the Mediterranean agro-food scenario. PRIMA will address the NEXUS between these issues through specific actions and dedicated calls for research proposals oriented to reinforce the circular economy aspects related to water reuse and waste management and valorisation as well as potential environmental externalities derived from agriculture and food production.

To maximize its impact, PRIMA has identified strategically important areas of research and innovation (Priorities) in each thematic area, aiming to meet the 8 operational objectives.

Representation for PRIMA thematic areas and the cross-cutting nexus among the three main areas of research and innovation.



## 4.3.1 Thematic Area 1



### MANAGEMENT OF WATER

Integrated and sustainable management of water  
for arid and semi-arid Mediterranean areas

In order to achieve a sustainable water management we require 1) a better understanding of the processes affecting the water cycle including the water needs to sustain functional ecosystems, 2) implementation of technical and water governance solutions to improve resilience to water scarcity conditions, optimizing both crop selection and water use efficiency throughout the production chain, taking also into account the water-energy nexus and 3) definition of new possibilities for increasing water availability and sustainable wastewater management, thus reinforcing water circularity and exploiting nonconventional new water resources.

More specifically, this thematic area aims to help secure water availability in terms of quality and quantity, as well as to improve wastewater management. The goal is developing innovative and energy efficient solutions promoting their application to increase the efficiency and sustainability of water provision in Euro-Mediterranean societies, providing environmental benefits and economic growth in the area and contributing to inclusive sustainable healthy growth.

In this perspective, the present thematic area will focus on **4 priorities**:

#### **1 Water resources availability and quality within catchments and aquifers**

The challenges now faced by water planners calls for integrated water resource management. A crucial component is an understanding of the overall catchment water balance, abstraction volumes of different users and recharge of natural and manmade water bodies. There is a need for catchment and aquifer management models that addresses the broad impacts of global changes on rainfall patterns, aquifer storage and depletion trajectory management, groundwater-dependent ecosystems, seawater intrusion and salinization, anthropogenic and geogenic contamination of the whole water cycle, and long-term sustainability. Mediterranean surface water bodies, on the other hand, are characterized by intermittent streams. Ephemeral streams convey runoff from mountain headwaters to lowlands and help recharge alluvial aquifers, sustain water resources and provide the same hydrological and ecological functions as perennial streams by moving water and sediments throughout the watershed.

#### **2 Sustainable, integrated water management**

Water sustainability in the Mediterranean region should be ensured through improved technical tools coupled with socio-economic studies to define the limits of water and energy use in certain key regions under present and future global change scenarios. In this sense, it is necessary to recognize water-energy food synergies and balance the potential trade-offs between water and energy-use efficiency. The issue of transboundary cooperation through sound legal and institutional arrangements has to be included in decision tools in certain critical parts of the Mediterranean area.

#### **3 Irrigation technologies and practices**

In the Mediterranean basin, agriculture is by far the main user of water resources, and irrigation is a crucial field practice influencing crop productivity and product quality. In addition, irrigation is a major driver of solute transport in arid and semi-arid environments, having an important role in the potentially negative impacts of improper water management on soil salinization and aquifer pollution. The challenge is therefore to improve irrigation water productivity while minimizing the possible environmental risks associated with irrigation also considering aspects related with the efficient use of energy in pressurized irrigation networks.

#### **4 Use of alternative water resources**

In a scenario where the fresh water available for agriculture and food processing industries is not enough to cover current demand or needs to be reduced to allow for over-exploited freshwater resources to be restored and additional gains in water use efficiency are difficult to achieve, re-using water for multiple purposes is a possible solution. The challenge is to provide end-users with new more economically feasible and energy efficient water treatment technologies and application systems, taking into account the main environmental, socio-economic and legal constraints limiting adoption of these technologies.



Each research priority is linked to at least one PRIMA operational objective.

Table 1

Research and innovation priorities and operational objectives for Thematic Area 1.

OPERATIONAL OBJECTIVE	R&I PRIORITY	EXPECTED OUTPUTS
 <p><b>1/WATER SAVING SOLUTIONS</b></p>	3 + 4	<ul style="list-style-type: none"> <li>✓ Innovative earth observation and ICT tools-based, Decision Support Systems for planning adaptation to global changes and anticipating droughts;</li> <li>✓ Enhanced remote sensing and ICT technologies and devices for assessing water and energy budget;</li> <li>✓ Optimized balance between soil evaporation and plant evapotranspiration to improve plant water status and retention soil-water productivity;</li> <li>✓ Decision support systems based on cost-effective devices and sensors for irrigation under water quality/quantity constraints;</li> <li>✓ Water treatment technology for specific irrigation requirements (e.g., precision irrigation);</li> <li>✓ Water scarcity management supported by forecasting systems that monitor the anthropogenic impact on the integrated water cycle;</li> <li>✓ Decentralized wastewater management systems for long-term sustainability in peri-urban areas.</li> </ul>
 <p><b>2/LAND AND WATER SUSTAINABILITY</b></p>	1 + 2	<ul style="list-style-type: none"> <li>✓ New modelling routines for determining the basic components of the water cycle, including economic, social and technical aspects (e.g. groundwater accumulation and storage);</li> <li>✓ Enhanced knowledge about pollution sources and processes in order to attenuate the impact of anthropogenic activities on water resources availability and quality;</li> <li>✓ Energy efficiency enhanced technologies for wastewater and seawater treatment for unconventional renewable water resource production;</li> <li>✓ Protection of water resources quality from food production activities, i.e. by pollution reduction and remediation, for the sustainable ecosystem functioning;</li> <li>✓ Cost-effective and high-efficiency managed aquifer recharge and retention measures for floodplain re-naturalization;</li> <li>✓ Resources production (desalination and treated wastewater) integrated into water management system, with assessed economic and environmental impacts.</li> </ul>
 <p><b>3/WATER GOVERNANCE SYSTEMS</b></p>	2 + 4	<ul style="list-style-type: none"> <li>✓ Development and review of water rights systems – ensuring allocations for all water users are based on up to date knowledge of the overall water balance, including that needed to sustain ecosystems;</li> </ul>

## 4.3.2 Thematic Area 2



### FARMING SYSTEMS

Sustainable farming systems under Mediterranean environmental constraints

Considering the context of climate change, the scarcity of resources, demographic growth, contamination, desertification, degradation of arable lands and loss of biodiversity, there is an urgent need to invest in improving the productivity, efficiency and sustainability of agricultural farming systems. Mediterranean agriculture is expected to provide products with high added value (economically, nutritionally) and increased product shelf-life in order to cope with progressively more pressing societal needs and environmental constraints, to protect natural resources, and to adapt to climate change.

In this perspective, the present thematic area will focus on **4 priorities**:

#### **1 Adaptation of agriculture to climate change**

Climate change is dramatically impacting the Mediterranean area and solutions need to be found to adapt agricultural practices to rising temperatures, drought and soil salinity, and increasing occurrence of extreme events. This is clearly a challenge that calls for pooling of resources, knowledge and capacities into common programmes. Agriculture is already limited by climate change all around the Mediterranean and this situation is predicted to worsen in the near future, with the northern part of the region experiencing similar conditions to those existing today on the southern shores. Adapting to climate change is therefore a common necessity for Mediterranean agriculture. Genetic and plant breeding is key for this topic, but cropping system diversification, and spatial organisation, as well as diversification of animals are also important for improving resilience to climate change.

