WaterShift project:

Framing study on business models for water use transition

Final report

31/05/2021

Summary

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List of abbreviations

AFD : French Agency for Development (Agence Française de Développement)
CEEM : Center for Environmental Economics - Montpellier
CIHEAM : International Centre for Advanced Mediterranean Agronomic Studies (Centre International de Hautes Etudes Agronomiques Méditerranéennes)
CNRS : French National Scientific Research Center (Centre National de la Recherche Scientifique)
CUT : Cyprus University of Technology
EEA : European Environment Agency
FAO : Food and Agriculture Organization of the United Nations
FAOSTAT : Food and Agriculture Organization Corporate Statistical Database
GDP : Gross Domestic Product
IDEA : Farm Sustainability Indicators (Indicateurs de Développement des Exploitations Agricoles)
INRAE : French national center for agronomic research (Institut national de recherche pour l'agriculture, l'alimentation et l'environnement)
IUCN : International Union for Conservation of Nature
IPCC : Intergovernmental Panel on Climate Change
MedECC : Mediterranean Experts on Climate and Environmental Change
MED-EUWI : Mediterranean Component of the European Union Water Initiative
PNUE/PAM : United Nations Environment Programme - Mediterranean Action Plan (Plan d'action pour la Méditerranée relevant du Programme des Nations Unies pour l'environnement).
WFD : Water Framework Directive
WSI : Water Stress Index
WWF : World Wide Fund for Nature

Introduction

The COVID-19 pandemic has prompted many challenges on water supply and sanitation, especially in the Mediterranean region, one of the most water-scarce regions in the world. Additionally, the region concentrates many other interconnected challenges associated with water and sustainability, ranging from the necessary improvement of drinkable water access and of its quality, to the adaptation of water resources management to the impacts associated with climate change. If water is a scarce and essential resource to any form of life on the Earth, it is also a catalyst for the social, economic and political development of territories. The degree of water scarcity and its political, economic and social implications are felt much more severely in regions like the Mediterranean. Almost every factor linked with water crises globally is gathered in this region, including scarcity of freshwater resources, rapidly growing population, changing levels of economic development as well as poor water management. **Shifting the status-quo in the Mediterranean region is urgently needed, yet the challenge of bringing change is enormous.**

We believe that this transformation depends on two factors: the existence of sustainable business models technically and economically feasible, and the activation of financial levers to arouse models' transformation. The WaterShift project deals with these two factors and the current framing study aims at delimiting the perimeter of sustainable business models. The high costs to engage in order to reach those goals and the lack of financing availabilities restrain the progress of the processes engaged to take up those challenges. This observation represents a real opportunity to develop innovative mechanisms to ease collaborations as well as sectorial outcomes in the private sector.

In this context, the WaterShift project, supported by the MAVA Foundation and coordinated by Vertigo Lab in partnership with the IUCN and Birdlife International, aims to support the transformation of the most impacting sectors towards more sustainable practices and virtuous business models regarding water resources and biodiversity within the Mediterranean. Due to their major impact on water resources in the Mediterranean basin, three sectors are selected. Each partner oversees one of these main sectors: Vertigo Lab is in charge of the agriculture sector; the IUCN is in charge of the tourism sector and Birdlife International is in charge of the salt production sector.

Thus, how to define the most sustainable practices of impacting sectors as well as business models that best overcome the main water resources and biodiversity challenges in the Mediterranean ?

This framing study first reviews the main water issues faced in the Mediterranean and caused by the most impacting sectors on water resources. Then it evaluates the positive economic, social and environmental impacts of sustainable practices of each sector, as well as their effect on business models. Finally, the study proposes a typology of the most sustainable sectorial practices and business models related to these practices.

This framing study also aims at introducing the guiding principles that will be released in December 2021 as part of the WaterShift project. While the current study sets down the theoretical basis of the project, the guidelines will assist economic actors' transition towards more sustainable practices.

1. Water challenges in the Mediterranean region: literature review and interviews synthesis

I. Territorial context and water challenges in the Mediterranean region

1.1 The Mediterranean basin: a highly populated region facing sustainable development issues

The Mediterranean basin is around 1.75 million km² and is defined by 73 water catchments that have their outlets in the Mediterranean Sea (Milano *et al.*, 2013).

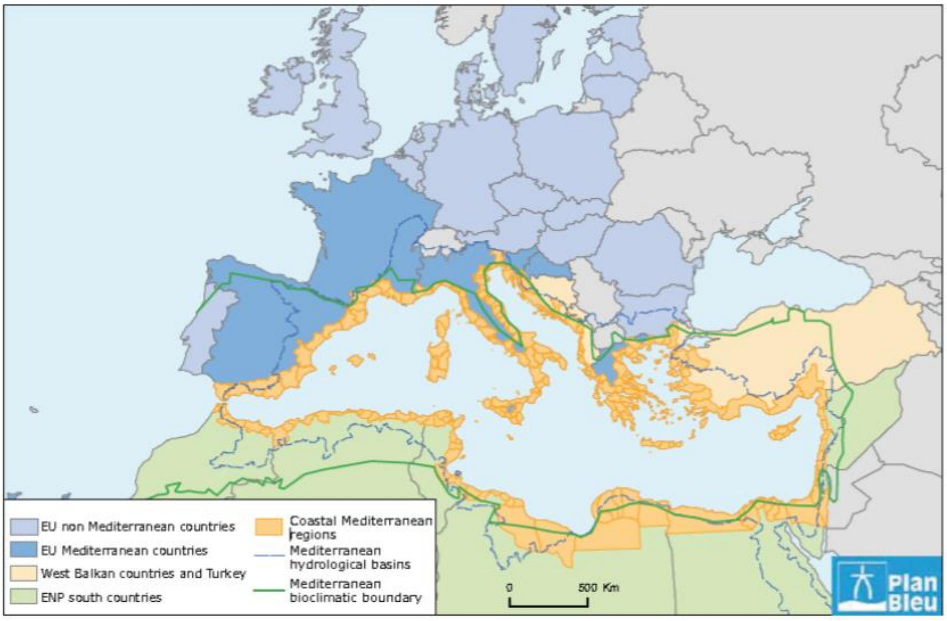

Figure 1: Mediterranean countries and hydrological basins (Plan Bleu, 2014)

The geographic demarcation of the Mediterranean riparian countries is divided into two groups (Burak and Margat, 2016):

- **Northern Mediterranean Countries** (NMC) consisting of Turkey and European countries: Spain, France, Italy, Greece, Slovenia, Croatia, Bosnia-Herzegovina, Montenegro, Albania, Cyprus and Malta;
- **Southern Mediterranean Countries** (SMC) consisting of Syria, Lebanon, Israel, Palestinian Occupied Territories, Egypt, Libya, Tunisia, Algeria and Morocco.

The Mediterranean countries have an area of around **8.82 million km².** Their population is about 468 million people, which represents 7.4% of the world population. Of these, about 37% live in the coastal strip, which represents about 17% of the total area (see Figure 1). **The coastal population density is on average more than double the global population density.**
This situation is reinforced by a strong seasonal tourist and migratory flow of more than 150 million people. (MED-EUWI, 2007; Mandi, 2014). With almost 1/3 more people visiting the related

countries in summer, the Mediterranean basin is at risk of facing environmental changes that would likely impact its sustainable development. As summarized in Figure 2, these main environmental changes are linked with climate-related and non-climate-related drivers that will have a major impact on:

- Ecosystems evolution;
- Water resources (both regarding quantity and quality);
- Food supply and consumption;
- Coastal landscape;
- Health.

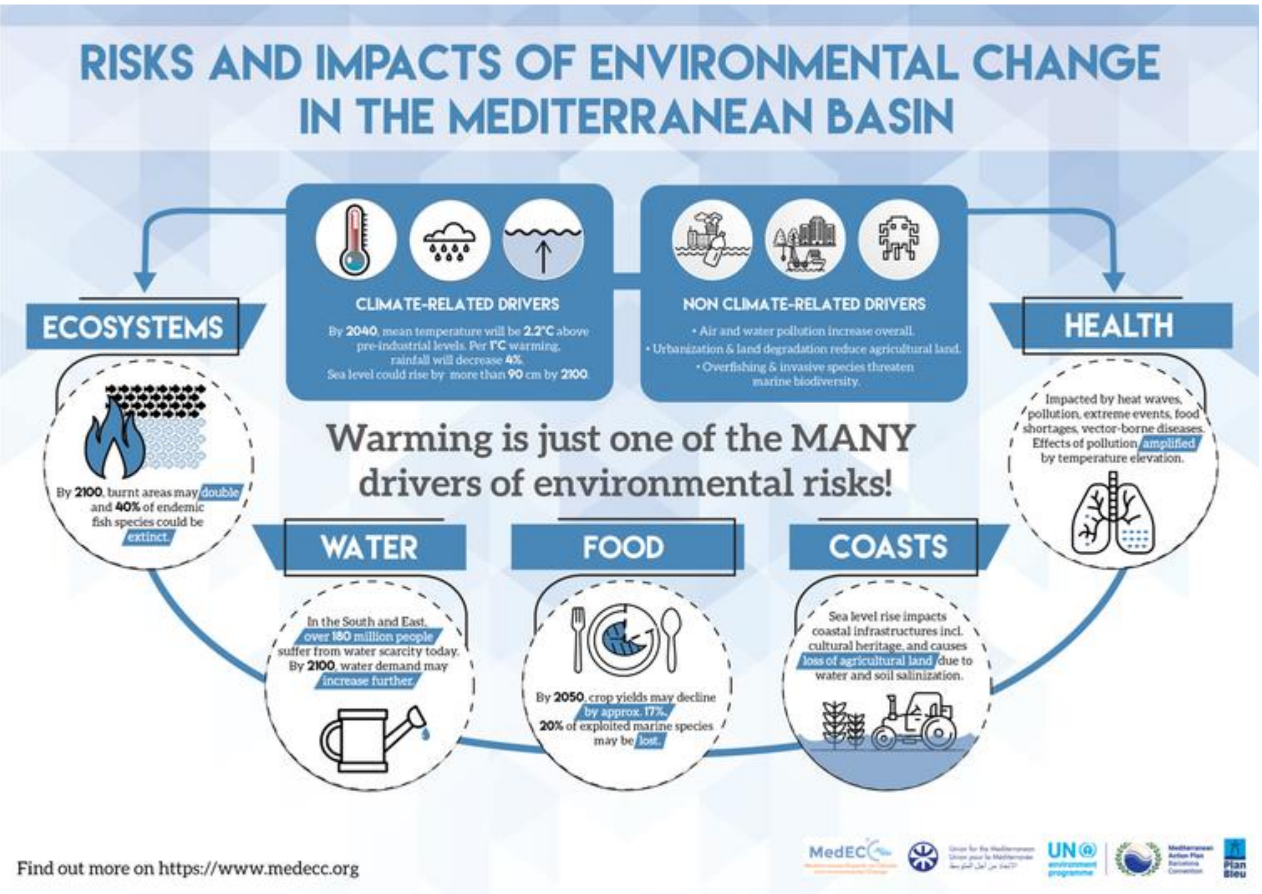

Figure 2 : Summary of the conclusions of the first report on the environment and climate change in the Mediterranean Basin (MedECC, 2020)

1.2 Water: a resource at the heart of the Mediterranean basin's major issues

1.2.1 Water scarcity and the unequal distribution of water

Water resources in the Mediterranean are scarce, limited, unevenly distributed and often mismatching human and environmental needs. While only covering 2.6% of the freshwater resources, Mediterranean countries represent 7.4% of the world's population, which lead to water security issues (see Box 1) in several of these countries (MED-EUWI, 2007; MedECC, 2020).

Water security – Theoretical framework and definitions

Water security (United Nations, 2013)**:**
"The capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability."

Water Stress Index (Falkenmark and Widstrand, 1992; Damkjaer and Taylor, 2017) :
Conceived in the context of famines taking place across Africa, the Falkenmark indicator or Water Stress Index (WSI) was originally intended to provide an early warning system to inform strategies for food self-sufficiency considering anticipated future droughts and a growing population. The WSI has since become the most widely applied measure of water scarcity and is used to qualify water security at the global and Mediterranean scale, as in the last report on the state of Environment and Development in the Mediterranean (PNUE/PAM and Plan Bleu, 2020) The following water stress index thresholds are considered :

Category	Contemporary WSI threshold (m^3 $capita^{-1}$ $year^{-1}$)
Absolute water stress or shortage	<500
Water stress	500-1000
Water vulnerability	1000-1700
Water security	>1,700

Box 1: Water security – Theoretical framework and definitions

Northern Mediterranean countries hold 74% of the Mediterranean freshwater resources for 36% of the total Mediterranean population, while the southern Mediterranean countries share the remaining 26% (Ferragina, 2010; FAO, 2016). As a result, **180 million people in the southern and eastern Mediterranean suffer from water stress** (<1,000 m^3/capita/year) **including 80 million people from absolute water shortage** (<500 m^3/capita/year) (Ferragina, 2010). In the northern Mediterranean, an average water availability of 1,700 m^3/capita/year is provided, with maximums about 10,000 m^3/capita/year in Balkan states (Figure 3) (Milano *et al.*, 2013; MedECC, 2020).

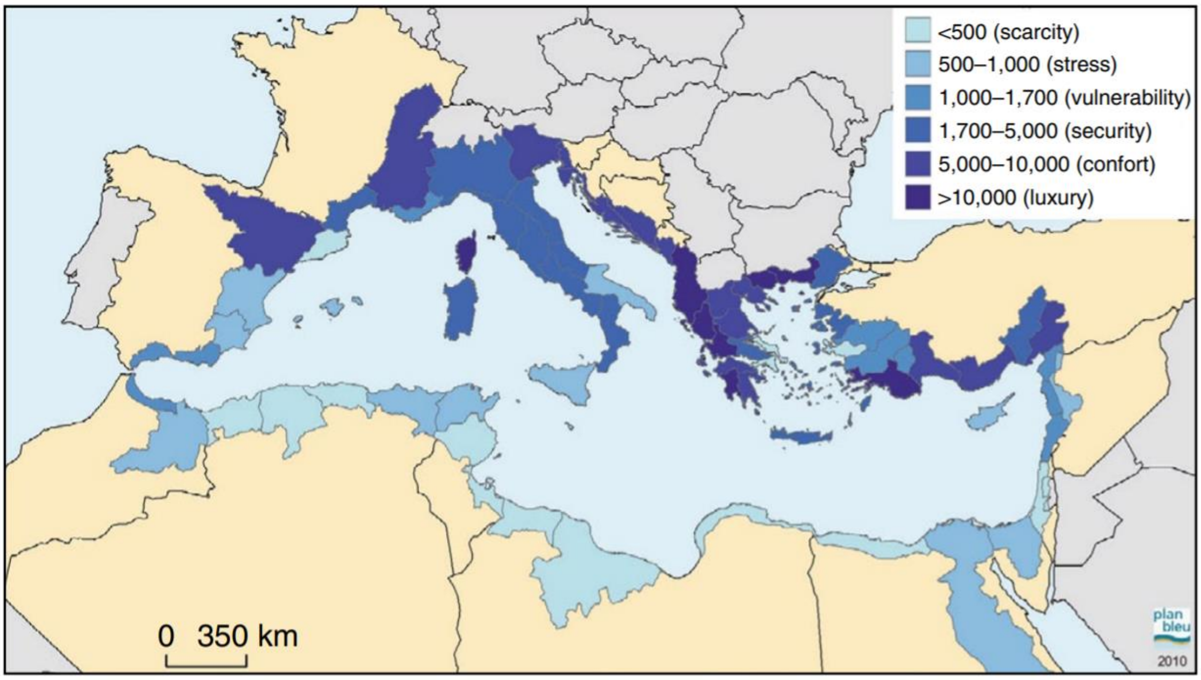

Figure 3 : Water availability (m³/capita/year) in the main Mediterranean watersheds (Plan bleu, 2010)

1.2.2 A degradation of water quality due to specific human activities

Water scarcity is in many cases accompanied by poor quality of both surface and groundwater, especially in coastal aquifers. A general groundwater quality deterioration occurs in many parts of the Mediterranean region, mainly due to contamination in recharge areas, mismanagement during irrigation practices and over-exploitation of coastal aquifers.(MED-EUWI, 2007). For the 16 river basin districts monitored for surface water pollution and habitat degradation along the Mediterranean coastline, 49% on average of the water bodies do not reach good ecological status (EEA, 2018).

The main environmental impacts on water quality in the Mediterranean, which have been reported in response to the Water Framework Directive (WFD) are **saltwater intrusion**, **pesticides from agricultural runoff**, **eutrophication** (see Box 2), and **chemical and industrial waste** including pharmaceuticals, heavy metals and persistent chlorinated hydrocarbon pollution (EEA, 2006, 2018; MED-EUWI, 2007; Ludwig *et al.*, 2010; Nikolaidis *et al.*, 2014; PNUE/PAM and Plan Bleu, 2020).

Impacts on water quality – definitions, causes and consequences

Saltwater intrusion

Saltwater intrusion is the movement of saline water into freshwater aquifers. Saltwater intrusion can naturally occur in coastal aquifers, owing to the hydraulic connection between groundwater and seawater and because saline water is denser than freshwater. Certain human activities, especially groundwater pumping from coastal freshwater wells, have increased saltwater intrusion in many Mediterranean coastal areas. Sea level rise caused by climate change also contributes to saltwater intrusion. Water extraction drops the level of fresh groundwater, reducing its water pressure and allowing saltwater to flow further inland, which can lead to groundwater quality degradation (Johnson, 2007; MED-EUWI, 2007; Ludwig *et al.*, 2010).

Agricultural runoff

Agricultural runoff describes water from farm fields that flows over the earth and can be absorbed into the ground or enter bodies of waters. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into watersheds through rivers, coastal waters, and even underground aquifers. Coming from farms, this runoff can contain pesticides, nutrients (phosphorus, nitrogen and potassium from fertilizers), sediment (soil particles) and even metals. (Wiens, 1980; Crampton and Ragusa, 2014; Zak *et al.*, 2018)

Eutrophication

Eutrophication refers to the process by which a body of water becomes enriched in dissolved nutrients that stimulate the growth of aquatic plant life. These nutrients are added to a water body from any of a wide variety of polluting inputs including sewage treatment, industrial waste and farming practices. The visible effect of eutrophication is often nuisance algal blooms that can cause substantial ecological degradation. This process may result in oxygen depletion after the bacterial degradation of the algae. Eutrophication causes an important degradation of the water quality along the coastal zone of many Mediterranean countries and results in negative impacts on living environment (EEA, 2006; Schindler and Vallentyne, 2008; Ansari and Gill, 2014)

Box 2: Impacts on water quality – definitions, causes and consequences

Two types of water pollution sources should specifically be considered: (i) **point source** and (ii) **diffuse source.** While point sources, such as untreated municipal wastewater or industrial discharges, still represent a main challenge for most of the Mediterranean countries, the major water contamination sources remain the diffuse sources. Those sources, which cannot be defined as having a specific point of origin, are mainly generated by irrigated agriculture. Table 1 summarizes existing major environmental problems for water quality along the coastal zone of different Mediterranean countries, and shows the spatial heterogeneity of water quality problems. (EEA, 2006; MED-EUWI, 2007; Mandi, 2014; MedECC, 2020):

Table 1 : Major environmental problems along the coastal zone of Mediterranean countries

Country	Urban effluent	Urban solid waste	Industrial effluent	Oil effluent	Chemical toxic product	Coastal eutrophication	Coastal urbanization
Albania	+	+	-	-	+	+/-	+/-
Algeria	+	+	+	+	-	+/-	+
Bosnia and Herzegovina	+	+	-	-	+/-	-	+
Croatia	+	+	-	+ (expected)	-	+	+
Cyprus	+/-	-	+	-	-	-	+/-
Egypt	+	+	+	+/-	-	+	+
Spain	+	-	+	-	-	+/-	+
France	+	-	+	-	-	+/-	+/-
Greece	+	+	+	-	-	+/-	+/-
Israel	+	-	+	+/-	-	+/-	+/-
Italy	+	-	+	+	-	+	+
Lebanon	+	+	+/-	-	-	-	+
Libya	+	+	+	+/-	-	-	-
Malta	+	+/-	+/-	+/-	-	-	+
Morocco	+	+	+	+	+/-	+/-	+
Gaza	+	+	+	-	-	+/-	+
Monaco	-	-	-	-	-	-	+
Slovenia	+	-	+	-	-	+/-	+
Syrian Arab Republic	+	+	+	+	-	+/-	+/-

(+: Important problem; +/–: Medium problem; –: Minor problem).

Source: EEA (2006)

Concerning human activities responsible for the degradation of water quality, the link between water and food production is clear from the examination of nutrient loads as agriculture and wastewater treatment plants remain the most important sources of nitrogen and phosphorus (Malagò and Bouraoui, 2017). Additionally, tourism activities contribute to water pollution challenges due to an increase of contamination load estimated by 5-fold during summer seasons (Burak, Dogan and Gazioglu, 2004).

1.2.3 The Mediterranean basin: a threatened biodiversity hotspot

Freshwater habitats are also facing major threats, due to human water consumption for agriculture and energy production, and degradation of water quality. Mediterranean rivers contain more than 3,500 dams. Sediment discharge is drastically reduced and water is diverted for energy production, irrigation or water supply. It therefore reduces the original basin drainage area by about 78% (Poulos and Collins, 2002). In most Mediterranean countries, water-use is approaching the limit of available resources (Plan Bleu, 2005). Hundreds of species of amphibians, crustaceans, freshwater fishes, dragonflies, reptiles and mammals are dependent of these freshwater habitats for at least some part of their life cycle. The fact that 38% of them are threatened gives an indication of the worrying status of Mediterranean wetlands and rivers. Moreover, several habitats like wetlands provide priceless ecosystem services. As an example, the Mediterranean region has lost 48% of its natural wetlands since 1970.

This trend is even more worrying as the Mediterranean territory is also a major **biodiversity hotspot** highly dependent on the quality of its aquatic ecosystems and habitats. It contains 25,000 plant species, of which 60% are endemic- 2 out of 3 amphibian species are also endemic- as well as half of the crabs and crayfish, 48% of the reptiles and a quarter of mammals. Although the Mediterranean Sea makes up less than 1% of the global ocean surface, up to 18% of the world's macroscopic marine species are found there. From 25 to 30% of the latter are endemic, which represents an incredibly rich biodiversity for such a small area (Bianchi and Morri, 2000).

Moreover, in addition to current threats from human activities, the Mediterranean ecosystems are under increasing threats related to climate change like temperature increase and droughts (Guiot and Cramer, 2021).

1.2.4 Major water issues in Mediterranean will be exacerbated by climate change

On the one hand, a significant decrease (from 30 to 50%) in **freshwater resources available** is projected over the whole Mediterranean basin by 2050 (see Figure 4). It would be caused mainly by an expected increase in air temperature, and an expected decrease in precipitation. The water catchments in southern Spain, Morocco, Algeria and southeastern Mediterranean are expected to be the most affected by this decrease (Milano *et al.*, 2013; Mandi, 2014).

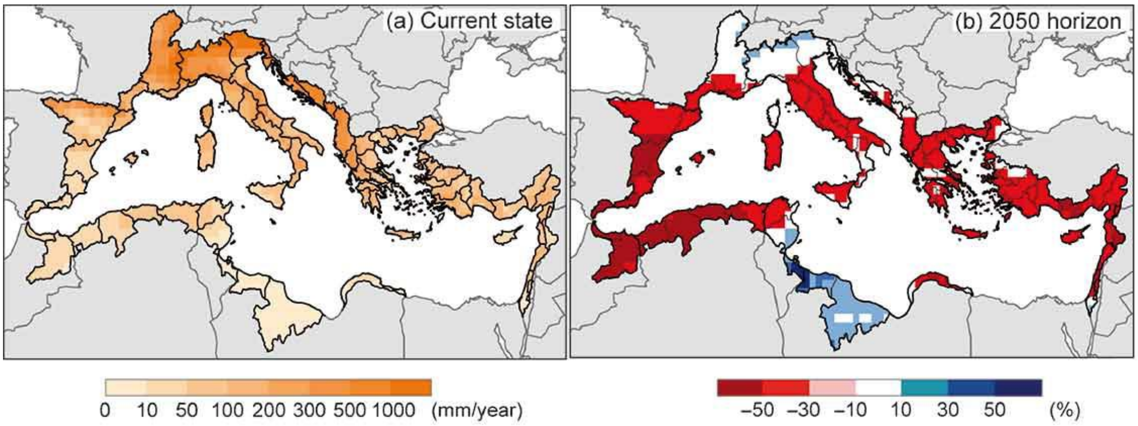

Figure 4 - Freshwater variation rate over the Mediterranean basin: (a) current mean annual freshwater availability; (b) evolution rate in freshwater availability by the 2050 horizon (Milano and al., 2013)

Based on the Intergovernmental Panel on Climate Change (IPCC) projections (IPCC, 2019):

- **Actual air temperature** is rising quicker in the Mediterranean region with 1,54°C against 1,1°C at the global scale.
- **Precipitation** is undergoing a paradoxical evolution with an accentuation of drought during summer months, already affecting 180 million people in the Mediterranean region for whom the lack of water will become more pronounced, and an increase in the risk of flooding in the winter months. However, annual precipitation are expected to decrease by 5 to 20% in 2050 (IPCC, 2007; Milano *et al.*, 2012).
- **Sea level rise** also represents a huge challenge to the densely populated Mediterranean for people, agrosystems and infrastructures located near a low tide coastline(Milano *et al.*, 2013; MedECC, 2020; Guiot and Cramer, 2021). By 2100, IPCC projections estimate a potential seal level rise from 0.43 m up to 2.5 m above actual sea level (Garner *et al.*, 2018; IPCC, 2019; PNUE/PAM and Plan Bleu, 2020).

On the other hand, **the general increase in water scarcity is enhanced by the increasing water demand for irrigated agriculture**, to maintain food security (Iglesias *et al.*, 2012; Schwabe, 2013). Irrigation demands in the Mediterranean region are projected to increase between 4 and 18% by 2100 due to climate change alone. Population growth and increased demand may escalate these numbers to between 22 and 74% (Fader *et al.*, 2016). Moreover, the peak in water consumption by tourism coincides with that of agriculture, which will increasingly require irrigation and exacerbate use conflicts (MedECC, 2020; Guiot and Cramer, 2021).

The expected increase in population, particularly in the coastal areas of countries in the eastern and southern Mediterranean, and the increasing urbanization would not only lead to higher water demand, but also to **further deterioration of water quality**. Challenges to water availability and quality in coastal areas will arise from salt-water intrusion driven by enhanced extraction from aquifers, sea-level rise and increasing water pollution on the southern and eastern shores, as well as from the development of new industries, urban sprawl and tourism development (Ludwig *et al.*, 2010; Cramer *et al.*, 2018).

Marine and freshwater ecosystems in the Mediterranean Basin will be affected by mean and seasonal changes in temperature and precipitation, as well as extreme changes (Guiot and Cramer, 2016). Falling water levels and reduced water quality are impacting wildlife in Mediterranean inland wetlands and freshwater ecosystems (Klausmeyer and Shaw, 2009; Zacharias and Zamparas, 2010). Climate change is also greatly modifying the structure and function of marine and coastal ecosystems. Higher sea temperatures are linked to increased mass mortality events of many different species. These ecological changes on land and in the ocean has led to an overall biodiversity loss. They may also compromise the numerous benefits and services that Mediterranean ecosystems provide, including renewable natural resources, environmental and social services (Rivetti *et al.*, 2014; Marbà *et al.*, 2015; Liquete *et al.*, 2016).

In conclusion, the Mediterranean basin is a territory with strong interconnected issues related to water: **scarcity of the resource**, **degradation of water quality and disappearance of marine and freshwater ecosystems**. The demographic and touristic development of this region, as well as the consequences of climate change, exacerbate these issues, which remain very much linked to specific human activities.

It is therefore essential to support the sectors that have the greatest impact on water resources in order to ensure the sustainable development of this region through appropriate water management. In this context, the WaterShift project seeks to accompany the transition of three sectors that are both impacting and suffering from water-related issues: **agriculture, salt production** and **tourism**.

II. Three major sectors for Mediterranean water challenges: agriculture, salt production and tourism

1.1 Agriculture, a major sector for the region's socio-economic development pressuring water resources

1.1.1 Agriculture: a key sector for the socio-economic development of Mediterranean countries

Mediterranean countries have approximately 882 million ha of land, of which an average of **28% is devoted to agriculture**, from 4% of Egypt to almost 76% of Syria. (Figure 5).

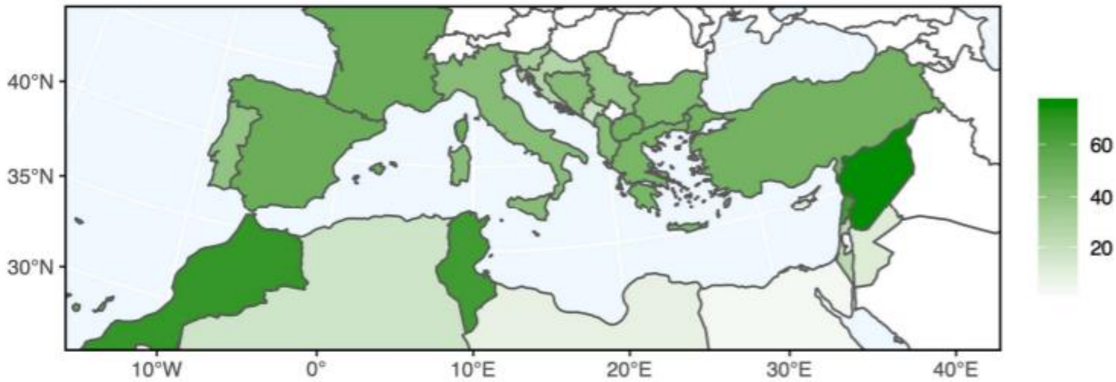

Figure 5: Total agricultural land (in %) in the Mediterranean countries in 2016 (World Bank, 2020).

The share of agriculture in Gross Domestic Product (GDP) in the Mediterranean countries is very unequal, from less than 2% in the EU Mediterranean countries (Malta, Cyprus, Slovenia, France, Italy, Spain) to more than 10% in most of the Southern Mediterranean countries (Tunisia, Morocco, Algeria, Egypt). Agriculture remains a very important economic sector for the Southern Mediterranean countries with an average contribution of 12% to total GDP (CIHEAM, 2008; FAO, 2018; PNUE/PAM and Plan Bleu, 2020)

The observation is similar for the share of employment from agriculture, with huge differences between northern and southern Mediterranean countries. **Agriculture represents less than 5% of jobs in the EU Mediterranean countries, while still contributing from 10% to 37% (in Morocco) of southern countries employment** (CIHEAM, 2008; FAO, 2018; PNUE/PAM and Plan Bleu, 2020).

Overall, the share of agriculture in GDP and employment derived from agriculture has been steadily declining over time in almost all Mediterranean countries due to the tertiarization of national economies. However, the agricultural sector still remains essential to the socio-economic development of Mediterranean countries through its direct and indirect impacts on economy (like agro-food industry) and socio-territorial development (PNUE/PAM and Plan Bleu, 2020; EEA, 2021).

Agriculture in the Mediterranean Basin is mainly **rain-fed**. **Cereals, citrus fruits and vegetables account for over 85% of the Mediterranean's total agricultural production** (UNEP-MAP, 2009). Cultivation of olives and grapes also occupies a significant amount of the remaining agricultural land (see Figure 7) (Leff, Ramankutty and Foley, 2004).