#### **2 Developing sustainable and productive agro-ecosystems**

In recent decades a substantial proportion of agriculture in the Mediterranean area has been modernized and intensified by improved farming practices and systems. Improvements have also been achieved in the livestock area. However, yield increases are still insufficient to face the ever-growing food demand. Furthermore, unsustainable intensification of farming practices has often led to pollution, overexploitation of natural areas and resources, loss of fertility of agricultural land, soil erosion, salinization, runoff, and in some cases desertification. Better integration of natural environmental regulation of biotic and abiotic stresses into farming systems, optimization of input use, development of new cropping systems and use of digital technologies could be widely developed in the Mediterranean. To do so, the specificity of Mediterranean ecosystem assets and vulnerabilities must be taken into account and solutions adapted to local conditions must be developed.

#### **3 Preventing emergence of animal and plant diseases**

Mediterranean agriculture is facing a heavy increase in outbreaks of plant and animal diseases. Climate change and trade intensification are concentrating the number of outbreaks and the impact of diseases. Plant and animal diseases and pests cause significant yield losses for fruit, cereal crops, vegetables and animal products and have severe economic and social consequences. When a new disease breaks out, it is usually already too late to find and implement effective solutions. The challenge is to obtain scientific knowledge in order to understand and foresee outbreaks and to develop preventive actions (as for example the genetic structure of populations and the genetic manipulations of pests in order to reduce or eliminate virulence).

#### **4 Developing farming systems able to generate income, to create employment and to contribute to a balanced territorial development**

The potential benefits of agriculture in terms of employment and poverty alleviation should encourage the development of labour-intensive agricultural activities and the design of profitable farming systems for small-scale agriculture with subsequent integration into cooperative forms of aggregation, enabling sustainable and efficient market capacity to be achieved. The growth of rural employment is critical for fighting rural poverty. Potential synergies among activities of the various economic sectors in rural areas and rural/urban synergies should be enhanced.

Each research priority is linked to at least one PRIMA operational objectives.

Table 2

Research and innovation priorities and operational objectives for Thematic Area 2.

OPERATIONAL OBJECTIVE	R&I PRIORITY	EXPECTED OUTPUTS
 <p><b>4/ SMART AND SUSTAINABLE FARMING</b></p>	1 + 2 + 4	<ul style="list-style-type: none"> <li>✓ Improved knowledge of ecology and genetics (plants/ animals/microbiomes), supporting adaptation to Mediterranean environmental constraints and to abiotic/ biotic stresses;</li> <li>✓ New varieties, crops and breeds combining economic and environmental performance and exploiting the spontaneous and domesticated biodiversity of Mediterranean agricultural and animal husbandry systems;</li> <li>✓ Redesigned cropping systems, more resilient to climate uncertainties, based for example on crop associations, agro-forestry, multi-crop rotations, and enhancement of pulses and other leguminous plants;</li> <li>✓ Improvement of livestock and rangeland farming and mixed farming sustainability;</li> <li>✓ Reduced and optimized use of scarce natural resources (water, energy, nutrients) and potentially toxic substances (synthetic pesticides, mineral fertilizers, antibiotics) in agriculture;</li> <li>✓ Enhanced integrated utilization of farm by-products (e.g. by application of new techniques in manure and pasture management and on-farm bio-waste refineries) for fertilization according to circular bio-economy principles;</li> <li>✓ Improved knowledge of soil erosion mechanisms to enhance fertility under conditions of water scarcity and to develop management recommendations for soil conservation;</li> <li>✓ Improved knowledge of the technical, spatial and organizational dynamics of Mediterranean production systems to promote adoption of innovations by farmers also by integrating farmers' knowledge in the innovation process;</li> <li>✓ Novel tools (best practices, decision support system, models, discussion and co-development platforms, ICT, etc.) assisting farmers to improve management in a risky and uncertain environment.</li> </ul>
 <p><b>5/ PESTS AND PATHOGENS IN FARMING</b></p>	3	<ul style="list-style-type: none"> <li>✓ Epidemiological dynamics and modelling of animal and plant diseases; evolutionary biology of pathogen populations and their vectors in the Mediterranean;</li> <li>✓ Integrated pest and disease management solutions, for plant and animal production systems in stressful environments;</li> <li>✓ Knowledge of the role of crop and animal diversity in the design of systems less prone to disease and pests;</li> <li>✓ Novel remote and non-invasive ICT monitoring systems, new diagnostic tools and biocontrol agents, vaccines and innovative therapeutics against disease and infestation.</li> </ul>

### 4.3.3 Thematic Area 3



#### AGRO-FOOD VALUE CHAIN

Sustainable Mediterranean agro-food value chain for regional and local development.

Mediterranean food industries produce and process large quantities of products, often with unique qualities by virtue of Mediterranean natural advantage and local knowledge. They provide added value rural employment and environmental services. However, most of these firms, often of small dimension, operate in an inefficient informal setting with recurrent food safety issues. Integration of small producers into formal supply channels is a major challenge for Mediterranean food systems. Improved supply chain management is needed to link agricultural producers to urban markets, reduce post-harvest losses, and control quality and safety throughout the food chain.

The Mediterranean food processing and packaging industry needs active, intelligent and sustainable food packaging materials combined with flexible packaging technologies to stay competitive on the EU and global market, and to respond to local population nutrition needs. The EU and Mediterranean countries would benefit from cooperation in the area of advanced smart food packing solutions.

Ensuring food security in the Mediterranean also means considering nutrition, as diet-related diseases are an emerging public health issue in this region.

In this perspective, the present thematic area will focus on **4 priorities**:

#### **1** Valorising food products from traditional Mediterranean diet

Mediterranean areas are characterised by traditional food products, inspired by the local cultural heritage, which are the basis of a well-recognized healthy diet. However, life-style changes have led to dietary changes and consumption of lower quality food, poor in essential nutrients and health-promoting bioactive ingredients. In such context, as a remedy, efforts must be directed to improve the accessibility and attractiveness of agro-ecologically sustainable Mediterranean food. Research is needed to develop new products and processes, building on and taking advantage of reliable and detailed information on the nutritional value of traditional recipes, to preserve and even increase the quality of Mediterranean foods. Innovation is transferred in the food value chain by combining improvement of raw material and ingredients composition, better exploiting resilient biodiversity and valorising genotypes and phenotypes richer in health-promoting bioactive compounds, with better use of sustainable production systems and soft processing technologies preserving the content of essential food components. The result will be better nutritional quality of food products, stable nutrient-dense ingredients and products, bioactive enriched extracts and functional ingredients.