The Mediterranean agriculture is characterized by a high variety of productions, sub-climates, farm structures and agro-management practices (UNEP-MAP, 2009; MedECC, 2020) :

- **Permanent crops** consist of fruits (especially citrus fruits), olives, grapes and dates. These productions represent a highly specialized commercial agriculture and are mainly for export (FAOSTAT, 2020). The highest values (15-22 million t) come from Egypt, Italy, Spain and Turkey.
- **Annual crops** consist of cereals and vegetables. Wheat, maize, barley and rice cover more than 90% of the entire Mediterranean cereal production. These crops are raised mainly for domestic consumption, most of the countries being net importer (FAOSTAT, 2020). For cereals, France, Turkey, Egypt, Spain and Italy are also the major producers.

Mediterranean agriculture is also characterized by limited animal husbandry, with large spatial differences for the livestock subsector between countries.

Which water uses for agriculture?

From the farm point of view, **water is both considered an input and an output**. As represented in the **Figure 6**, there are four main spots of water uses at a farm scale: (i) irrigation; (ii) maintenance and cleaning; (iii) sprinkling; and (iv) watering.

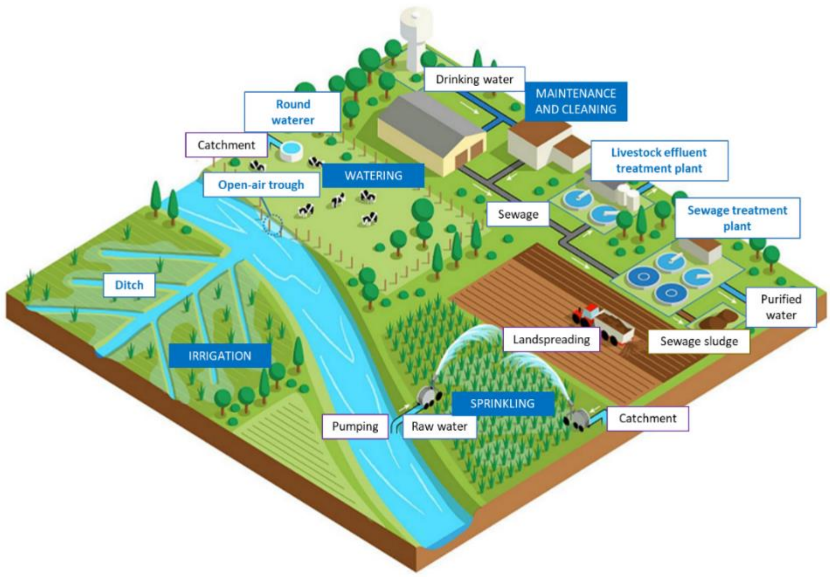

Figure 6: The uses of water and aquatic environments for agriculture – Agence Française pour la Biodiversité, 2018.

This frame of water uses at a farm scale brings a **systemic approach** to the water issue as considered in the WaterShift project. Starting from the resource itself, the project tackles the water issue by its sectorial uses and expenditure spots. This way, we will focus on main impacts of sectorial uses and practices on water resources.

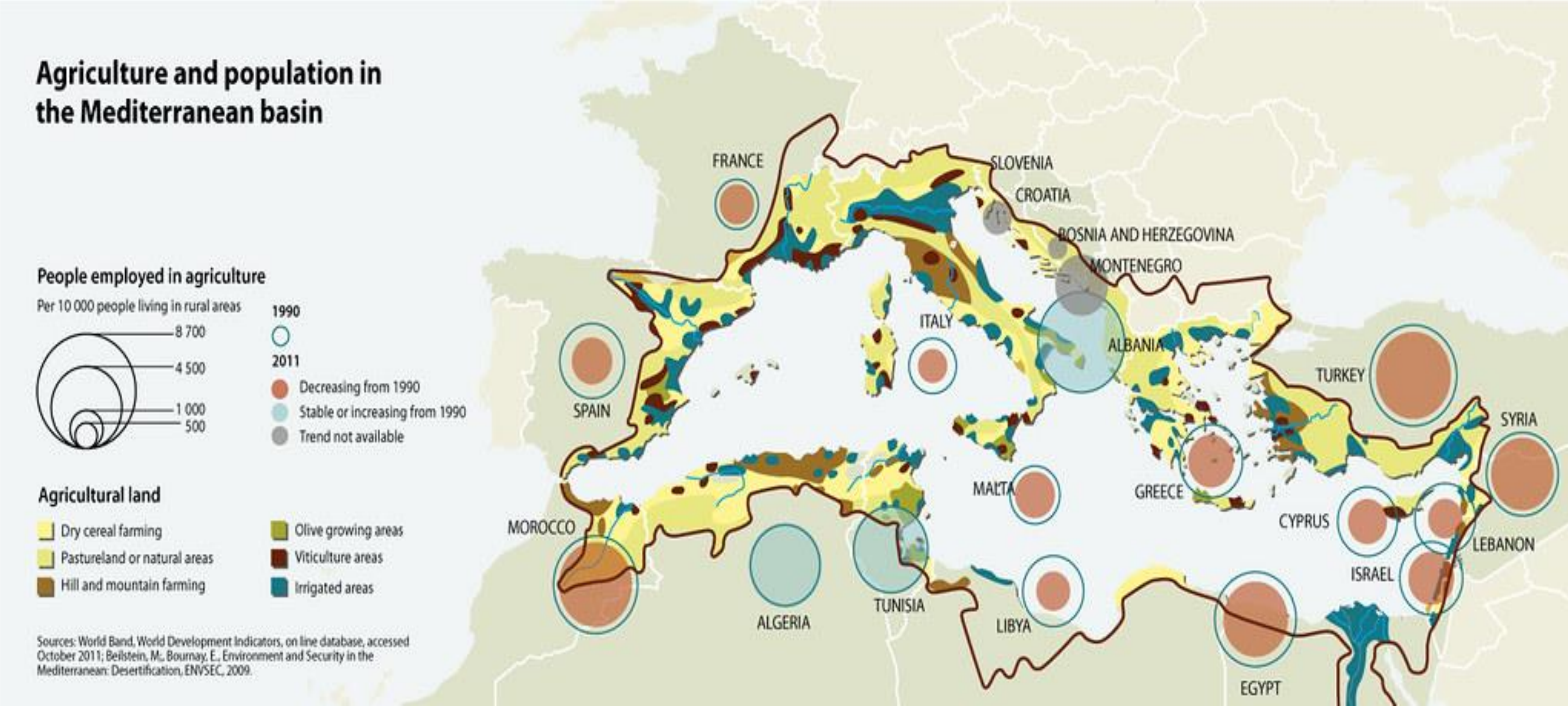

Figure 7: Agriculture and population in the Mediterranean basin (Beilstein and Bournay, 2009; World Bank, 2011).

1.1.2 Mediterranean agriculture is responsible for major impacts on water resources.

Agriculture is the highest water consuming sector in the Mediterranean with 66 billion m3/year (55% the total water demand), mainly to produce cereals, vegetables and citrus (Margat and Treyer, 2004; Milano *et al.*, 2012). The agricultural sector represents the most water-intensive sector for most of the Mediterranean countries (see Figure 8) (Burak and Margat, 2016).

In the southern Mediterranean countries, agriculture uses 76% of the abstracted water, whereas the industrial and urban consumption aamounts to only 4% and 20% respectively (FAO, 2016). Total water withdrawals are expected to increase over the entire Mediterranean basin and it is expected to double due to both the expansion of irrigated land and demographic pressure. This rise is mostly related to an increase in agricultural water withdrawals in line with warmer and drier conditions (Milano *et al.*, 2013). Agriculture also represents the largest water usage (36%) in the northern Mediterranean countries (FAO, 2016).

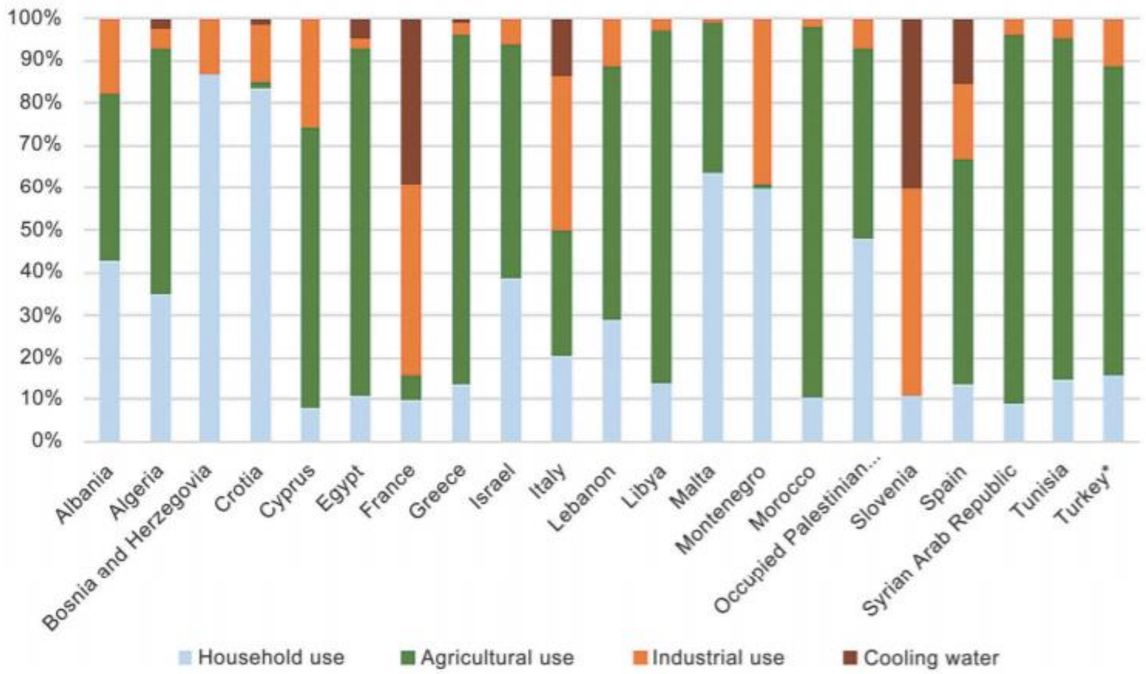

Figure 8: Water demand per sectoral use as percentage of total water demand (Burak and Margat, 2016).

In several Mediterranean countries, trends show the replacement of surface irrigation by localized irrigation (Rodríguez-Díaz *et al.*, 2011). However, this trend towards more efficient irrigation systems have not led to water savings because of several **rebound effects** (see Box 3) like changes towards more water-demanding and profitable crops or the expansion of irrigated areas. Yet, it has led to higher water productivity (tons and revenues produced per unit of water) (Ward and Pulido-Velazquez, 2008; Rodríguez-Díaz *et al.*, 2011; Shah, 2014).

REBOUND EFFECT

Definition: The rebound effect is the reduction in expected gains from new technologies that increase the efficiency of resource use (like water), **because of behavioral or other systemic responses. These responses diminish the beneficial effects of the new technology** or other measures taken (Grubb, 1990).

Back in 2014, Pfeiffer and Lin conducted one of the first ex-post evaluations of a local policy to reduce pressure from farmers on groundwater in the state of Kansas - US, from 1996 to 2005. The lever was to boost adoption of more efficient irrigation technologies by giving a subsidy up to 75% of the purchase price of the irrigation technology, to farmers. Pfeiffer and Lin demonstrated that adoption of those new water-efficient technologies lead to an overall increase of water consumption at the watershed level. Indeed, both the **average quantity used per irrigated surface** (so called the extensive margin) and the **total irrigated land** (so called the intensive margin) increased. As a result, the final impacts of this policy's implementation are a higher abstraction from groundwater, which are contrary to the initial objectives(Pfeiffer and Lin, 2014).

Considered as a major risk for the WaterShift project, the rebound effect will be closely considered when designing financial mechanism that aims at promoting sustainable water-saving solutions.

Box 3 : Definition and examples of the rebound effect

Agriculture also represents one of the most impacting sectors on water quality. As described above, the main impacts of agriculture on marine and freshwater environments are due to the runoff of nutrients and agro-chemicals into the water bodies. The runoff of inorganic nitrogen and phosphorus fertilizers leads to eutrophication, which negatively impacts marine ecosystems. The runoff and infiltration of pesticides into the sea and aquifers affects the marine and freshwater environments at a slower pace by bioaccumulation higher up the food chain (Ansari and Gill, 2014; Zak *et al.*, 2018; PNUE/PAM and Plan Bleu, 2020).

The average consumption of fertilizers of Mediterranean countries increased by 10% between 2002 and 2016, from 160 kg per hectare to 174 kg per hectare of arable land. **Around 1/3 of Mediterranean countries show national fertilizers consumptions above global average of 141 kg per hectare of arable land** (World Bank, 2020).

The consumption of pesticides in the Mediterranean basin varies largely between countries. In 2016, the average use of pesticides in kilogram per hectare of cropland was below or around the world average in most Southern Mediterranean and generally above the world average in Northern Mediterranean Countries (see Figure 9).

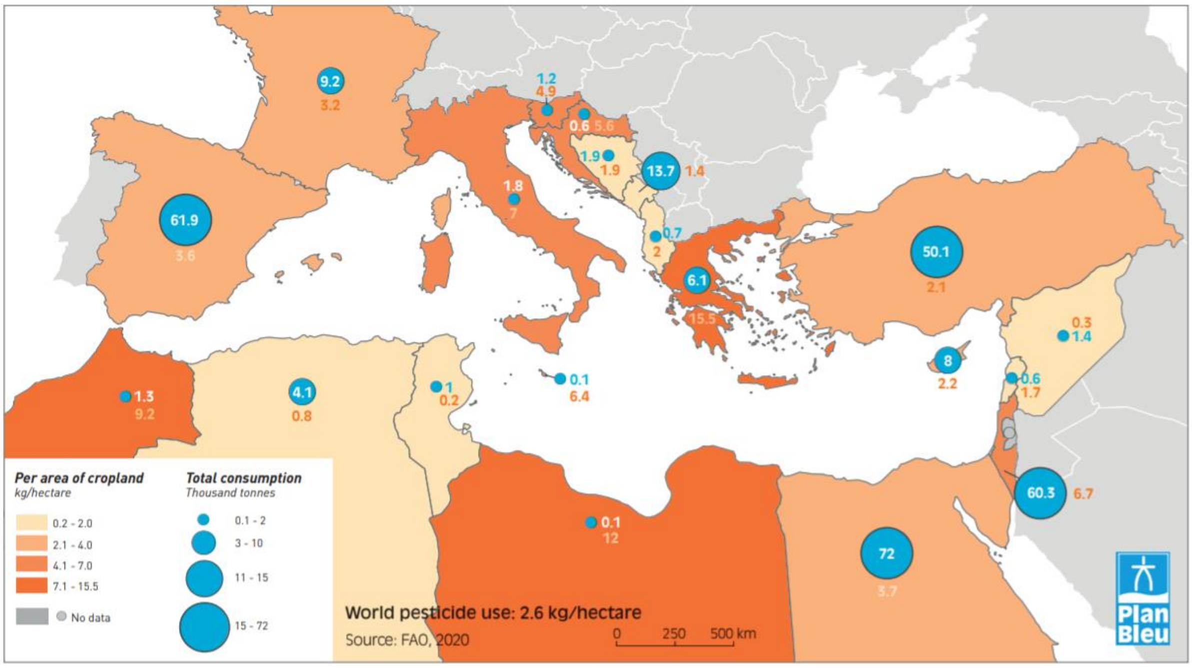

Figure 9: Agricultural use of pesticides in Mediterranean countries (FAOSTAT, 2020).

Given the key role inherent to agriculture in providing food security, the agricultural sector is in urgent need of more resilient solutions. New systemic approaches consider management of river runoffs, and a gradual reduction in the use of fertilizers and pesticides, to prevent the release of nutrients and pollutants into the watersheds.

As a hypothesis that we would like to explore, the **rebound effect** mentioned above could be one of the main negative consequences on water resource management at the watershed scale due to the spreading of innovative irrigation systems (Oréade-Brèche, 2018). As a matter of fact, those practices are designed to **provide economic profit** to farmers who implement them thanks to water efficiency increase.

While irrigation practices can be seen as a proof of the non-sustainable farming system's intensification, they could also be a lever to improve awareness within farmers about water resource preservation. Using this economic criterion, water savings brought by irrigation systems could lead to much broader **strategical decisions for the farm management and managers**. To do so, identified farming practices have to be considered from **farmer's needs**, **matching their economic realities**: under which circumstances farmers would be willing to make a shift towards more sustainable practices regarding water resources? How much financial revenue could this bring to the farmer?

As shown in **Figure 10** below, factors influencing farmers decision-making are highly relying on **economic incentives** *(see blue rounds in the* Figure 10*)*: large scale economic factors; availability of funding and loans; financial situation; socio-economic farm characteristics and efficacy of measures.

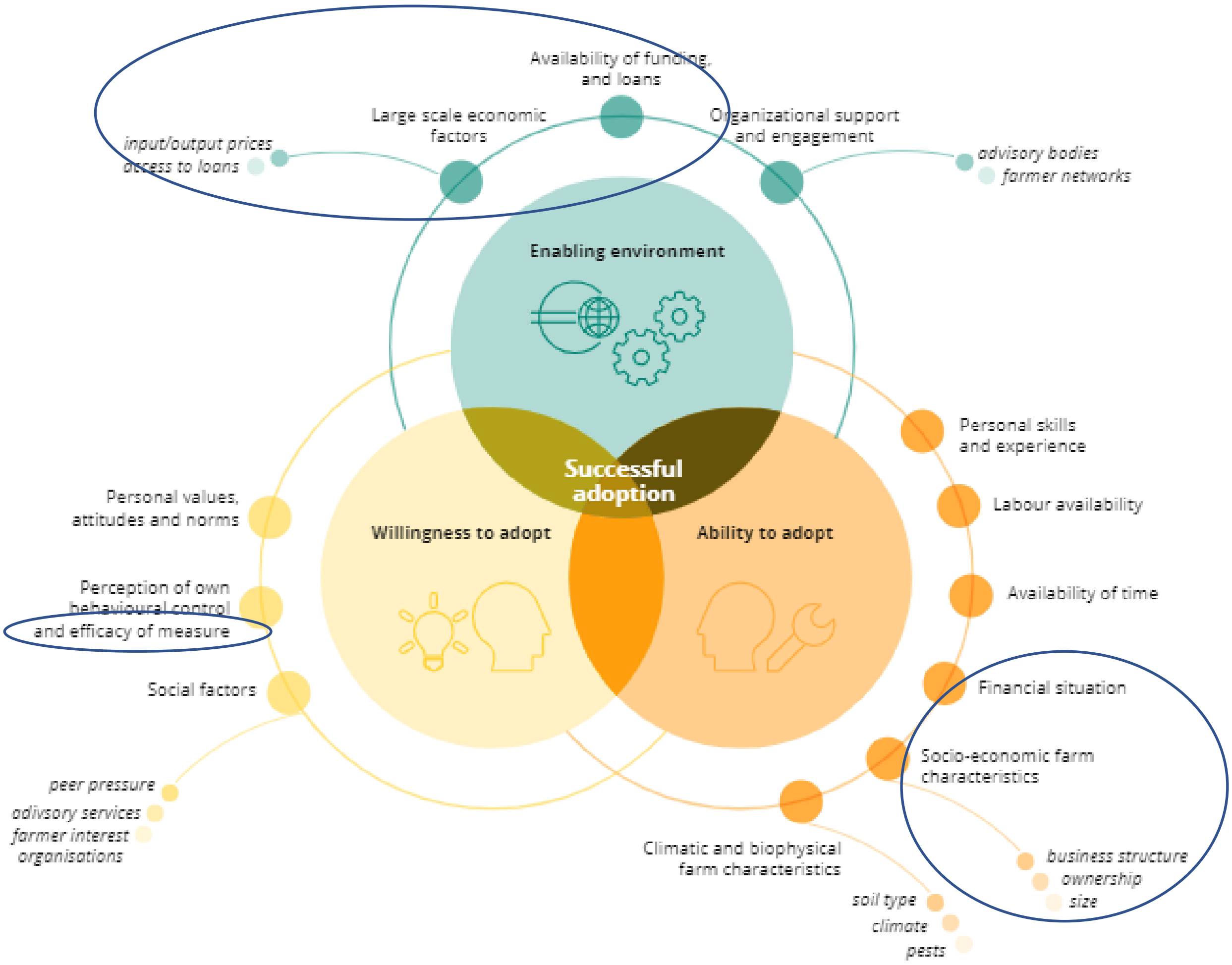

Figure 10 : Factors influencing farmers decision-making (Mills *et al.*, 2017; EEA, 2021).

Thus, the last main issue we identified regarding water management improvement in agriculture is **farmers economic interest to preserve the water resource.** From farmers point of view, irrigation is both considered as an **essential input to production**, a way to **secure yields** and a way to **improve product quality** (Oréade-Brèche, 2018). Those three levers are related to the farmers economic interest to preserve water and will be explored further in the study.

A **problem tree** was created to summarize the main water challenges of Mediterranean agriculture, and to help identify their main causes and effects. This problem tree is detailed in Annex 1.

1.1.3 Interviews with stakeholders: crossed vision on water-related issues by operators and institutions

A number of interviews were carried out with a panel of stakeholders involved at different levels of practices implementation in the agriculture sector in the Mediterranean region towards water-related impact. Those interviews were led in order to:

- complete our literature review and identify further sustainable practices;
- understand the practical levers to enhance sustainable practices in the Mediterranean region;
- engage networking to identify possible case studies on site.

A total of 15 interviews were conducted and a diversity of profiles were included: academic-researchers, conservation practitioners, economic actors implementing practices, and economic actors leading territorial water strategies (see Table 2).

Table 2 : List of interviews led for the agriculture sector.

Country	Organization	Contact person
France	Pays de l'Or community	Benjamin Pallard, Water manager Alice Galtier, Economic development manager
	CNRS	Coralie Calvet, Economist - Researcher
	CEEM	Sébastien Roussel, Assistant professor in Environmental Economics, Agriculture and Behavioral Economics
	AFD	Jérémie Dulioust, Environmental and Social expert
	INRAE	Nina Graveline, Economist - Researcher
Spain	GOB Menorca	Miquel Camps, Policy coordinator Cristina Gomila, Project manager
	WWF Spain - WWF network	Eva Hernandez, Living European Rivers Initiative Lead
Morocco	WOLFS Company	Gernant Magnin, Consultant
	WWF North Africa	Yusra Madani, Director WWF Morocco Oussama Belloulid, Freshwater project officer
Cyprus	Terra Cypria	Lefkios Sergides, Executive Director
	TDV board	Clairie Papazoglou, Independent Environment Consultant (ex-BirdLife Cyprus)
	CUT Cyprus	Menelaos Stavrinides, Assistant professor
	Cyprus Institute	Adriana Bruggeman, Monitoring and modeling of hydrologic and environmental processes
		Christos Zoumides, Resource Management Research and Economics
Slovenia	Strunjan Natural Reserve	Robert Smrekar, Director Sara Cemich, Project manager Samanta Makovac, Project manager

Depending on the interviewee profile, each interview reached a different objective, but a quick list below presents a snapshot of some questions that were asked:

- Is our project main topic (economic aspects of water management in agriculture) of interest to you and would you have some experience to share with us in this regard?
- What are the main challenges you are currently facing in relation to agriculture and water use? How are you tackling those challenges?
- Do you have some experience implementing (or assisting with the implementation) similar sustainable practices or projects you would be willing to share with us?

- Have you identified any operational continuity needs from the research you previously worked on or are working on?
- A business case on [type of crop, location, type of water used, relevant practice, etc.] could be considered?
- In your opinion, are there specific regions that could be of interest for the project (ie. economic actors in place, farmers willing to innovate, water challenges that should be focused on…)?
- Do the Watershift project objectives match with your research needs? Are there any opportunities for collaboration?

The main findings that were brought out were of threefold:

- To complete our literature review and theoretical basis on the project, environmental economics' experts we interviewed sharingsome insightful conclusions of their research. As an example, Coralie Calvet, from the CNRS (French national research center) shared some publications **highlighting the levers** (Chabe-Ferret *et al.*, 2019), (Kuhfuss, Préget and Thoyer, 2012) and **obstacles** (Kuhfuss *et al.*, 2011) in adopting agri-environmental measures in France. This feedback helped us with the in-depth assessment while working on the WaterShift problem tree.
- To get some inspiration from practical projects, Eva Hernandez, from WWF Spain, presented the main highlights from a project implemented in Germany. In partnership with WWF, the retailer Edeka aims to offer sustainable oranges for the German market sources from Andalucian farms. This collaborative project introduces methods to significantly **reduce the amount of pesticides used on plantations** (by an estimated two-thirds per hectare), as well as **encouraging greater biodiversity** and **water saving measures**. Indeed, reconnecting public and private interests are one of the objectives led by the WaterShift project and this business case could be of consideration while assessing the economic factors in place.
- Similarly, Yusra Madani, from WWF Morocco, presented the **Sebou Water Fund project**, launched in November 2019 and coordinated by WWF Morocco. The fund is a sustainable financing mechanism based on **payment for ecosystem services** that makes possible the conservation of water resources, the restoration of biodiversity, and the preservation of socio-economic and cultural activities that depend on them. Although the fund is of complete interest regarding the objective and down-top approach of the Watershift project, this discussion drove our team to rethink the focus on a more adapted study perimeter considering the timeframe of the project and the need to provide both tangible practices to farmers and technical inputs for business cases to bidders and investors.

These discussions also led to the identification of possible opportunities for further collaboration in the research and academic space. As an example, Nina Graveline, researcher at the INRAE (French national center for agronomic research), presented the Climate KiC project, which aims at developing a collaborative platform and networking opportunities in the viticulture sector, in which Watershift could be part of. Sébastien Roussel also presented the TYPOCLIM Project that is aimed at preparing a TYpology and assessment of POlicy instruments to promote agricultural adaptation to CLIMate change. This collaborative project runs from 2019 to 2021 and focusses on policy instruments to facilitate agricultural adaptation to climate change. These projects provide some relevant contacts and project ideas to be developed in the Mediterranean region.

Finally, the interviews led to identify opportunities for collaboration on some specific sites in the Mediterranean region :

- In Croatia, the agriculture sector represents about 70% of the water used, the groundwater is nearly exhausted and salinity levels have increased drastically. The interviews led with local consultants and researchers highlighted the opportunity analyze further some case studies such as the **potato crop** (most profitable one in Croatia), **the illegal use of bore** or **the economic aspects of water use in agriculture**. The actors we interviewed showed a willingness to contribute for further practical research and engagement with farmers.
- In the territorial region named Pays de l'Or in the South of France, the agriculture sector has **high agronomic potential with innovative water efficiency practices already implemented**. The cultivated crops are representative of the Mediterranean region (wine, wheat, arboriculture, etc.). The council water manager shared with us a robust territorial agriculture diagnosis led in 2020 that highlighted the obstacles in identifying action levers to sustain practices changes and incentivize farmers to collaborate more with territorial actors. Another main challenge highlighted by Pays de l'Or is related to **real estate**. The administration is looking at implementing a legal mechanism to tackle this challenge (*Obligation Réelle Environnementale*, allowing landowners to create sustainable land protection obligations on their land).
- In Slovenia, the Strunjan Natural Reserve gathers strong water challenges related to **water floods and salination that weaken tourism, agriculture and salt production sectors**. The Natural reserve administration is strongly looking for solutions to mitigate the impact and is willing to collaborate with us to develop innovative and impactful incentives.

1.1.4 Crossed-analysis about water-related challenges of the farming sector in the Mediterranean region

Strengths	Weaknesses
• Diversity of production • Specialization on high added value production • Optimized irrigation systems in the main producing countries	• Scarcity and unequal distribution of water resources • High water-consuming agricultural crops (citrus-growing, arboriculture, grain crops) • Abuse of fertilizers and pesticides impacting water quality and leading to environmental degradation (ie. eutrophication, biodiversity loss…) • Rebound effects (more efficient irrigation systems do not always lead to water savings) • High competition for water between sectors
Opportunities	**Threats**
• Technical and financial levers to facilitate farmers' transition to more sustainable business models • Innovative irrigation systems to reduce water consumption • Low water-consuming crops and varieties • Innovative fertilization systems	• Decrease of water resources availability • Increase of water demand and competition due to demographic changes • Contamination of aquifers: runoff of pesticides and fertilizers, salt-water intrusion • Loss of agricultural land: urbanization, sea-level rise • Increase of droughts and floods • Change of cultural landscapes

1.2 Salt production: a sector at the heart of environmental and economic evolution in the Mediterranean

1.2.1 General context

In the Mediterranean basin there are more than 170 saltworks in 18 countries (see Figure 11). 90 are active saltworks, from which 75% are located in the northern and central Mediterranean countries: Spain, Greece, Italy, France and Portugal. Traditional salt pans are in continuous decline in the Mediterranean from the 1950s, since they are suffering from environmental pressures and economic stress. Their products face strong competition from cheaper land-produced salt and from the world trade. To stay viable, salinas are confronted with the choice of closing, industrializing the production or changing the business orientation towards sustainable tourism and new artisanal products.

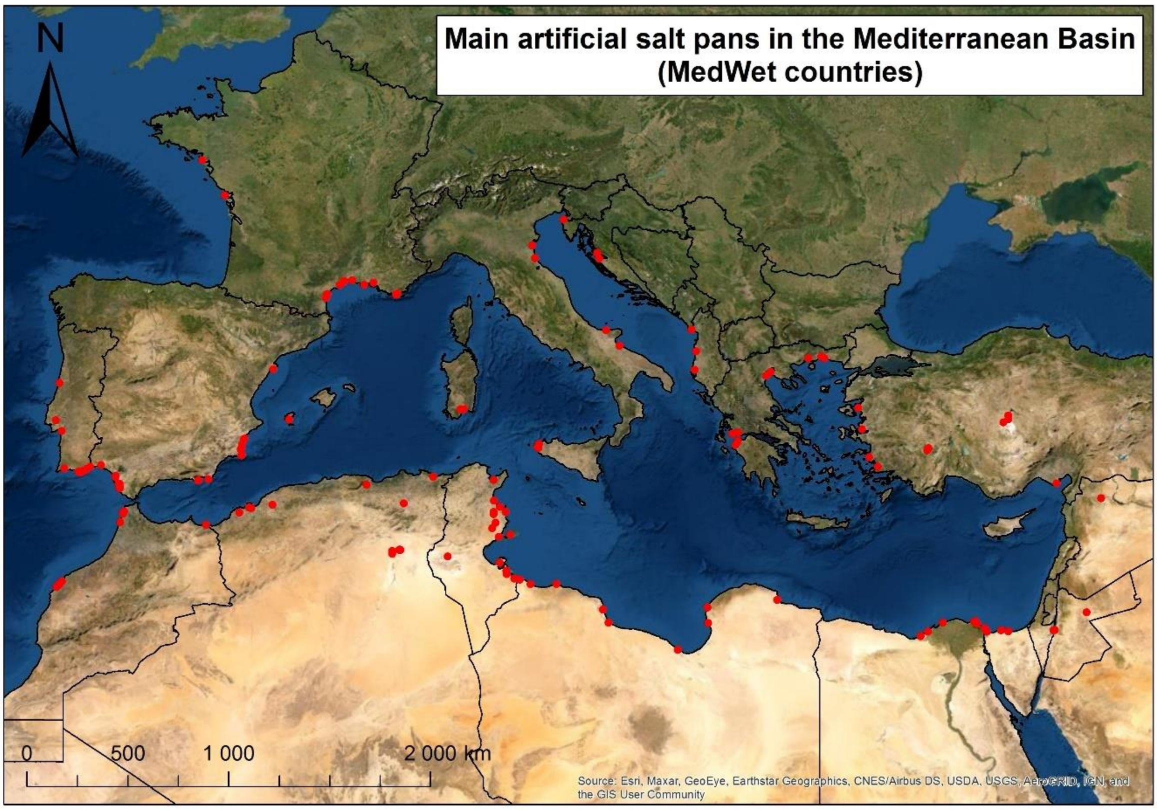

Figure 11: Main artificial salt pans in the Mediterranean basin (MedWet countries) (Guelmami and Mediterranean Wetlands Observatory, 2021)

In the last decades, some European countries, including Portugal, France and Spain have modified their technical-sanitary regulations for the obtention and sale of edible salt with a minimum content of sodium chloride of 94%. This modification allows the commercialization of sea salt harvested in salinas with traditional management and collected manually, distinguishing two types of sea salt, both obtained exclusively by the action of the wind and the sun, collected by hand and without adding any ingredient "Fleur de sel" comes from the top crystallized layer of the pond and "virgin sea salt" is obtained from the bottom or sides and washed only in the pond or crystallizer.