#### **2** Food Safety in local food chains

Food safety is a key issue for the Mediterranean agro-food sector. Lack of efficiency and food safety problems are recurrent in Mediterranean agro-food value chains, both regarding upstream suppliers, who struggle to assess the quality of raw materials, and downstream suppliers, who struggle to comply with the increasingly stringent standards of quality, traceability, product homogeneity and supply regularity required by the sector. Research should focus on the elaboration and adoption of innovative solutions aimed at improving quality control in supply chains at local and regional levels in order to ensure food quality and safety throughout the food chain, as well as enhancing links between place of origin, food processing and food quality and safety.

#### **3** Implementation of innovation in the Agro-food chain, promoting higher quality, sustainability and competitiveness, with particular reference to smallholders

Most Mediterranean food firms operate in an inefficient informal setting with recurrent food safety problems. Adoption of technological and organisational innovations for quality and sustainability among Mediterranean firms results to be very low especially with reference to Small and Medium Enterprises (SMEs), which are a significant economic and employment driver in the area. The objective is to integrate small producers into formal supply channels and to improve supply chain management to better link agricultural producers to urban markets and to reduce post-harvest losses while increasing adoption of technological, organisational and cultural innovations, as well as new strategies and business models, with the final goal of enhancing their competitiveness and their contribution to Mediterranean food security.

#### 4 Implications of dietary shifts and sustainable diets for the Med populations and food industry

While the traditional Mediterranean lifestyle composed by three main pillars (Mediterranean diet, physical activity pattern and socio-cultural behaviours) is considered an ideal combination and particularly healthy, the Mediterranean is paradoxically one of the areas of the world where overweight and obesity are most prevalent—a clear sign of lifestyle shift in progress in several modifiable factors: excess consumption of carbohydrates, sugars, saturated fat and salt, lower consumption of fruits, vegetables and fibers; decreased physical activity; loss of Mediterranean traditional socio-cultural habits. The emergence of chronic diseases related with lifestyle such as diet and physical activity (heart disease, cancer, chronic respiratory disease and diabetes) is massive in the Southern and Eastern Mediterranean. The complex relationship between lifestyle and health in the Mediterranean context needs to be understood, as well as the diet and physical activity habits, their heterogeneity and their determinants, and the vulnerability of populations should be addressed. The goal is also to prevent lifestyle-related diseases by raising awareness among both Mediterranean population and policy-makers.

Each research priority is linked to at least one PRIMA operational objectives.

Table 3  
Research and innovation priorities and operational objectives for Thematic Area 3.

OPERATIONAL OBJECTIVE	R&I PRIORITY	EXPECTED OUTPUTS
 <b>6/ NUTRITION AND HEALTH</b>	1 + 4	<ul style="list-style-type: none"> <li>✓ New sustainable healthy Mediterranean diet-based food products and functional ingredients through novel and sustainable processing and preservation technologies;</li> <li>✓ New formulations of recipes, nutritionally adequate and compatible with other dimensions of sustainability;</li> <li>✓ New “naturally” fortified traditional plant varieties and friendly processed food products;</li> <li>✓ New norms and standards on hazards, risk assessment and essential quality requirements;</li> <li>✓ Nutrigenomics, nutrimetabolomics and exerdiomics studies to identify the genetic and phenotypic features of Mediterranean populations in terms of physiological responses to food and physical activity as components of Mediterranean lifestyle;</li> <li>✓ Provision of affordable Mediterranean Diet and adequate physical activity patterns for population groups with specific nutritional requirements (e.g. infants, intolerants, elderly);</li> <li>✓ Translation of knowledge advancements on the Mediterranean diet into public food and health policies, strategies and guidelines for consumers, industry and for policy makers;</li> <li>✓ Better understanding of economic, social, and health impacts of nutritional transitions, determinants of consumers’ behaviours, diets of populations and households, as well as of the impacts of climate change and water scarcity on the quality of the Mediterranean food production;</li> </ul>
 <b>7/ REDUCE LOSSES AND WASTES</b>	2 + 3	<ul style="list-style-type: none"> <li>✓ Organizational solutions, also ICT-based, to improve sustainability and horizontal and vertical coordination of agro-food value chain, as well as integration of all processes along the whole food chains to minimize waste and losses, better exploit biodiversity and recycle biomasses;</li> <li>✓ Innovative and sustainable food packaging materials and technologies obtained by sustainable processing of side- and by-products from agriculture;</li> </ul>
 <b>8/ NEW AGRO-FOOD BUSINESS MODELS</b>	3	<ul style="list-style-type: none"> <li>✓ New business models for quality and sustainability, suited especially to SMEs, and creation of a new generation of young entrepreneurs;</li> <li>✓ Innovative planning and management control systems for quality and sustainability;</li> <li>✓ Development of efficient methods for assessing food traceability and safety.</li> </ul>

# 5

## Cross cutting themes and activities

In the framework of the specificities and complexities of the thematic areas in which PRIMA will operate, a set of cross-cutting issues have been identified.

The **cross-cutting themes** include transverse areas of research and enabling technologies and approaches:



### SOIL SUSTAINABILITY

Soils are the pivotal element for the agro-ecosystem productivity, and its role is particularly important in semi-arid areas where large variations in rainfall regime both across seasons and within a single season can occur. In this sense, agricultural soil degradation increases the risk of water and nutrient stress and promotes additional irrigation water and fertilizer use, damaging the environment and especially water bodies. Degraded and salinized soils are associated with extreme yield variability under climate change, thereby affecting the profitability of investments in agro-food industries and limiting access of local consumers to fresh high-quality products. Soil, water, climate and vegetation and their interactions form the basis of food systems.

As a consequence, land restoration, agroforestry and soil and water conservation methods can be used to restore soil health and avoid water depletion, while sustainably increasing food production. Minimizing the risk of soil salinization and restoring soil organic matter, and thereby achieving soil organic carbon sequestration, is often assumed to contribute to long-term food security, and climate change adaptation and mitigation, while helping regulate water availability for crops and pastures and conserving biodiversity at soil and landscape scale. In rain-fed systems, soil water harvesting technologies and aquifer recharge management techniques need to be developed to sustain the design of sustainable crop and animal production systems. In more intensive systems, such as orchards and vineyards, floor management practices aimed at reducing soil evaporation and increasing soil water retention capacities needs to be promoted and adapted to the particularly dry environments of the Mediterranean sea basin agriculture systems. In this sense, a close link between soil quality parameters and the final system productivity needs to be explored in order to reach a more holistic approach where soil physical and chemical properties are related to the whole agro-ecosystem performance.

Attention will be also payed to the assessment of soil quality through analysis of organisms biodiversity (biological indicators).



### FOOD SECURITY

Water and food quality, food availability, and access to food and its links to poverty and social stability are issues cross-cutting the three thematic areas of PRIMA. Agricultural production in the Mediterranean basin is severely constrained by limited availability of water and arable land. This situation is exacerbated in the South and East of the basin. The North Africa/Middle East region is one of the worst off in terms of per capita food availability, a situation likely to worsen by 2030 due to growing demand for food. Imports can certainly compensate for a lack of production, but at the cost of high dependency on the international market and concomitant risks of food crises. Addressing these issues jointly at Euro-Mediterranean regional level is of primary importance for the economic and social stability of the region.

It implies developing research to increase agricultural and food production in a sustainable way and through a holistic approach to the whole agricultural system, involving stakeholders all along the chain, from water management systems and farmers to food industries and consumers. It implies also research into: 1) foresight analysis of future supply-demand situations in the different countries and areas and support of innovative solutions; 2) conditions to increase Mediterranean food and water security at regional, country and population scales ; 3) actions to enhance the link between diversified diet and the diversity of cropping systems implemented by farmers; 4) recommendations for policy makers on public policies able to address the different components of food and water security



## DIGITAL REVOLUTION

PRIMA supports Information and Communication Technologies (ICT) across all three thematic areas because of their potential to contribute new solutions to the main challenges identified. More specifically, PRIMA will enhance Digital and ICT tools, precision technologies aimed at increasing farm operation and food processing resource efficiency (time and space-wise). New ICT technologies can also be used to monitor environmental indicators for a better understanding of the water cycle and weather events. For instance, ICT tools and Decision Support Systems based on cost-effective devices and sensors should be developed for irrigation under water quality and quantity constraints for planning adaptation to global changes, anticipating droughts and assessing water and energy budget. Precision farming will also be promoted particularly for improving use efficiency of external inputs so that they reduce the negative environmental externalities of intensive agriculture. Novel ICT platforms based on Internet of Things coupled with smart sensor technologies can also be applied to optimize food processing and reduce waste production.



## SOCIO-ECONOMIC RESEARCH AND STAKEHOLDERS INVOLVEMENT

Societal engagement in research and innovation ensures that research responds to society's needs. It requires new mechanisms and types of cooperation between stakeholders, research policy and civil society to shape research priorities as well as to contribute to the overall research and innovation cycle. In this regard, the multi-actor approach<sup>1</sup> will be adopted being founded on the genuine and sufficient involvement of the various actors (end-users such as farmers/farmers' groups, advisors, enterprises, etc.) characterizing the research and innovation cycle, and therefore involving different (and complementary) types of knowledge working together towards the provision of more demand-driven innovation in the Mediterranean for a sustainable production, smart consumption and an inclusive growth.

PRIMA will enhance the development of interaction and learning among scientific and entrepreneurial actors in the public and private sectors in order to produce technical changes and innovation.

The problem-solving driven Research and Innovation approach requires socio-economic research embedded across a wide range of research and innovation areas, as it is indeed critical to the design and implementation of appropriate technological solutions. Understanding the behaviour of economic actors in the water, agriculture and food sectors, their motivations and what holds them back, is required to enhance adoption of technological solutions. Socio-economic research should also provide foresight studies (e.g. through integrated modelling) to help decision-makers choose among different scenarios. Finally, economic and political sciences are also required to study and design organizational innovations and public policies for better regulation and governance of the agricultural, food and water systems.



## CAPACITY BUILDING

PRIMA will enhance research capacity in Euro-Mediterranean countries, fostering innovation in water management and agro-food systems through training programmes for young researchers and entrepreneurs.

- Regional EU-MED training programmes to implement a high education program including tech-to-business curriculum to achieve the appropriate critical mass of specialists at MPCs. The impact of the programme will be remarkable change to the innovation and technical level of the MPCs to a more balanced cooperation with the EU in the sectors of water and agro-food.
- will be remarkable change to the innovation and technical level of the MPCs to a more balanced cooperation with the EU in the sectors of water and agro-food.
- Euro-Mediterranean Summer Schools addressing innovation, social innovation and sustainable technology development in such areas;
- Euro-Mediterranean Summer Schools on Water-Food Nexus: concept, awareness, thematic features, innovation/market opportunities, policies;
- Regional training programmes aimed at fostering alignment of the existing R&I approaches on water management and agro-food systems in the Mediterranean area;
- Promotion of local (country based) and Euro-Mediterranean multi-level stakeholder/actor networks to improve governance-related capacity in agricultural water and agro-food systems, integrating and bridging different (and opposite) interests and stakes;
- Development of an online learning and communication platform on water saving/ agricultural water management allowing wider dissemination, transfer and exchange of best practices, solutions and innovative ideas/tools/products;
- Training programmes to enhance the capacity of farmers for the uptake of innovation through knowledge exchange offered by farmer-to-farmer learning. This should cover both demonstration of research results and the spreading of best farming practices among practitioners;
- Strengthen capabilities and encompass capacity building initiatives to provide technical assistance centred on the dissemination and effective implementation of sustainable water, land and food management policies and practices.

Note:

<sup>1</sup> <http://www.eip-agri.eu/>







# 6

## Integrated approach of the PRIMA programme

The PRIMA programme aims to face the challenges of the Mediterranean Region of unsustainable managed water provision and food systems through a long-term collaboration among Euro-Mediterranean countries while fostering alignment within their national programmes and with the European Research Area for the Neighbourhood.

Addressing the challenges requires trans-disciplinary research and development of innovative solutions fully piloted and demonstrated on the ground, adapted to the realities of the region, and easily transferable across it.

This can be achieved if, in a structured way, a durable framework for R&I in the field of water provision and food systems is put in place. Such framework must necessarily take into consideration the complex NEXUS between sustainable management of water and the food production and processing, ensuring that national policies and programmes for sectorial development are compatible.

In particular, reaching the scale and scope of R&I efforts requires the orientation of all national R&I programmes towards the implementation of the strategic R&I agenda, the structural involvement of all relevant R&I actors (the public and private sectors) in the implementation of the strategic R&I agenda by pooling knowledge and financial resources so as to achieve the necessary critical mass and the strengthening of R&I funding and implementation capabilities of all involved actors.

In parallel, the fulfillment of the three specific objectives will act not only as key drivers of the PRIMA Initiative, but also as functional leverages to shape and achieve detailed expected outcomes.

PRIMA is expected to have significant impacts in the Mediterranean area at economic, social and environmental level. Potential socio-economic benefits include creation of new jobs, increased competitiveness of companies in both shores of the Mediterranean area.