All the saltworks in the European Union countries are protected as Sites of Community Importance (future Special Areas of Conservation) under the Habitats Directive and as Special Protection Areas under the Birds Directive. Also, the Directive 2000/60/EC "Good-quality water in Europe" (EU Water Framework Directive) is important for the protection of saltworks (and of wetlands in general), because it aims at protecting "all standing or flowing water on the land's surface" and at "restoring the ecosystems in and around these bodies of water". This Directive has led to the enactment of implementing rules at the level of each country, which positively affects water management and conservation of wetlands, including saltworks.

Table 3 shows the **distribution of Natura 2000 sites including solar saltworks** in the countries of the European Union, along the Mediterranean and the Black Sea coasts (Massimiliano Costa, Fabrizio Borghesi, Lino Casini, Zsuzsa Fidlóczky, Francesca Migani, 2016).

Table 3 : Distribution of Natura 2000 sites including solar saltworks in European Mediterranean countries

Country	SCI/SPA	SCI	SPA	Total
Bulgaria	1	1	1	3
Greece	3	8	8	19
Croatia		7	3	10
Slovenia		3	3	6
Italy	7	13	7	27
Malta			1	1
France		11	11	22
Spain	8	4	3	15
Total	19	53	44	115

The spatial organization of the ponds in the salinas and their different depths, necessary for the salt production process, favors a high degree of spatial heterogeneity and very productive microenvironments that are attractive to many primary and secondary consumers (Evagelopoulos et al. 2008). Such conditions hold aquatic communities with complex cycles and interspecific relationships and species which are highly specialized for life in this environment. Species richness generally decreases with higher salinity levels, which also very much reduces the presence of aquatic invertebrates and alter waterbird communities, which are the main consumers and most vulnerable components to changes in water conditions (López et al 2009).

Salinas are often classified as functional wetlands with high biological richness, and considered as a substitution habitat for birds that breed, winter or stop-over along coastlands where most original tidal habitats have been transformed or removed (Masero 2003). Balancing the economical, patrimonial and biodiversity values of salinas is thus needed to mitigate the threats posed by global changes on waterbirds. However, since the hypersaline conditions that dominate in the salinas are suboptimum to most species, and waterbird concentrations are dictated by the lack of alternatives in the surrounding landscape rather than by habitat suitability, conservation actions should be oriented towards the creation of a habitat mosaic within the saltpans (Barnagaud et al 2019). Besides, these habitats are also important for the conservation of other animal groups, such as endangered endemic fishes (Oliva-Paterna et al 2009; Verniell-Cubedo et al 2014).

1.2.2 Literature review

A literature review was conducted in the first months of the project and 30 publications were selected as the most relevant to the topic, with publication dates ranging from 2002 to 2019. Most of the European pilot cases were located in Portugal, France, Spain, Slovenia and Greece. We also looked across other parts of the world were saltworks occur. Publications put the focus on 3 types of Salinas: artisanal, extensive and mixed. The main challenge faced by Mediterranean Salinas was the economic competitiveness of artisanal vs commercial salt production operations leaving many artisanal operations abandoned or poorly maintained. A comprehensive analysis of the causes of the crisis of the salt of the Mediterranean during the last 50 years was provided by Duarte et al (2014):

- high production costs in comparison with other salt productions styles;
- global competition with an increased market liberalization scenario;
- land pressures in a tourism driven demographic change context;
- lack of technological innovation;
- the appearance and development of semi-intensive and intensive aquaculture in the same areas; - changes in hydrological regimes;
- the lack of environmental integration

A problem tree (Figure 12) was developed to identify the main **problems around salt works and water use**, along with their causes and effects, to help us understand the main sustainable practices within this sector:

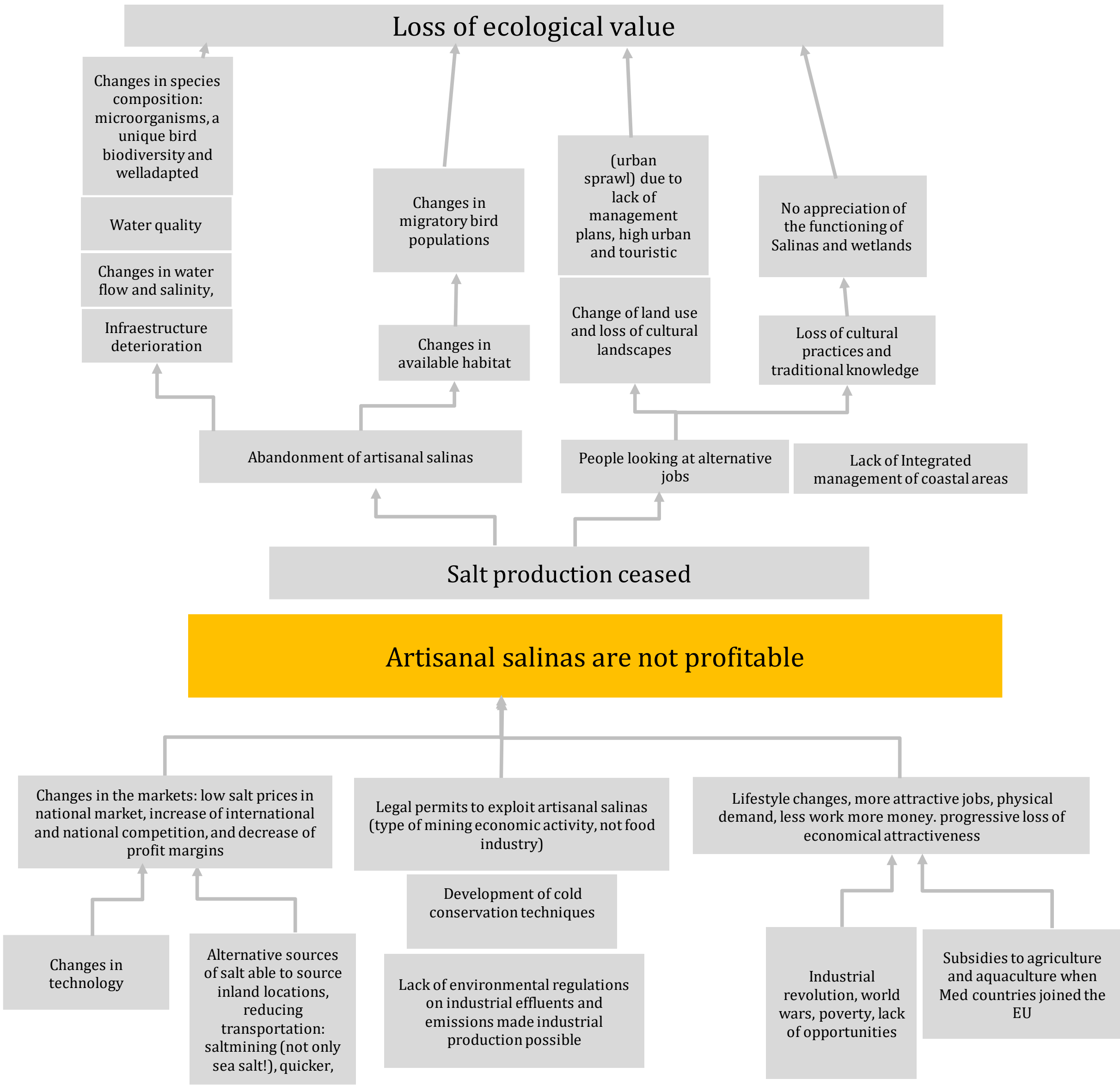

Figure 12 : Problem tree of artisanal Salinas derived from the literature review.

1.2.3 Survey on Mediterranean salinas

The collaboration with the MedArtSal project has given us the opportunity to better understand the challenges and opportunities around the salt production sector in Mediterranean coastal wetlands. At the end of 2020, a survey was launched where 34 artisanal Salinas were identified in 7 Mediterranean countries (Algeria, Egypt, Spain, Italy, Lebanon, Slovenia and Tunisia).

- 27 salinas replied (80%)
- 17 of them were artisanal
- 29 questions on 5 topics: environment, economics, marketing, conservation and management.

The main themes addressed in the survey were the following:

- Types of Salinas by production and by location
- Ownership and business structure

- Current activity : active or abandoned
- Extension
- Salt productivity
- Profitability
- Commercial characteristics
- Environmental aspects
- Touristic activities
- Gender parity

Some of the conclusions from the survey:

- Most Salinas are located on private land. The average area of artisanal Salinas is less than 10 ha.
- Coarse salt is the main product in Artisanal Salinas and most of them do not focus on secondary products
- Artisanal Salinas sell mainly locally and its profitability is low or very low at moment
- Most of them are located in Natural Protected Areas and have biodiversity monitoring schemes
- Most artisanal Salinas carry out some type of touristic activities with significant revenue

1.2.4 Feedback from local salt producers on water use, financial aspects and biodiversity conservation

According to the interviewees (Biomaris and San Vicente Salinas, both saltworks in Bahía de Cádiz), freshwater is not essential for salt production in artisanal salinas, but only the sea water, whose supply is guaranteed in quantity, but not always in quality. This must be controlled, in terms of temperature and transparency. Moreover, prevention measures must be implemented in the event of a contingency related to water quality, such as an urban wastewater discharge, closing the gates and using evacuation systems.

Concerning the diversification of activities, for these artisanal salinas, it seems to be a must in order to supplement the incomes. Most have already implemented tourism-related activities, but also the obtention of cosmetic products and aquaculture. An additional factor to consider is that, in Bahía de Cádiz at least, an important limitation for the economic development of the sector seems to be the low level of associationism among producers. This can be considered as a common characteristic in most Spanish regions

Finally, in terms of biodiversity conservation, nesting or feeding birds in the ponds and structural elements are not considered as a problem and, in most cases, they are used as an attraction for tourists, especially flamingoes, that have become true hallmarks. Only in the case that the salt production is combined with aquaculture, fish-eating birds, especially cormorants, but also herons or gulls, become a problem due to direct competition, affecting the economic performance of these farms.

1.2.5 Crossed analysis about water-related challenges for the salt production sector in the Mediterranean region

Strengths	Weaknesses
• Using gourmet products that require very low water demand • Niche for different economic activities: fishing, fish farming, Artemia, halophilic bacteria, mud, brine, other types of salt, ecotourism, crustaceans, moluscs, macroalgae, microalgae, salinas orchard, birdwatching, hiking, environmental education, school visits, nautical routes, etnography of the saltworks, gastronomy (tasting experiences), etc. • Local Support, recovering traditions and cultural knowledge • Biodiversity conservation scenarios	• Changes in the markets: low salt prices in national market, increase of international and national competition, and decrease of profit margins • Lifestyle changes, progressive loss of saltworks economical attractiveness. • Fishing, fish farming, Artemia, halophilic bacteria and archaea, mud, brine, other types of salts
Opportunities	**Threats**
• Development and enforcement of water use and water quality monitoring programs, together with biodiversity management plans • Engaging the former workers of the salina, building community based on cultural knowledge and traditions • Considering the historical and cultural bonds of these sites, by considering them as natural heritage sites. • Engage Universities in the creation of Living Labs around the salina and the wetland to monitor water quality and availability. • Create a MBA volunteer program at a national or EU level to support formulation and implementation of business plan	• Change of land use leading to economic high water demand activities (agriculture, tourism) • Loss of ecological value (Changes in species composition: microorganisms, a unique bird biodiversity and well adapted vegetation) • Loss of cultural practices and traditional knowledge • Change of cultural landscapes

1.3 Tourism, a major socio-economic sector that exacerbates the demographic pressure on water resources

1.3.1 General context

Tourism in many places around the world has increased dramatically over the last decades. It is the most dominant economic sector in regions, such as in the Caribbean (Charara *et al.* 2010) and the Mediterranean (Hadjikakou *et al.* 2013). Even though tourism is a major source of income and employment within the Mediterranean and other touristic places (Briguglio 2008), it has been identified as one of the main causes of environmental degradation, exerting significant pressure on all natural resources, such as water. According to Mangion (2013), tourism is the main source of extreme demand for diverse natural resources, which in consequence inflicts severe environmental threats combined with high infrastructural costs, which unfortunately are often not taken into account. Even though tourist visitors contribute significantly to the economic growth of many places such as cities and towns, they often require services and facilities that produce an unsustainable balance between infrastructure and natural resources. Therefore, a massive construction due to tourism has been identified, as well as an insufficient control of urban planning, such as the case of many of the Mediterranean Islands (Essex *et al.* 2004).

1.3.2 Water use related to tourism

Despite the fact that several tourist places have limited natural and water resources, the expansion of these type of destinations over the last 40 years has been overwhelming (Essex *et al.* 2004). As a result, tourism growth in several regions has been identified to cause deficiencies in the provision of water supply and sewage systems (Bramwell 2003; Marques *et al.* 2013). In addition, tourism increases overall per capita water consumption, concentrating it in time (often in the dry and high seasons). In addition, the increase of water demand is also amplified by the growth of local population, needed to provide facilities and services to satisfy tourist visitors. For instance, in some areas of the Mediterranean, the proportion of local population compared to that of tourists may change significantly along the year, reaching in some cases more than one to six. Specifically, the water use during peak months of tourism (e.g. in July 1999) in the Balearic Islands, was equal to 20% of the water use of the entire local population for the entire year (Gössling *et al.* 2015). According to Mangion (2013), a tourist in Malta consumes on average three times more water than a local resident, creating a challenge for water supply utilities to be able to comply with these elevated rates (Briguglio 1995).

Water consumption in the tourism sector varies depending on the activities. For example, there are activities such as: bathing and showering, toilet use, golf courts, landscaping, spas, wellness areas, swimming pools, as well as food and fuel production, that have been identified as intensive water consumptive. In addition to these uses, there is hotel water consumption that includes recreational activities such as sailing, diving and fishing (Gössling *et al.* 2012). Because of this, the proportion of water consumption by the tourist sector can be as high as 40% (e.g. in Mauritius) over the resident average water use; tending to be higher in areas where water is scarce and the number of tourists is even higher.

Table 4: Water use categories and estimated use per tourist per day (Gössling et al. (2012))

Water use category	Description	L/tourist/day
Direct use	Accommodation (shower, bath, toilet, spas, pools, landscapes, sport and health centers, laundry, restaurants)	84-2000
	Activities (e.g. golf, skiing)	10-30
Indirect use	Fossil fuels (water use for energy consumption and/or production)	750 (per 1000 km by air/car)
	Biofuels (water use for biofuel consumption and/or production)	2500 (per L of bio fuel)
	Food (water use for food consumption and/or production)	2000-5000
Total per tourist per day		2000-7500

According to De Stefano (2004), the main causes of the impacts on freshwater resources are high water consumption due to population increase and the higher consumption of water associated to facilities and leisure, such as hotels. According to Barberan et al. (2013), water is essential on the fulfillment of several hotel activities. Due to the fact that tourists require constant access to water, hotel tourists consume on average one third more water per day than a local inhabitant (Romagosa et al., 2014), and as three times the average consumption of people living at home (Barberan et al, 2013). In addition, hotels vary in size and type of accommodation, making the consumption in the most luxurious places significantly high. For instance extensive landscaping, water parks, swimming pools and golf courses are typical tourist facilities that require extensive amounts of water during the drier seasons on most of the Mediterranean region.