SDGs implementation

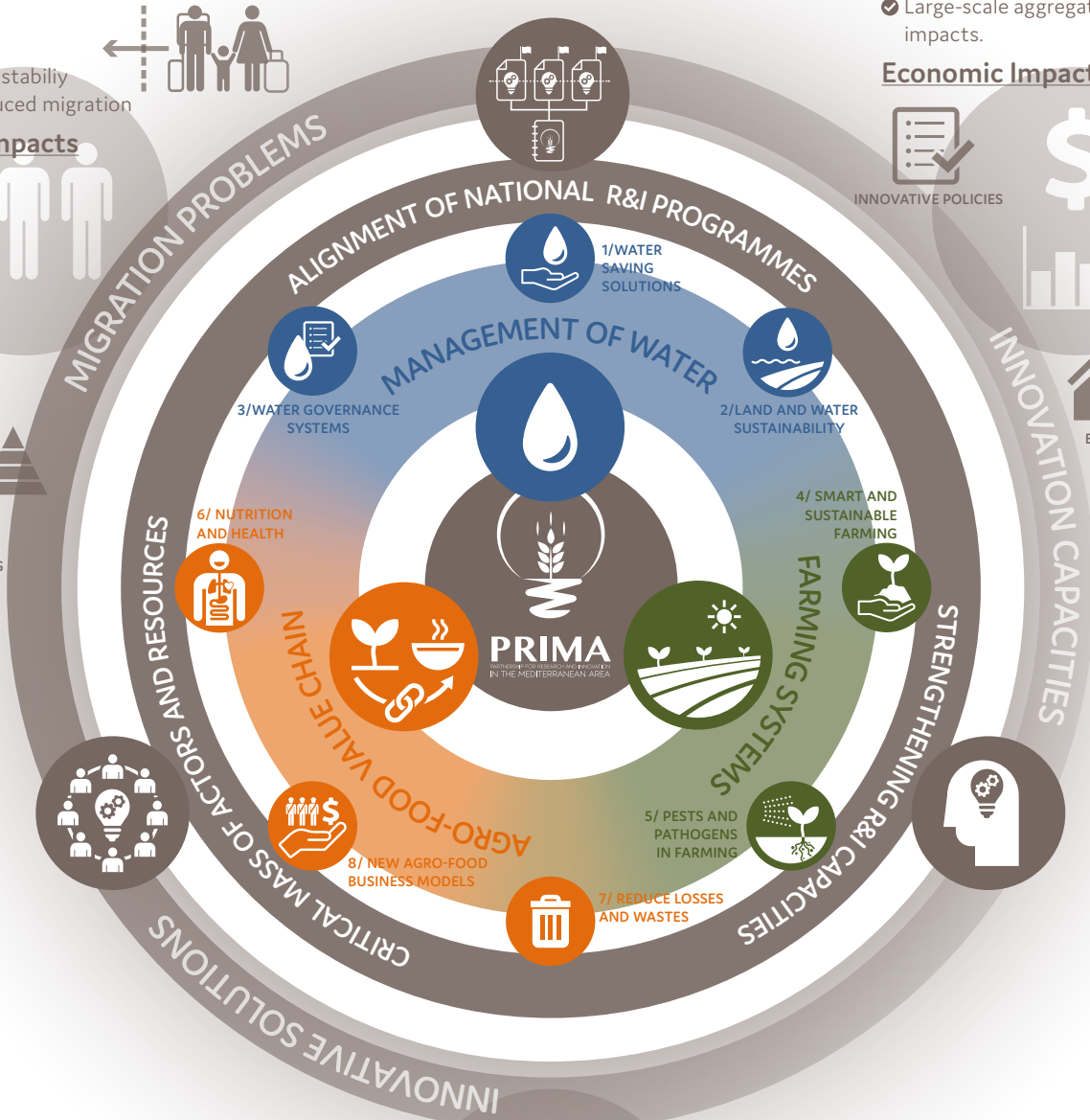


- ✓ Increase in production and efficiency;
- ✓ Access to new markets;
- ✓ Greater funding options (InnovFin programme);
- ✓ Large-scale aggregate economic impacts.

**Economic Impacts**

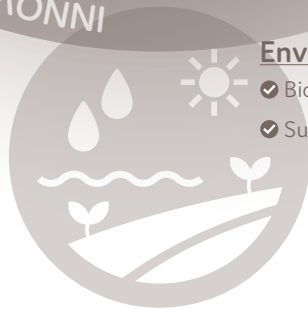


**Social Impacts**



**Environmental Impacts**

- ✓ Biodiversity conservation;
- ✓ Sustainable farming practices.



# 7

## Monitoring of impacts and actions

PRIMA is expected to have significant impact in the Mediterranean area.

The most important evaluation criteria will be the ability of the PRIMA programme to develop and eventually adopt innovative and sustainable solutions for water management and provision and agro-food systems for development of healthy populations in the Mediterranean area contributing to Agenda 2030 through the implementation of Sustainable Development Goals (SDGs).

Potential socio-economic benefits include creation of new jobs, increased competitiveness of companies in both shores of the Mediterranean area, tackling the migration issue upstream.

The impact of the programme will be monitored using Key Performance Indicators (KPIs) that measure progress towards planned goals taking as reference the implementation of Sustainable Development Goals (SDGs) in the Mediterranean Area.










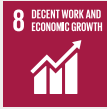



The evaluation of the programme will be linked to its specific objectives and a resultsbased management system will be implemented measuring innovation through outcomes indicators.

Monitoring system will be also developed to measure on a regular basis the implementation of the programme through Operational indicators.

SDGs implementation in the Mediterranean area



Table 4  
Monitoring the impacts  
of general goals with Key  
Performance Indicators

		IMPACT INDICATORS	
		KPIs	SDGs implementation <sup>1</sup>
General goals	 <b>Innovation for MANAGEMENT OF WATER</b>	<ul style="list-style-type: none"> <li>• Number of applied R&amp;I solutions to the challenges of water management</li> <li>• SDG#6 - 06.21 Biochemical oxygen demand in rivers;</li> <li>• SDG#6 - 06.24 Nitrate in groundwater</li> <li>• SDG#6 - 06.26 Phosphate in rivers every year</li> <li>• SDG#6 - 06.41 Water exploitation index (WEI)</li> </ul>	
	 <b>Innovation for FARMING SYSTEMS</b>	<ul style="list-style-type: none"> <li>• SDG#2 - 2.4.1 Proportion of agricultural area under productive and sustainable agriculture</li> <li>• SDG#2 - 2.5.2 Proportion of local breeds classified as being at risk, not-at-risk or at unknown level of risk of extinction</li> <li>• SDG#11 - 11.3.1 Ratio of land consumption rate to population growth rate.</li> </ul>	 
	 <b>Innovation for AGRO-FOOD VALUE CHAIN</b>	<ul style="list-style-type: none"> <li>• SDG#12 - 12.3.1 Global food loss index</li> <li>• Percentage increase in Mediterranean agro-food products exported</li> <li>• Percentage decrease in Food imports dependency (%imports/consumption)</li> </ul>	
	 <b>Economic Growth/ Competitiveness</b>	<ul style="list-style-type: none"> <li>• New water and food quality oriented business models and strategies</li> <li>• Start-ups created adopting organisational and technological innovation</li> <li>• SDG#10 - 10.2.1 Proportion of people living below 50 per cent of median income, by sex, age and persons with disabilities</li> <li>• SDG#8 - 8.1.1 Annual growth rate of real GDP per capita</li> </ul>	 
	 <b>Diet/Health/Well-being</b>	<ul style="list-style-type: none"> <li>• Decrease in overweight population percentage (of which obese) by sex and by Country</li> <li>• SDG#6 - 6.1.1 Proportion of population using safely managed drinking water services</li> </ul>	
	 <b>Migration</b>	<ul style="list-style-type: none"> <li>• Multidimensional Poverty Index (SDG) by Country<sup>2,3</sup></li> </ul>	

<sup>1</sup> Sachs, J., Schmidt-Traub, G., Kroll, C., Durand-Delacre, D. and Teksoz, K. (2017). *SDG Index and Dashboards Report 2017*.

<sup>2</sup> Alkire, S., Apablaza, M., and Jung, E. (2014). *Multidimensional poverty measurement for EUSILC countries*. OPHI Research in Progress 36b.

<sup>3</sup> Alkire, S. and Robles, G. (2017). *Multidimensional Poverty Index Summer 2017: Brief methodological note and results*. OPHI Methodological Note 44, University of Oxford.

Table 5  
Monitoring the outcomes  
of specific objectives and  
thematic areas with Key  
Performance Indicators

		OUTCOMES INDICATORS	
		KPIs	SDGs implementation <sup>1</sup>
Specific objectives	 <b>ALIGNMENT OF NATIONAL R&amp;I PROGRAMMES</b>	<ul style="list-style-type: none"> <li>• Changes in R&amp;I priorities of national agencies oriented towards PRIMA objectives</li> <li>• Percentage increase of coordination</li> </ul>	
	 <b>CRITICAL MASS OF ACTORS AND RESOURCES</b>	<ul style="list-style-type: none"> <li>• Increase of means for R&amp;I funding</li> <li>• Increased involvement of industry incl. SMEs</li> <li>• New public-public or public-private partnerships, new collaborations</li> <li>• Efficiency benefits through pooling of resources, sharing of public investment of PS</li> </ul>	
	 <b>STRENGTHENING R&amp;I CAPACITIES</b>	<ul style="list-style-type: none"> <li>• Improved capacity of R&amp;I organisations</li> <li>• Number of pilots and demonstrators</li> <li>• New practices for R&amp;I organisations</li> <li>• <b>9.5.2 Researchers (in full-time equivalent) per million inhabitants</b></li> </ul>	
Thematic Areas and Priorities	 <b>1/ MANAGEMENT OF WATER</b> <ol style="list-style-type: none"> <li>1 Water resources availability;</li> <li>2 Sustainable integrated water management;</li> <li>3 Irrigation technologies;</li> <li>4 Use of alternative water resources.</li> </ol>	<ul style="list-style-type: none"> <li>• Number of new modelling routines for determining basic components of water cycle related to groundwater accumulation;</li> <li>• Number of efficiency enhanced technologies for wastewater treatment for unconventional renewable water resource production;</li> <li>• Number and efficiency performance of new irrigation technologies and scheduling protocols and models;</li> <li>• Number of water treatment technologies for specific irrigation requirements.</li> </ul>	
	 <b>2/ FARMING SYSTEMS</b> <ol style="list-style-type: none"> <li>1 Adaption of agriculture to climate change;</li> <li>2 Developing sustainable and productive agro-ecosystems;</li> <li>3 Preventing emergence of animal and plant diseases;</li> <li>4 Developing farming systems, create employment etc.</li> </ol>	<ul style="list-style-type: none"> <li>• Number of new varieties/species adaptable to climate change;</li> <li>• Improved Knowledge of soil erosion mechanisms to enhance fertility and mitigate salinization under conditions of water scarcity improving nutrient balance;</li> <li>• Number of integrated solutions for pest and diseases management for plant and animal production systems;</li> <li>• Number of innovations in farming systems developed enabling sustainable and efficient agriculture and food systems.</li> </ul>	
	 <b>3/ AGRO-FOOD VALUE CHAIN</b> <ol style="list-style-type: none"> <li>1 Valorising food products;</li> <li>2 Food safety in local chains;</li> <li>3 Implementation of innovation in the agro-food chain;</li> <li>4 Implications of dietary shifts.</li> </ol>	<ul style="list-style-type: none"> <li>• Number of new food products with enhanced shelf-life, quality and health-related beneficial properties;</li> <li>• Number of innovative solutions aimed to improve quality control mechanisms and techniques throughout supply chains;</li> <li>• Number of business models for quality and sustainability adapted to SME and smallholders;</li> <li>• Number of raising awareness campaign promoting an environment conducive to healthy food choices through appropriate incentives and information provision to consumers and policy makers.</li> </ul>	

Table 6  
Monitoring the outputs of  
PRIMA programme with Key  
Performance Indicators

## OPERATIONAL INDICATORS

### KPIs

#### Development of a SRIA

- Number of meetings/events/participants

#### Joint transnational calls for proposal

- Number of calls, number of proposals submitted/funded;
- time to contract, time to grant, time to pay.

#### Networking activities, Stakeholder involvement, Knowledge-sharing/Dissemination, Mobility/Training

- Number of events;
- Participation of industry/society in the implementation;
- Number of events/schemes;
- Number of participants.

# 8

## PRIMA Added value

The reference framework for R&I in the water and food sectors at EU level is provided by major EU initiatives, but it does not specifically tackle the problems identified in the Mediterranean area.

References should be also on national, bilateral and transnational programmes used to improve R&I on water provision and food systems that were not successful.

**The national, bilateral and transnational programmes that have been used so far to improve R&I on water provision and food systems have not proved to be sufficient to tackle cross-border issues and attract further public and private investments.**

At national level, there is no evidence of synchronization between programmes, and alignment only takes place in a few thematic areas covered by Joint Programming activities. Moreover, the focus is on EU-EU alignment, and not on alignment with Mediterranean third countries.

Discussion and approaches to address the lack of RIS3 in the region will be addressed.

The challenges of water provision and food systems in the Mediterranean area are complex, interrelated, transnational and multi-sectorial, and therefore have to be addressed by EU Member States and non-EU Mediterranean countries on an equal footing. In this regard, the added value of EU level action can be described according to the following three dimensions:

- Attaining scale and scope and achieving a critical mass of resources;
- Leverage effects delivery on impacts and broader implications to the EU's external policies and migration;
- International leadership, global cooperation and the European Southern Neighbourhood.



# 9

## Synergies and complementarities among PRIMA and other EU R&I funding initiatives on Water Resources and Food systems

The challenges of water provision and food systems in the Mediterranean area are complex, interrelated, transnational and multi-sectorial, and therefore have to be addressed by EU Member States and non-EU Mediterranean countries on an equal footing. National, bilateral and transnational programmes have so far been used to improve basic research on water provision and food systems, but it is now necessary to tackle cross-border issues and attract further public and private investments.

At EU level, the reference framework for R&I in the water and food sectors is provided by major EU initiatives (see Table 8 for a summary), but it does not specifically tackle the problems identified in the Mediterranean area or consider the environmental, socio-economic and structural specificities of Mediterranean agro-food systems.

Joint programme initiative JPI such as FACCE, HDHL and WATER are currently financing activities under a very wide range of environmental and socio-economic conditions. PRIMA will complement the actions of JPIs by considering Mediterranean specificities, enabling a more geographic and problem-based orientation of the research programme. Regarding JPI FACCE, the implications of climate change for farming systems, resilience of food value chains and land and water management are of primary importance in the Mediterranean area. The issues of drought, water scarcity and salinity and the importance of the water used in agriculture, which are characteristics of the Mediterranean area, will be addressed in PRIMA, complementary to JPI Water and in extension to actions undertaken in ERA-nets, ERANETMED and ARIMNet, which are currently setting the foundations for a longer-term programme.