Tourism water use tends to increase with hotel standards, increased water-intense activities, as well as with the growth rates of tourist visitors. Gössling (2001) reported that the variation on water consumption is directly related to the hotel category. According to Deng and Burnett (2002), the average water use in five-star hotels is approximately 5 m^3/m^2 of hotel area, while in four-star hotels and three-stars hotels are 4 and 3 m^3/m^2, respectively. According to this study, the main water consuming activities within hotels are: (1) garden irrigation, (2) swimming pools, (3) spas and wellness facilities, (4) golf courses, (5) cooling towers, (6) guest rooms and (7) kitchens. Table 4 shows the average per capita consumption related to direct and indirect water use in the tourist sector. 47% of the water used goes to the laundry, 30% to the rooms and 22% to the kitchen. However, hotels without laundries consume 55% of their water in the kitchen and 44% in the rooms. As the current trend is for certain hotel services to be gradually outsourced, including laundry services, when evaluating water consumption and conservation measures it is advisable to focus mainly on guests and hotel catering services. According to Cobacho *et al.* (2005) the water use in the rooms of Spanish hotels are as follows: 45% of the water goes to the washbasin, 33% to the shower and 22% to the toilet. Cold water is mainly used in washbasins (38%), toilets (35%) and showers (27%). In the case of hot water, the greatest consumption is in washbasins (58%), followed by showers (42%).

On the other hand, golf courses are also among the highest water intensive activities involving the tourist sector. For instance, according to the study of water use in golf courses in Spain carried out by the National Spanish Golf Federation (RFE Golf), the average water consumption in a golf course of less than 18 holes per year is between 100.000 and 200.000 m^3 per year, while golf courses with 18-36 holes consume between 200.000 and 300.000 m^3. This study mentioned that close to 58% of the courts use recycled water, 4% desalinated water and the rest use other sources, including freshwater.
Tourism premises need to be attractive to satisfy tourists. For instance, a large and beautiful garden is an important criterion (usually) for the selection of a hotel (Antakyali *et al.,* 2008), nonetheless, this may require continuous irrigation, resulting in large volumes of water. This is particularly a challenge in arid regions, where water becomes scarce in certain periods. The use of water to satisfy tourist activities can become a significant environmental, as well as economic problems in such places where number of beds are high and the problems with water scarcity are severe. Tourist premises need to adequate water supplies of high quality in order to preserve their businesses and maintain the economic stability of the region. For this reason, hotels as major consumers need to look for options to reduce water consumption and become more environmentally friendly.

1.3.3 Identification of implemented practices in tourism to reduce water demand.

In order to identify the subsectors within tourism that are the most water consumptive, an extensive literature review was carried out. This review included research publications, policy documents such as technical reports, guidelines, news or blogs that were related in any measure aiming to reduce water demand in the tourist sector. The search was done through google search google scholar, scopus and web of science with keywords such as 1) water demand, 2) water consumption, 3) water management, 4) water scarcity, 5) water supply, 6) Mediterranean, 7) sustainable practices, 8) water saving measures, among other related keywords.

An extensive revision of 32 policy-related documents and 32 research publications regarding any areas within the Mediterranean was carried out. A systematic revision was done as well, by categorizing each document by year, type of practice (physical tool or mechanism, policy, and recommendation), the type of audience, the objective, the expected results, monitoring indicators, among others. After analysing the audience of the 64 revised documents, results indicated that 42 out of the 64 had an audience of either hotels or golf courses. For this reason, it was decided to focus on these two subsectors for the different analyses to follow.

In addition, another filtration was carried out in order to summarize the most important sustainable water-saving practices. Therefore, the final list with previously selected sustainable measures are from the year 2010 onwards and only the ones including physical tools or mechanisms. That way we could summarize in an easier way the latest tools implemented, and have more updated information regarding costs, motivations, challenges, etc. Annex 2 indicates a summary of the literature carried out and how the 'audience' determined which tourist sub-sectors to use.

III. Study methodology: a practice-based approach on the most impacting sectors on water resources to define sustainable business models for transition

1.1 Identification of sustainable practices in each sector

As detailed above, the three selected sectors are central for the management of water issues in the Mediterranean. The main common challenges between these 3 sectors are identified as: (i) **water consumption**, (ii) **impact on surface water and groundwater quality**, and (iii) **conservation of rich habitats and biodiversity**.

The sustainable transition of these sectors is even more essential as their impacts are extremely reliant on the demographic pressure, and will be increased by the coming demographic changes, especially in coastal areas where the demographic and tourist pressure is higher. Global climate changes will also increase drastically the pressure on water resources and therefore the current challenges. However, the major socio-economic role of these sectors for the Mediterranean region must be taken into consideration. The environmental transition of these sectors towards more sustainable practices and models will only be possible if accompanied by an economic and social transition as well.

Considering Mediterranean water-related issues, **sectorial practices represent the main source of impact on water** of these sectors' companies. Although closely correlated with their business models, practices of these companies directly affect the water resources and ecosystems. Considered as a source of pressure, practices can also be seen as main levers for change in each sector. Finally, the sectorial practices are the direct link between the companies' business models and the companies' impact on the water resource.

To meet the WaterShift project objectives, the methodology presented in this study is based on an approach which aims to identify the most sustainable practices that best meet each sectors' objectives and considers water-related issues of each sector. A first list of sustainable practices is proposed for each sector, obtained from the literature review and interviews led by each partner's contacts. These practices are grouped according to their area of intervention.

Practices are then **assessed in order** to select the ones that best meet the main water challenges and ensure an environmental, economic and socio-territorial transition of the sectors. From the selected practices, the main characteristics of sustainable business models that enable their implementation are defined.

1.2 Assessment of the sustainability of practices' impact and selection of the best practices

After the initial in-depth review of practices that enable companies to face water-related challenges, a selection was made to ensure the overall sustainability and viability of chosen practices for both companies themselves and their environment. Considering the importance of the socio-economic viability of the practice for its acceptability and implementation, the suggested sustainability assessment is carried out according to the three major dimensions of sustainable development: economic, social and environmental.

For each dimension, three major themes and indicators were chosen. These themes and indicators represent the main sustainability issues of companies in the Mediterranean. For example, the three chosen themes for the environmental dimension are the level of impact on water quantity, water quality and ecosystems, which represent the main water-related issues in the Mediterranean, as detailed previously (see section *1)-I-1.2)*. The full method developed to co-create the impact assessment grid is detailed below (see *2)-II-1.1*).

The 10 best sustainable practices per sector according to the assessment ranking are selected to define features of business models for transition.

1.3 Identification of sustainable business models' characteristics based on selected practices

Finally, based on the selected practices, characteristics of sustainable business models for transition were defined. The impact of the practices' implementation on the companies' business models is evaluated through its major components: its value chain, value proposition and revenue model.

The objective of this analysis is to define the most impactful components on companies' business models sustainability, and the major long-term effects of practices implementation, in order to define and select as accurately as possible the business models for transition. After the definition of links between sustainable practices and business models components, a second analysis based on the impact assessment is carried out to find correlations between the companies' business models components and their economic, social and environmental impact.

The full business model analysis is detailed below *(see 2)-III).*

2. Review of sustainable practices and business models per sector

I. Identification of sustainable practices

1.1 Good practices in agriculture

1.1.1 To limit freshwater overconsumption

Area of intervention	Intervention name
Irrigation management and farmers knowledge of crops' water needs	Installation of water sensors
	Tactical choices for controlled irrigation management
	Review and monitoring to detect leaks
	Remote irrigation management
Irrigation systems	Localized irrigation (sprinklers, pivot)
	Surface drip irrigation
	Underground drip irrigation
	Hydroponic irrigation
Crops	Choice of low water consuming crops/varieties
	Choice of varieties adapted to optimized irrigation systems
Other farming expenditures spots with high margin for water savings	Cleaning water - Optimize cleaning systems
	Cleaning water - Training staff to save water
Alternative water sources	Implementation of re-use systems
	Use of treated sea water
	Use of stored rainwater

1.1.2 To reduce agricultural impact on water quality and on watershed ecosystems

Area of intervention	Intervention name
Innovative fertilisation systems	Implementation of fertigation systems
Fertilisers and pesticides overconsumption	Implementation of reasoned pesticide application plans for major crops.
	Implementation of bio-control techniques
Impact on ecosystems and biodiversity	Implementation of agroecological infratructures : buffer zones, habitats etc.
	Assess the impact on downstream environments

1.1.3 To facilitate farmers' economic transition

Area of intervention	Intervention name
Evolution of the global farm strategy to preserve water resource.	Implementation of organic agriculture techniques
	Implementation of agroforestry techniques
	Implementation of conservative agriculture techniques
	Implementation of hybrid and diversified agricultural workshops (cereals and livestock; climate-smart agriculture)
	Design and implementation of the irrigation strategy
Threatening of final product quality's decline	Diversification of selling goods and products towards locally adapted, high added value and water savings products
	Association with local pioneers farms to promote water-efficient agriculture
Threatening of yields decreasing because of water availability's decline	Subscription to existing water-saving economic incentives
	Subscription to drought's insurance mechanisms

1.2 Good practices in salt production

A sustainable Salina would be one that fosters the local economic development through sustainable salt production and development of new products and services, preserving their environmental and cultural values.

Area of intervention	Intervention name
Economic **Improving profitability of artisanal salinas and facilitating salt manager´s economic transition to a more sustainable salina**	Diversification of business practices depending on the season (e.g. Combining salt production with alternative uses of the salinas : fishing, fish farming, Artemia, halophilic bacteria, mud, brine, other types of salt, ecotourism, crustaceans, moluscs, macroalgae, microalgae, salinas orchard, birdwatching, hiking, environmental education, school visits, nautical routes, etnography of the saltworks, gastronomy (tasting experiences), etc.
	Capitalizing on gourmet product with high ecoefficiency (e.g. Fleur du Sel)
	Mantaining infraestructure to avoid economic loss
	Proving to managers that projects based in biological production and land rehabilitation, environmental education and other integrated activities could generate higher profits to solar salt works and consequently their sustainability and their development.
	Exploring Business model focused on the relationship between the occupied surface and production ´ s revenue

	Promoting Solar salt production as a sustainable activity due to its low fossil energy requirements. Given the alternative process, which requires non solar water ev aporation, that is a huge advantage.
	Setting up tax deductable donations
	Give to solar salt added value, by associating the different kind to specific food items (meat, fish, vegetables by their composition or structure; labelling the salt in a trustworthy manner to strengthen the sense of authenticity; using quality seals, especially when approved by independent panels or relevant institutions to build trust among customers and the general public; associating the salt to natural protected areas, to the values of nature or to the history of the saltwork
	Letting visitors and customers to produce their own salt, to create a sense of belonging and to increase the value of salt
	Artisanal production supported by smart strategies for marketing, providing an added value to salt production, that allows to raise up the prize
	Selling of not refined salt, with presence of specific micronutrients or physic-chemical properties, to highlight the uniqueness of the salt and raise up the price
	Create events, such as cultural shows on site of salt making such as "Salt Fairs", salt museums or other options to create identity
	Make saltworks a tourist destination themselves, rich in history, culture, nature, gastronomy, landscapes
	Using the brine, the mother liquor and the mud (peloid) for spas, thalassotherapy and for cosmetic purposes (cellulite treatment), also for producing cosmetics
	Assessing the sustainable exploitation of products of high commercial value, such as Dunaliella salina β-carotene, Artemia salina and Chironomus salinarius for aquarium use, Algae for medical use, Salicornia and Sarcocornia for feed or pharmacological uses, extremely halophilic archaea (e.g. Halobacterium salinarum) for biotechnological applications
	Assessing the production of energy through the Reverse Electrodialysis technology
	Reduce energy consumption in the saltworks, using or improving the natural difference in water levels (gravitational water management), for water run-in and runoff, instead of the water pumping.
	Bring together professional salt producers, biologists, civil and water engineers, making it possible to optimise environmental management within saltworks
	Lobbying activities to obtain an exemption from the land tax when respecting the commitments to the Natura 2000 charter allows
	Replace the covers of the production of service buildings with photovoltaic panels, so as to reduce production costs
	Creating a Nature Park Trust Fund

Area of intervention	Intervention name
Environmental **Enhancing water quality and biodiversity in the salina and the coastal wetland they rely on**	Regulation and monitoring of water levels for bird colonies protection
	Bring together professional salt producers, biologists, civil and water engineers, making it possible to optimise environmental management within saltworks
	Monitoring water quality
	Monitoring of habitats and plants
	Monitoring of animal populations of species of Community interest and conservational concern
	Limiting predation on breeding colonies
	Maintenance of embankments and islets with conservation purposes
	Avoiding disturbances to colonies
	Keep a low human presence throughout the breeding season
	Ensure the presence of quiet areas for feeding, nesting and resting during the whole year, of at least 70% of the surface
	Create vegetation and straw screens along walking path and construct observation hides, to reduce human disturbance
	Reflooding of lagoons if abandoned. Maintaining different shallow levels is best option to achieve good bird community diversity
	Applying an alternative type of rehabilitation and management focused on improvement of water quality, while promoting and supporting environmental-friendly tourism
	Maintaining ponds of varying salinities and depths and monitor biodiversity.
	Development and enforcement of biodiversity management plans

Area of intervention	Intervention name
Social **Promoting the cultural value of salinas and the traditional knowledge, and reducing the impact of other economic practices around the wetland**	Conservation (maintained through cultural associations, educational research, guided tours, etc.) of traditions, culture, gastronomy, landscapes, toponyms, buildings, every topic connected to the "memory" of ancient salt production, for its own relevance and as an added value for the products
	Engaging former workers of the salina, building community based on cultural knowledge and traditions
	Considering the historical and cultural bonds of these sites, by considering them as natural heritage sites.
	Engage Universities in the creation of Living Labs around the salina and the wetland, Innovative Labs to define
	Create a MBA volunteer program at a national or EU level to support formulation and implementation of business plans
	Setting up visitors and interpretation center to promote the role of the local communities in the conservation of the landscape and the preservation of traditions.

1.3 Good practices in tourism

As indicated in section *1)-II-1.3*, 65% of the total of documents revised, pointed out to an audience of either hotels and/or golf courses. For this reason, the list of good practices refers only to these two sub-sectors.

Based on the extensive literature review carried out for this study, the list of good practices is divided into the ones applicable to hotels and the ones applicable to golf courses. Table 5 and Table 6 show the summary of identified intervention practices to save water in hotels and golf courses, respectively.

Table 5 : Summary of intervention practices in hotels

No.	Area of intervention	Intervention name
1	***Minimization of water leaks***	Periodic control of consumption by zones
		Location of leaks using electro-acoustic material
		Periodic review and monitoring to detect leaks
		Installation of meters in areas of great consumption
2	***Reduce demand***	Pressure reduction on the main hotel's water supply
		Installation of timed taps in general areas
		Installation of flow reduction systems in showers and hand basins
		Installation of low-flush systems in WC
		Installation of dual-flush systems in WC
		Installation of waterless urinals
		Introduction of aerators and consumption reduction devices
		Changing bathtubs for showers
		Green book for customers (opt for short showers, turn off the faucet while soaping, brushing teeth, or shaving, reuse bath and pool towels)
		Bed linen recommendation for guests
		Towel reuse recommendation for guests
		Smart showering
3	***Irrigation of gardens***	Installation of dual-water systems in bathroom
		Drip irrigation for gardens
		Use of low-water consumption plants
		Irrigation at times of least insolation
4	***Optimization of laundry operations***	Localized irrigation in gardens
		Redesign of gardens
5	***Non-conventional water sources***	Washing machines that consume less water
		Reusing water from rinsing after microfiltration
		Installation of greywater recovery system for indoor use (e.g. toilet flushing and irrigation)
		Installation of stormwater collection system
		Using sea water for swimming pools
6	***Staff***	Reuse of water from pools
7	***Kitchens***	Training staff to save water
		Installation of low flow spring loaded pre-rinse spray valves in kitchens
8	***Certifications***	Installation of aerators in kitchen taps
9	***Pools***	Installation of cleaning filters to reuse water

Table 6 : Summary of intervention practices in the golf courses

No.	Intervention name
1	Use of stored rainwater for irrigation
2	Use of greywater for irrigation
3	Use of surface runoff for irrigation
4	Water sensors
5	Low-pressure fitments
6	Replacing sprinkler heads to more efficient
7	Partnering with irrigation system companies
8	Sectorization of original sprinklers
9	Installation of electric valves with sprinklers in block alignment
10	Change greeners for Bermuda (grass)
11	Change to artificial grass

Since the previous list from the literature review is quite extensive, it was shortened based on the preferences identified on the interviews that were carried out for this study. A total of five interviews were carried out with hotel managers, golf manager and a researcher specialized on water saving devices in the hotel industry. The interviews lasted around 45 minutes and covered several aspects surrounding the installation of best practices to save water within their premises. After the interviews, they were analyzed based on five components: 1) perception of water scarcity in the Mediterranean region, 2) factors affecting the decision to implement a best practice (motivation), 4) challenges to implement the best practice and 5) interventions already implemented to save water and 5) costs of this interventions.