PRIMA will also align with the recently established BlueMed initiative. Marine research is not included in the scope of PRIMA as it is in BlueMed, but PRIMA will look for synergies and complementarities, particularly in aspects related to land-based aquaculture and sea-based food processing.



## FUNDING SCHEME AND RELATION TO PRIMA THEMATIC AREA

## SYNERGIES AND COMPLEMENTARITIES WITH PRIMA

### JPI FACCE

provides and steers research to support sustainable agricultural production and economic growth, to contribute to a European bio-based economy, while maintaining and restoring ecosystem services under current and future climate change.

**The areas of intervention are similar to PRIMA thematic area  
“Sustainable farming systems under Mediterranean environmental constraints”**



PRIMA will capitalize the results of JPI FACCE's previous activities in the sectors of: sustainable food security under climate change; environmentally sustainable growth and intensification of agricultural systems; assessing and reducing trade-offs between food production, biodiversity and ecosystem services; adaptation to climate change throughout the food chain and greenhouse gas mitigation. A more solutions-driven process to the currently identified Mediterranean challenges will be used in PRIMA, allowing extrapolation of previous results to the specific farming systems and socio-economic and environmental conditions of the Mediterranean area.

### JPI WATER

deals with research in the field of water and hydrological sciences covering a broad spectrum of water research under very different environmental and water user conditions.

**The areas of intervention are related to PRIMA thematic area  
“Integrated and sustainable management of water for arid and semi-arid Mediterranean areas”**



JPI Water already foresees a task force on alignment of activities, thereby facilitating a synergistic approach. Thematic complementarities will be specifically sought for improving ecosystem sustainability and restoration, closing the water cycle gap and improving sustainable water resource management. PRIMA will exploit previous research on integrated water management coordinated under WaterWorks, called to deal with the arid and semi-arid conditions of the Euro Mediterranean area where agriculture is the major user of water resources.

### JPI HDHL

addresses the promotion of healthy lifestyles with better diets and increased physical activity.

**The areas of intervention are related to PRIMA thematic area  
“Sustainable Mediterranean agro-food value chain for regional and local development”**



Through PRIMA it will be possible to enlarge the number of Mediterranean countries that might benefit from participation in JPI HDHL where Mediterranean countries like Turkey and Israel are already involved. PRIMA will favour the creation of synergies and complementarities in the entire agro-food value chain, supporting production of healthy foods from basic primary production and considering the inputs required for food production under a more holistic approach.

### ENI CBC Med

This cross-border cooperation programme between EU and non-EU Mediterranean countries of the EU Neighbourhood Policy has different thematic scopes, among which: sustainable water use, adaptation to climate change in irrigated agriculture, environmental sustainability of irrigated production and pest management control in line with the PRIMA thematic area on water management and agricultural production.



PRIMA will advance in the scientific and technological developments needed in the priority areas identified, which will be implemented at regional and local level in coordination with ENI CBC Med, which is more concerned with local development and technology transfer. Synergies among the two initiatives will ensure more coherent planning of PRIMA activities towards two common objectives: 1) promoting economic and social development with particular reference to business and SMEs; 2) supporting education, research, technological development and innovation; addressing common challenges in environment.

**EIT Food Knowledge Innovation Community** focuses on the food supply chain. The objectives are to ensure a climate-resilient and sustainable global food system, and to meet increasing food demand within the constraints of available land and declining fish stocks, protecting the natural environment and safeguarding human health. This knowledge-innovation-community is focused on the innovation chain reinforcing the path from research to the market, innovation projects and business incubators.



Since the scope of the KIC is European, while international outreach is expected, PRIMA can be a strong avenue by which the Euro-Mediterranean area engages possible new members and mobilises local stakeholders in the KIC. Vice versa, instruments of the KIC might be of inspiration or might be co-developed, since the two initiatives are not competitive in terms of scope, vision, governance or funding, and place particular emphasis on training and business development/entrepreneurship support. In particular, complementarities will be sought in the field of creating consumer valued food for healthier nutrition, enhancing sustainability and catalysing food education, entrepreneurship and innovation.

### S3 Agrifood Platform

Smart specialisation is a new policy approach to regional development and regional innovation strategy planning introducing integrated, place-based evolutionary process. It builds on national/regional assets, strengths, potentials, capacities, critical mass and expertise. The objective of the S3P Agri-food platform is to help regions develop trans-regional collaboration in agri-food, specifically by promoting the formation of partnerships for trans-regional cooperation in agri-food value chains. The S3P Agri-food platform is based on a bottom-up approach and is driven by the regions that wish to foster inter-regional cooperation based on matching their smart specialisation priorities related to agri-food. It is thus co-developed and co-led by proactive regions, with the active participation of business organisations, research institutions, academia and civil society.



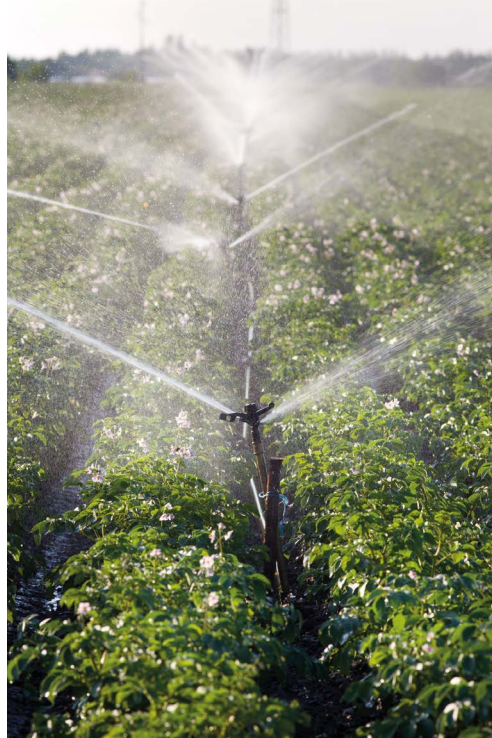
Prima will allow innovation actors and HEIs to identify new value chains and business opportunities, tapping on their core competences and combining them with other skills and knowledge inputs, to create such new combinations at Mediterranean level. Innovation actions (IA) will allow the creation of demonstration activities, piloting and testing to address market gaps, industrial trends and new markets.

Links with WSSTP and working groups such as Water NEXUS or Water beyond Europe will also be considered.

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← Table 7

A summary of currently on-going EU research and innovation funding initiatives related to PRIMA thematic areas



PRIMA has the peculiarity to be a multidisciplinary R&I initiative with three thematic areas of research (water, agricultural science and food science/technology), in the common context of a geographical area with scant water resources. PRIMA will then be able to cover the entire agro-food chain, from the basic resources for agricultural production to the final food product and its effect on human health. PRIMA envisage a wide range of instruments and actions such as Research & Innovation Actions, Innovation Actions (including Demonstrator and Pilot projects) and Coordination and Support Actions, resulting in involvement of different types of actors, including SMEs and industries. This will improve collaboration between the different stakeholders, in particular the public sector and the business sector.