1.3.1 Interviews with stakeholders

In order to analyse the perception on water scarcity, as well as the underlying motivation to install water-saving measures, challenges or limitations when installing them and the actual practices to reduce water demand, five interviews were carried out with different types of questions. Table 7 shows the list of interviewees.

Table 7 : List of selected interviewees

Name	Role	Description
Pablo Pereira	Researcher at the University of Surrey	Extensive research on smart metering in different hotels
Juan Antonio Moreno	Representantative of Suncomfort	Carried out the study for the implementation of the measure for the reduction of environmental impacts by installing a filtering system in pools to reuse water in Flamingo Albir hotel in Alfaz del Pí.

David Gomes Aguera	Representantative of RFEGOLF of Spain	Watering of golf courses with regenerated water and rainwater. Sectorization of original sprinklers and installation of electric valves with sprinklers located in blocks. Changing of type of grass.
Yolanda Cuna	Exploitation Director in Port hotels in Benidorm	Manager of Port Hotel in Benidorm, has implemented several water saving measures
José Luis Martinez	Repair and Maintenance Chief of Asia Gardens Hotel and Thai Spa in Benidorm	Connected to the regenerated water pipeline for garden irrigation.

The thematic and specific questions to each interviewee are summarized in Annex 3: Grid for analysis of interviewees' responses.

1.3.2 Synthesis of interviews

The main conclusion of the interviews is that saving water within the Mediterranean region by the hotel and golf sector is very important, and something that must be taken into account for the future. Many interviewees agreed that the scarcity is not severe in the Mediterranean at the moment, compared to other parts of the world, such as the Canary Islands. Most of the interviewees agree that the main factors that motivates a hotel or a golf course to introduce a water-saving best practice are the costs and the return-on-investment time. Also, it is important the environmental part, which refers to saving water due to the fact that hotels are big consumers. The biggest limitations are the budgets planned for this aspect, and the lack of external funding such as subsidies or specific loans for this type of applications. Also, it is important to mention the type of technology involved, and the type of premise.

For big hotels, it is profitable to install some water-saving best practices, that for smaller hotels will be more challenging in the absence of subsidies. Also, some measures might need certain WIFI connection, or certain type of infrastructure, which not all premises might have.

Based on the five conversations held with stakeholders, the list of best practices was modified as shown in Table 8.

Table 8 : Final list of best practices for impact assessment evaluation

HOTELS	
1	Periodic control of consumption by zones
2	Periodic review and monitoring to detect leaks
3	Installation of meters in areas of great consumption
4	Pressure reduction on the main hotel's water supply
5	Installation of timed taps in general areas
6	Introduction of aerators and consumption reduction devices
7	Installation of low-flush systems in WC
8	Installation of dual-flush systems in WC
9	Changing bathtubs for showers
10	Green messages for customers (opt for short showers, turn off the faucet while soaping, brushing teeth, or shaving, reuse bath and pool towels)
11	Smart showering devices
12	Drip irrigation for gardens
13	Use of low-water consumption plants in gardens
14	Localized irrigation in gardens
15	Installation of greywater recovery system for indoor use (e.g., toilet flushing and irrigation)
16	Installation of rainwater collection system
17	Using sea water or from own wells for swimming pools
18	Reuse of water from pools
19	Training staff to create awareness and save water
GOLF COURSES	
1	Use of stored rainwater for irrigation
2	Use of greywater for irrigation
3	Use of surface runoff for irrigation
4	Water sensors
5	Low-pressure fitments
6	Replacing sprinkler heads to more efficient
7	Sectorization of original sprinklers
8	Change greeners for more drought resistance grass

II. Impact assessment of selected sustainable practices

1.1 Impact assessment framework based on a systemic approach

In order to start the analysis of good sectorial practices, we decided to **better understand why they are qualified as sustainable good practices** with regards to water resources and its good ecological status. To do so, the partnership organized three workshops in March 2021, that resulted in a **collaborative-designed impact assessment methodology and grid**.

1.1.1 Impact assessment methodology and conceptual framework

The partnership went back from the first objective of the WaterShift project, namely *"support the transformation of the most impacting sectors towards more sustainable practices and virtuous business models regarding water resources and biodiversity in the Mediterranean"*. Thus, the sustainability of sectorial practices needed to be characterized before going further into their business models analysis. Due to WaterShift's willingness to support a **strong sustainability approach,** the partnership chose to get inspiration from the **IDEA Methodology** (see Box 4). Thus, the impact assessment grid was structured around the **three main sustainable dimensions**: economic, environmental and social (considered as non-substitutable).

In parallel, each partner selected the main sectorial challenges identified during the sectorial diagnosis. These challenges were turned into **themes** in order to illustrate the three sustainability dimensions per sector. Then, each sectorial theme was declined into **two to three SMART[1] indicators** that best illustrate the practices' features. At last, Vertigo Lab pooled and synthetized those inputs into a **common impact assessment grid** for good practices (see Table 9). Partners' inputs are presented in the Excel annex document "Final impact assessment grids", tab "Partners' inputs".

The IDEA method

The IDEA method is developed by several French researchers specialized in sustainable agricultural practices assessment. IDEA stands for *Indicateurs de Durabilité des Exploitations Agricoles* (or Farm Sustainability Indicators). This is a **normative approach** focused on sustainable development and the three normative dimensions. For the last 20 years, the IDEA method has been applied to the farming sector to bring field content about best practices in farming. It has been revised several times to best fit with farmers' feedbacks, and expectations on their practices' assessment. The last revised version dates 2020 and chose to underline the **strong sustainability approach** in its conceptual framework. That is why we have inspired from the IDEA method to deepen the Watershift's practice-based approach and apply it for tourism and salt production sectors.

Box 4 : The IDEA method (Source : (Zahm *et al.*, 2008, 2019))

[1] SMART : Specific, Measurable, Achievable, Realistic, Timely

Table 9 : Common impact assessment grid

Impact assessment core topic	Sustainability of practices' impact on water resource								
Dimensions	Economic impact			Socio-territorial impact			Environmental impact		
Themes	Financial accessibility	Profitability	Competitiveness of the company	Acceptability by the company	Replicability to other companies of the same sector	Territorial public acceptability	Water quantity	Water quality	Environmental performance
Indicators	Level of investment needed to implement the practice	Level of profit generated by the practice implementa tion	Level of competitiveness improvement brought by the practice to the company	Level of practice's acceptability by the company	Level of dissemination of the practice to other companies	Level of practice's acceptability by local population and impact on the image of the company	Level of water savings due to practice implementation at the company's scale	Level of water quality improvement gained with the practice implementation	Level of impact on other natural resources (biodiversity, soil, habitats, climate,air quality etc.)

These indicators are **qualitative** and their grading is based on both literature review and conducted interviews. They are related to **levels of impact** and fit into a scale going from 1 to 5: 1 being the lowest rate and 5 the highest. Each rating scale has been clarified per indicator, as detailed in the Excel annex document "Final impact assessment grids", tab "Definitions and method".

1.1.2 Impact assessment conduction of sectorial good practices

Once the impact assessment grid was homogenized, each partner conducted his practices' assessment for all the selected ones. It concretely relies on scoring from 1 to 5 each indicator per practice. Then, we sub-sum each ranking per dimension.

> *For instance,* ***"Installation of water sensors"*** *has 9 points for economic dimension; 9 points for socio-territorial dimension; and 6 points for environmental dimension.*

As we decided to stick to a strong sustainability approach, the final score of the practice corresponds to the lowest sub-total it gets.

> *To full fill with the example, the final score of* ***"Installation of water sensors"*** *is 6.*

This impact assessment resulted in a good practices ranking that allowed each sector to go from a general list of good practices to the ten best ones. The score per practice is the final IDEA score; and in case of a tie between practices selection, the chosen practice was the one with the highest global score. *For instance, "****Subscription to existing water-saving economic incentives"*** *and* ***"diversification of selling gods and products towards locally adapted, high value added and water savings products****", both have a 7-IDEA Score and respectively get 28 and 25 points as their global score. Then, the first practice was selected as a best practice to be further evaluated.*

In conclusion, the partnership selected a total of 33 sectorial practices that have the best impact on the water resource's preservation. They will be further mobilized again during the **analytic method of the practices' impact on business models' components.**

1.2 Impact assessment results for the WaterShift project

Complete impact assessment grids of each sector are detailed in the Excel annex document "Final impact assessment grids". The synthesis of the 10 best practices per sector according to their impact assessment rating are presented below (see Table 10, Table 11 and Table 12).

All bibliographical references used to carry out these impact assessments are detailed in the Excel annex document and in Annex 4 for agriculture. The practices are split between the hotels and golf courses sub-sectors for the tourism sector, with only the three best practices being selected for the golf courses sub-sector considering the lower initial number of practices.

1.2.1 Agriculture sector

Table 10 : Synthesis of the best practices in the agriculture sector.

		Impact assessment grid										
Impact assessment core topic		Sustainability of practices' impact on water resource										
Dimensions		Economic impact			Socio-territorial impact			Environmental impact				
Themes		Financial accessibility	Profitability	Competitiveness of the company	Acceptability by the company	Replicability to other companies of the same sector	Territorial public acceptability	Water quantity	Water quality	Environmental performance		
Indicators		Level of investment needed to implement the practice	Level of profit generated by the practice implementation	Level of competitiveness improvement brought by the practice to the company	Level of practice's acceptability by the company	Level of dissemination of the practice to other companies	Level of practice's acceptability by local population and impact on the image of the company	Level of water savings due to practice implementation at the company's scale	Level of water quality improvement gained with the practice implementation	Level of impact on other natural resources (biodiversity, soil, habitats, climate,air quality etc.)		
	10 best practices										Global score	IDEA Score
1	Implementation of organic agriculture techniques	1	3	5	3	3	4	3	5	5	32	9
2	Implementation of agroforestry techniques	2	3	4	3	2	4	3	4	5	30	9
3	Implementation of fertigation systems	2	3	5	2	4	3	4	4	2	29	9
4	Implementation of reasoned pesticide application plans for major crops.	3	1	4	2	4	5	1	5	4	29	8
5	Tactical choices for controlled irrigation management	3	2	4	2	4	4	5	2	1	27	8
6	Implementation of re-use systems	2	3	4	2	3	3	4	4	2	27	8
7	Implementation of conservative agriculture techniques	3	3	3	3	2	3	2	3	5	27	8
8	Design and implementation of the irrigation strategy	2	3	4	2	3	3	5	2	1	25	8
9	Subscription to existing water-saving economical incentives	5	4	2	4	3	3	4	2	1	28	7
10	Association with local pionniers farms to promote water-efficient agriculture	4	2	3	3	3	4	4	2	1	26	7

1.2.2 Salt production sector

Table 11 : Synthesis of the best practices in the salt production sector.

		Impact assessment grid										
Impact assessment core topic		Sustainability of practices' impact on water resource and biodiversity										
Dimensions		Economic impact			Socio-territorial impact			Environmental impact				
Themes		Financial accessibility	Profitability	Competitiveness of the company	Acceptability by the company	Replicability to other companies of the same sector	Territorial public acceptability	Water quantity	Water quality	Environmental performance		
Indicators		Level of investment needed to implement the practice	Level of profit generated by the practice implementation	Level of competitiveness improvement brought by the practice to the company	Level of practice's acceptability by the company	Level of dissemination of the practice to other companies	Level of practice's acceptability by local population and impact on the image of the company	Level of water savings due to practice implementation at the company's scale	Level of water quality improvement gained with the practice implementation	Level of impact on other natural resources (biodiversity, soil, habitats, climate,air quality etc.)		
											Global score	IDEA Score
1	Support managers in the integration of sustainable strategy that includes maintenance and restoration of the salina, along with good environmental practices in their operational processes	5	3	5	3	4	4	2	3	5	34	10
2	Maintaining infrastructure to avoid economic loss and for conservation gain: maintenance of embankments and islets with conservation purposes. Maintaining ponds of varying salinities and depths and monitor biodiversity. Maintenance of salt water circulation in the basins.	4	3	4	4	3	3	2	5	5	33	10
3	Monitoring water quality both within the saltpan operational space but also within the lagoon and buffer area	4	2	3	4	3	4	1	4	4	29	9
4	Diversification of business practices depending on the season (e.g. Combining salt production with alternative uses of the salinas : fishing, fish farming, Artemia, halophilic bacteria, mud, brine, other types of salt, ecotourism, crustaceans, moluscs, macroalgae, microalgae, salinas orchard, birdwatching, hiking, environmental education, school visits, nautical routes, etnography of the saltworks, gastronomy (tasting experiences), etc.	4	5	5	3	5	5	1	2	5	35	8
5	Artisanal production supported by smart strategies for marketing, providing an added value to salt production, that allows to raise up the prize, associating the salt to natural protected areas, to the values of nature or to the history of the saltwork. Capitalizing on gourmet product with high ecoefficiency (e.g. Fleur du Sel). Selling of not refined salt, with presence of specific micronutrients or physic-chemical properties, to highlight the uniqueness of the salt and raise up the price	3	5	5	4	4	4	2	2	4	33	8
6	Exploring Business model focused on reducing the footprint of the salina and the generation of products	4	4	5	4	3	3	1	3	4	31	8
7	Proper design of the saltpans to mantain gravitational water management to avoid water pumping , energy consumption and biodiversity disturbances.	4	4	4	3	4	2	2	2	4	29	8
8	Bring together professional salt producers, biologists, civil and water engineers, making it possible to optimise environmental management within saltworks	5	1	2	3	5	3	2	3	3	27	8
9	Development and enforcement of a biodiversity management plan focused on habitat restoration, and enhancement for the improvement of water use, water quality and conservation of associated species.	3	3	2	2	4	2	1	5	5	27	8
10	Make saltworks a tourist destination themselves, rich in history, culture, nature, gastronomy, landscape by considering them as natural heritage sites. Create events, such as cultural shows on site of salt making such as "Salt Fairs", salt museums or other options to create identity	5	1	2	3	4	3	1	4	3	26	8

1.2.3 Tourism sector

Table 12 : Synthesis of the best practices in the tourism sector.

	Impact assessment grid										
Impact assessment core topic	Sustainability of practices' impact on water resource										
Dimensions	Economic impact			Socio-territorial impact			Environmental impact				
Themes	Financial accessibility	Profitability	Competitiveness of the company	Acceptability by the company	Replicability to other companies of the same sector	Territorial public acceptability	Water quantity	Water quality	Environmental performance		
Indicators	Level of investment needed to implement the practice	Level of profit generated by the practice implementation	Level of competitiveness improvement brought by the practice to the company	Level of practice's acceptability by the company	Level of dissemination of the practice to other companies	Level of practice's acceptability by local population and impact on the image of the company	Level of water savings due to practice implementation at the company's scale	Level of water quality improvement gained with the practice implementation	Level of impact on other natural resources (biodiversity, soil, habitats, climate,air quality etc.)		
HOTELS										**Global score**	**IDEA Score**
Installation of greywater recovery system for indoor use (e.g. toilet flushing and irrigation)	1	5	4	3	2	5	5	4	4	33	10
Installation of rainwater collection system	1	5	4	3	2	5	5	3	3	31	10
Pressure reduction on the main hotel's water supply	4	4	3	4	4	3	4	2	3	31	9
Using sea water or from own wells for swimming pools	4	4	3	4	3	3	3	3	3	30	9
Periodic review and monitoring to detect leaks	2	4	3	3	3	3	4	2	2	26	8
Installation of meters in areas of great consumption	3	3	3	3	3	3	4	2	2	26	8
Introduction of aerators and consumption reduction devices	2	4	3	3	2	3	4	2	3	26	8
Installation of low-flush systems in WC	2	4	3	2	3	3	4	2	3	26	8
Changing bathtubs for showers	2	4	3	2	3	3	4	3	2	26	8
Smart showering devices	2	4	4	2	1	4	4	2	2	25	7
GOLF COURSES										**Global score**	**IDEA Score**
Use of greywater for irrigation	1	5	5	4	5	5	5	1	4	35	10
Use of stored rainwater for irrigation	2	4	4	5	5	5	4	1	4	34	9
Use of surface runoff for irrigation	3	4	4	5	5	4	4	1	4	34	9

III. Business models analysis based on selected practices

1.1 Context and objectives of the business models analysis

1.1.1 What is a business model ?

A business model describes the principles by which an organisation **creates**, **delivers** and **captures value** in the frame of specific social, environmental, economic criteria. The business model describes the core aspects of a business that can be a company, an organisation, or even an institution.