PRIMA will also align with the broader approach of Horizon 2020 Societal Challenge 5 “Climate action, Environment, Resource Efficiency and Raw Materials” and 2 “Food security, sustainable agriculture and forestry, marine, maritime and inland water research, and the bio-economy”, two priority societal challenges to be addressed through R&I investments. At work-programme level, synergies and complementarities will also be ensured by EU PRIMA countries participating in the two societal challenge programme committees.



### **PRIMA R&I links with other European and Mediterranean communities with multiple stakeholders**

PRIMA is also in line and coherent with other more policy oriented EU schemes and initiatives supporting the research and innovation chain across sectorial areas such as the **European Innovation Partnerships** (EIP) as summarized in the following table.

The thematic EIPs are a good examples to be replicated under PRIMA since they involve different types of stakeholders and players, which could complement with the institutional/public profile of PRIMA partners. Furthermore, EIPs have a strong record of linking research and innovation and of creating a critical mass to pursue the objectives identified in a participatory manner. To this regard, the implementation of joint activities under PRIMA will complement the prioritization of objectives, the management of coordinated initiatives and the commitment of participating countries.

Table 8

A summary of currently on-going EU research and innovation funding initiatives related with PRIMA thematic area

POLICY AND FUNDING SCHEME PRIMA THEMATIC AREA CONCERNED	SYNERGIES AND COMPLEMENTARITIES WITH PRIMA
<b>EIP WATER</b> EIP Water addresses themes of water reuse and recycling, water and wastewater treatment, risk management.	 PRIMA will initiate and promote collaborative processes for change and innovation in the water sector across the public and private sectors, non-governmental organizations and the general public.
<b>EIP AGRICULTURAL PRODUCTIVITY AND SUSTAINABILITY</b> EIP Agri aims at fostering competitive and sustainable farming and ensuring a steady supply of food, feed and biomaterials preserving the natural resources on which farming depends.	 PRIMA will model some of its activities on the one of the EIP Agri through building on the work of the past, current and future Focus Group. The relevant Focus Groups are the one, related to sustainability, agricultural production, climate change and farming.

### PRIMA and other actors' in the Mediterranean Region

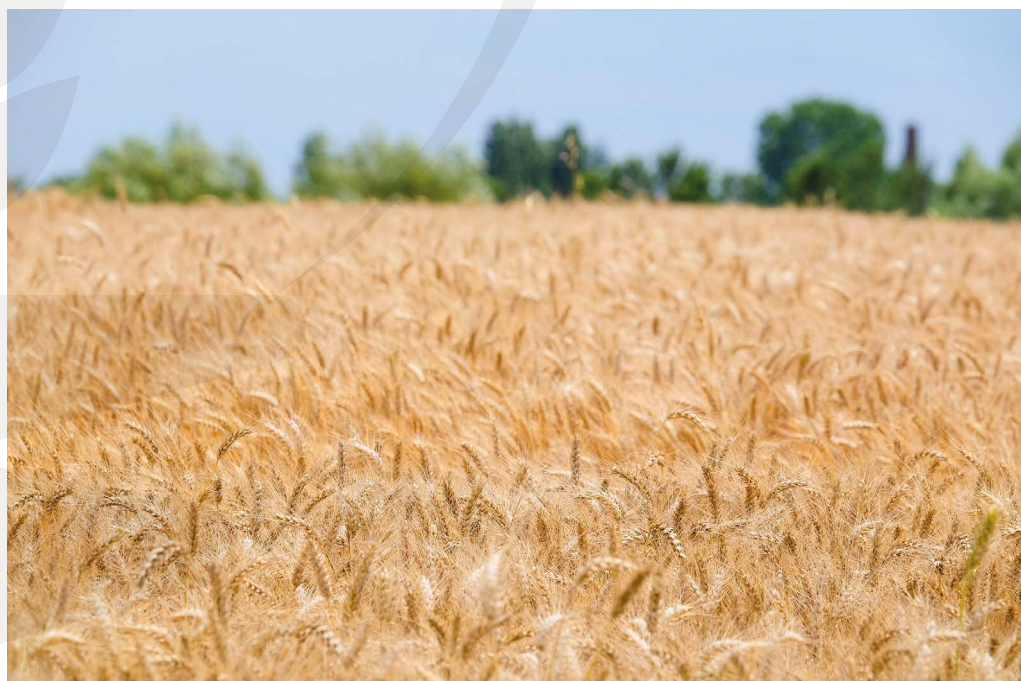
PRIMA will also complement other EU actions focused on water and agriculture by concentrating on the Mediterranean area:

**The European Neighborhood Partnership for Agricultural Development (ENPARD)** aimed at improving rural livelihoods, increasing productivity and food safety, and developing organizational and institutional capacities;

**The Sustainable Water Integrated Management Program (SWIM)** that provides technical assistance centred on the dissemination and effective implementation of sustainable water management policies and practices;

**The Mediterranean component of the EU Water Initiative (MED EUWI)** which aims to assist developing countries of the region in meeting water-related challenges to achieve Millennium Development Goals and sustainability.

In this case the focus is on EU-EU alignment, but a more comprehensive approach with Mediterranean third countries is now needed.



### Consistency with other policies and initiatives

The PRIMA Joint Programme is a concrete example of how research and innovation policy can promote effective cooperation by leveraging national budgets and bringing Mediterranean countries together around long-term common challenges.

The R&I objectives concerning water provision and agro-food systems in the Mediterranean area appear to be consistent with and relevant to the following EU policies and EU or international initiatives:

Table 9  
Initiatives consistent with PRIMA

<b>The Common Agricultural Policy (CAP)</b>
<b>The EU 2030 climate framework</b>
<b>The Water Framework Directive</b>
<b>The European Bioeconomy Strategy</b>
<b>The European Food and Nutrition Security Strategy</b>
<b>The new DG Agri strategy on Agricultural Research and Innovation that sets research priorities for H2020 and beyond</b>
<b>Food 2030</b>
<b>New Migration Partnership Framework</b>
<b>A resource-efficient Europe – Flagship initiative</b>
<b>European Research Area (ERA) for the Neighbourhood</b>
<b>Biodiversity strategy</b>
<b>Union for the Mediterranean Water Agenda</b>
Commission Staff Working document on Agriculture and Sustainable Water Management in the EU <a href="https://circabc.europa.eu/sd/a/abff972e-203a-4b4e-b42e-a0f291d3fdf9/SWD_2017_EN_V4_P1_885057.pdf">https://circabc.europa.eu/sd/a/abff972e-203a-4b4e-b42e-a0f291d3fdf9/SWD_2017_EN_V4_P1_885057.pdf</a>

Synergies with initiatives aimed at implementing and monitoring Agenda 2030 for sustainable development are particularly relevant, as PRIMA actions will have a positive impact on the achievement of **Sustainable Development Goals (SDGs)**.



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## Strategic Research and Innovation Agenda



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