1.1.2 What does it help to ?

A business model helps to (i) **identify the value one organisation can deliver, (ii) which kind of profit the business aims at making, and (iii) how the business concretely sustains itself. It also details the activities and needed resources to operate.** The business model creation helps the business draw its strategy, anticipate any costs, risks and actions to put in place.

The purpose to study a business model may be appraised as follows:

- Identify the value proposition the organisation can bring to the markets in response to clients' needs.
- Define the market segment to understand which problem the business aims at solving and how it could adjust to better answer to the targeted need.
- Spot the value chain and determine the business actions that are part of it or that are foreseen in terms of concrete activities such as design, production, delivery and support.
- Understand the position of the business in a larger network and amongst the diversity of businesses and value chains to determine the conditions of its sustainability including its competitive advantage and its possible interdependences or cooperation with other businesses.
- Be able to relate its purpose in the form of a narrative to be able to market the proposed value, inspire the targets and sell the proposed value effectively.

1.1.3 What are the main components of a business model?

The business model of a company can be summarized by its 3 main components, as illustrated below (see Figure 13):

- **Its value proposition: what is delivered** by the company. It can be a product, service or feature that creates benefits for the customer.
- **Its value chain: how the company creates the value proposition.** This includes notably all the activities that a firm operates and resources that are consumed in order to deliver the value proposition.
- **Its revenue model: why the company generates profit and captures value.** It refers to all the elements that ensure the economic sustainability of a company, including its customers, distribution channels and prices.

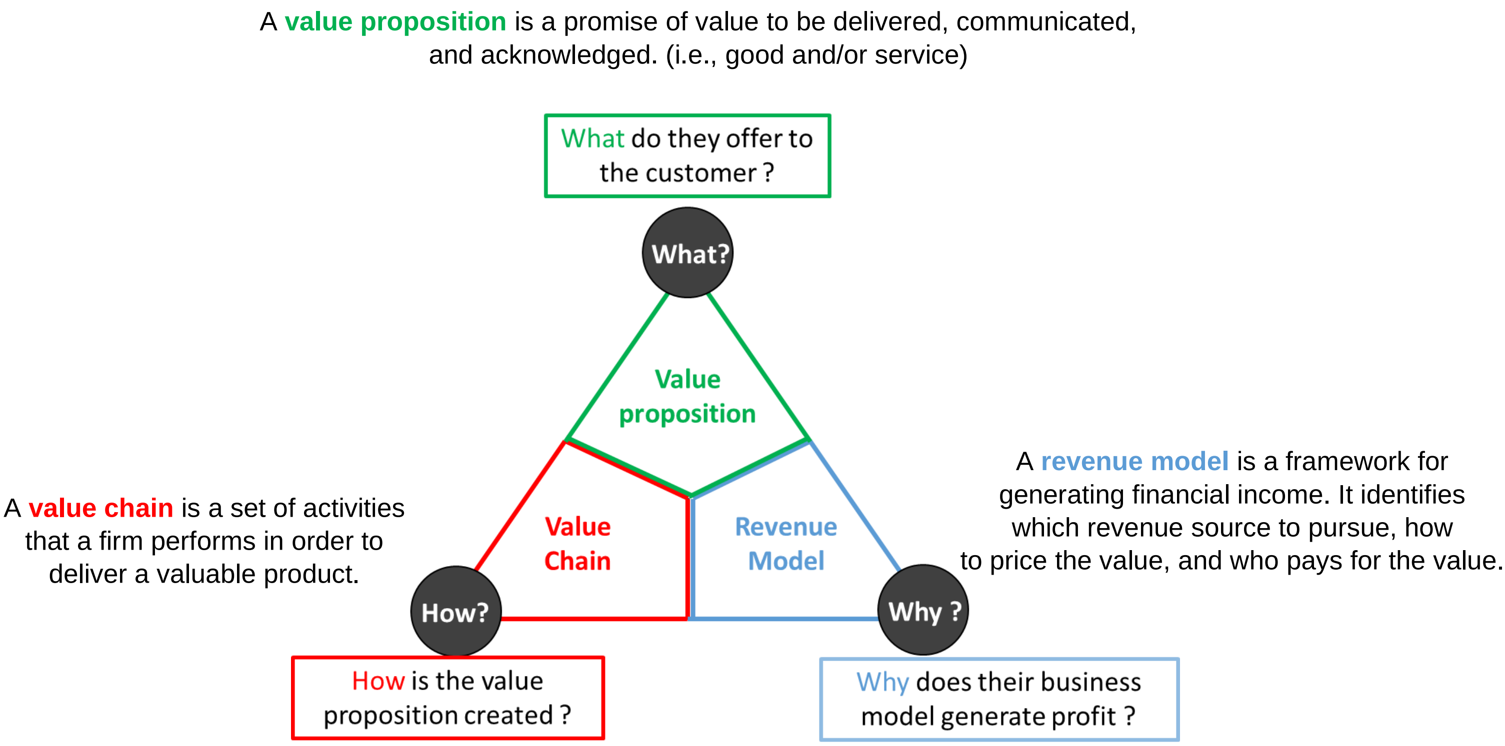

Figure 13: Main components of the business model of a company

The most common business model representation remains the **business model canvas**. Created by Osterwalder and Pigneur, this canvas divides the main aspects of a business model in nine specific parts: partners, activities, resources, cost structure, value proposition, customer segments, customer relationships, channels and revenue streams. This canvas summarizes and map those key elements into a coherent whole (Osterwalder and Pigneur, 2010). The links between this canvas and the 3 main components described above can be represented as in Figure 14:

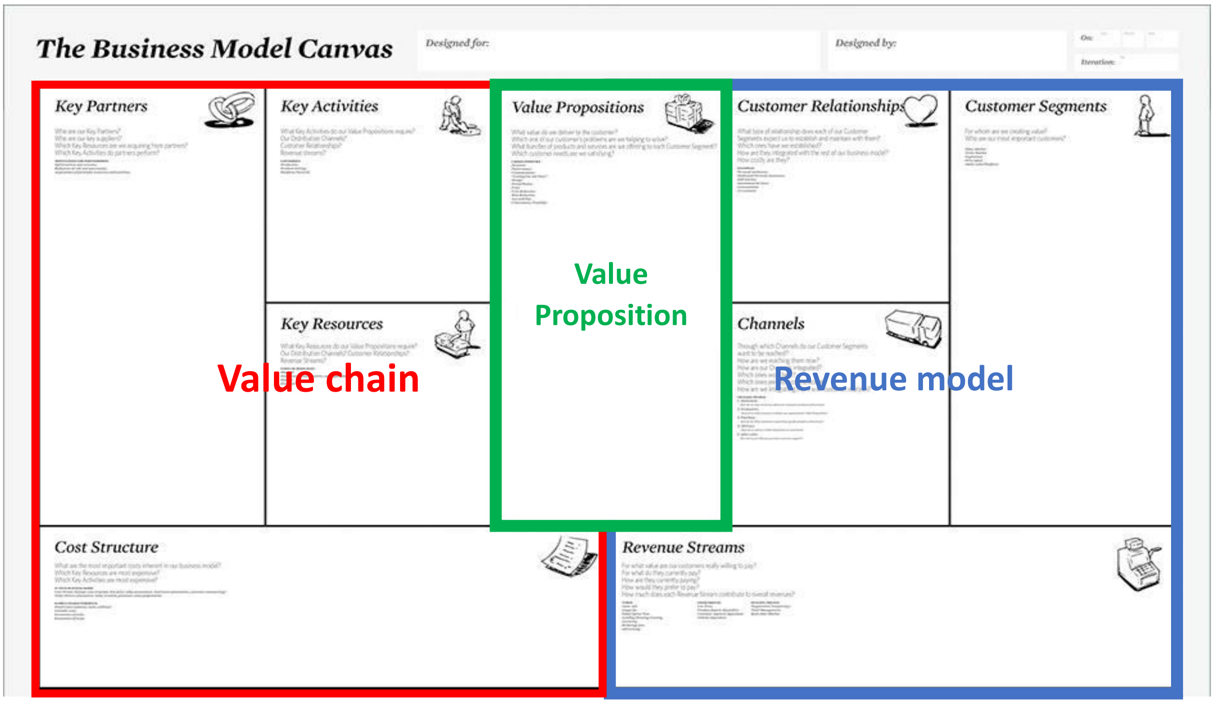

Figure 14: The business model canvas

1.1.4 Objectives of the WaterShift project

The Watershift project aims to **explore new approaches for conservation based on the transformation of sectors that have an impact on biodiversity and water resources**. The objective is to accompany the transformation of three sectors (agriculture, salt production and tourism) towards sustainable practices and water savings. To do so, **the transformation of sectors business models appears like a necessary objective to provide long-term and sustainable territorial changes** not only of sectorial practices but of sectors as a whole.

Given the above, the project wants to understand how to engage businesses of the Mediterranean basin into the transformation of their business models towards more sustainability and less environmentally impactful models, especially on water resource uses.

1.2 Identification of the most impactful components on companies' sustainability

The overall objective of this analysis is to define the most impactful components on companies' business models sustainability, in order to define and select as accurately as possible **business models for transition**. Based on the impact assessment described below, an **analytic method of the practices' impact on business models' components** has been developed.

1.2.1 Selection of the most sustainable practices.

To evaluate the link between companies' practices and their business models sustainability, a selection of the most sustainable practices per sector is made. Based on the previous impact assessment rating**, the 10 best sectorial practices with the highest sustainability score per sector are selected**.

1.2.2 Definition of links between sustainable practices and business models components

The objective of the analysis is to define what components of companies' business models affect and are affected by the best practices. To do so, and based on above, each selected practice is assessed according to the following questions:

"**Does the implementation of the practice have a major impact on**:

- **The value chain** of the company (i.e. the process to create the products or services)?
- **The value proposition** of the company (i.e. what products or services are created)?
- **The revenue model** of the company (i.e. why the company generates profit)?"

This analytic method was the main topic of the 3rd partnership working session. Thus, each partner answered those questions for their best sectorial practices. Results of this first analysis are detailed below.

1.3 Business models analysis results for selected practices

1.3.1 Agriculture sector

Business Model Analysis grid				
Parts of the Business Model of the Company affecting and/or being affected by the practice		**Value chain**	**Value proposition**	**Revenue Model**
Questions to ask oneself to complete the analysis grid		Does the practice have a major impact on the process to create the products or services ?	Does the practice have a major impact on the products or services that are created ?	Does the practice have a major impact on why the company generates profit ?
10 best practices		**Yes/No**	**Yes/No**	**Yes/No**
1	Implementation of organic agriculture techniques	X	X	X
2	Implementation of agroforestry techniques	X	X	X
3	Implementation of fertigation systems	X		
4	Implementation of reasoned pesticide application plans for major crops.	X		
5	Tactical choices for controlled irrigation management	X		
6	Implementation of re-use systems	X		
7	Implementation of conservative agriculture techniques	X	X	X
8	Design and implementation of the irrigation strategy	X		
9	Subscription to existing water-saving economical incentives	X		X
10	Association with local pionniers farms to promote water-efficient agriculture	X		X

X = Yes

1.3.2 Salt production sector

Business Model Analysis grid				
Parts of the Business Model of the Company affecting and/or being affected by the practice		Value chain	Value proposition	Revenue Model
Questions to ask oneself to complete the analysis grid		Does the practice have a major impact on the process to create the products or services ?	Does the practice have a major impact on the products or services that are created ?	Does the practice have a major impact on why the company generates profit ?
10 best practices		**Yes/No**	**Yes/No**	**Yes/No**
1	Support managers in the integration of a sustainable strategy that includes maintenance and restoration of the salina, along with good environmental practices in their operational processes (such as the ones described in this document)	X	X	
2	Maintaining infrastructure to avoid economic loss and for conservation gain: maintenance of embankments and islets with conservation purposes (for nesting birds, endemic, endangered plants, etc). Maintaining ponds of varying salinities and depths and monitor biodiversity.	X		X
3	Monitoring water quality both within the saltpan operational space but also within the buffer area.	X		
4	Diversification of business practices depending on the season (e.g. Combining salt production with alternative uses of the salinas : fishing, fish farming, Artemia, halophilic bacteria, mud, brine, other types of salt, ecotourism, crustaceans, moluscs, macroalgae, microalgae, salinas orchard, birdwatching, hiking, environmental education, school visits, nautical routes, etnography of the saltworks, gastronomy (tasting experiences), etc.	X	X	X
5	Artisanal production supported by smart strategies for marketing, providing an added value to salt production, that allows to raise up the prize, associating the salt to natural protected areas, to the values of nature or to the history of the saltwork. Capitalizing on gourmet product with high ecoefficiency (e.g. Fleur du Sel). Selling of not refined salt, with presence of specific micronutrients or physic-chemical properties, to highlight the uniqueness of the salt and raise up the price.		X	X
6	Exploring Business models that are focused on reducing the footprint of the salina and the generation of products.	X		
7	Proper design of the saltpans to mantain gravitational water management to avoid water pumping , energy consumption and biodiversity disturbances.	X		X
8	Bring together professional salt producers, biologists, civil and water engineers, making it possible to optimise environmental management within saltworks.	X		
9	Development and enforcement of a biodiversity management plan focused on habitat restoration, and enhancement for the improvement of water use, water quality and conservation of associated species.	X		
10	Make saltworks a tourist destination themselves, rich in history, culture, nature, gastronomy, landscape by considering them as natural heritage sites. Create events, such as cultural shows on site of salt making such as "Salt Fairs", salt museums or other options to create identity.			X

X = Yes

1.3.3 Tourism sector

Business Model Analysis grid				
Parts of the Business Model of the Company affecting and/or being affected by the practice		Value chain	Value proposition	Revenue Model
Questions to ask oneself to complete the analysis grid		Does the practice have a major impact on the process to create the products or services ?	Does the practice have a major impact on the products or services that are created ?	Does the practice have a major impact on why the company generates profit ?
HOTELS				
10 best practices		**Yes/No**	**Yes/No**	**Yes/No**
1	Installation of greywater recovery system for indoor use (e.g. toilet flushing and irrigation)	X	X	X
2	Installation of rainwater collection system		X	X
3	Pressure reduction on the main hotel's water supply	X		
4	Using sea water or from own wells for swimming pools		X	X
5	Periodic review and monitoring to detect leaks	X		X
6	Installation of meters in areas of great consumption	X		X
7	Introduction of aerators and consumption reduction devices		X	X
8	Installation of low-flush systems in WC	X	X	X
9	Changing bathtubs for showers		X	X
10	Smart showering devices	X	X	X
GOLF COURSES				
Best practices		**Yes/No**	**Yes/No**	**Yes/No**
1	Use of greywater for irrigation	X	X	X
2	Use of stored rainwater for irrigation		X	X
3	Use of surface runoff for irrigation		X	X

X = Yes

1.4 Interpretation of results

1.4.1 Business models most impacting components on sectors sustainability

One of the main conclusions drawn from the results refer to the components of business models that affect mostly each sectors' sustainability. On the one hand, **the implementation of best practices to preserve water resources mainly impacts the value chain for agriculture and salt production sectors** (18 out of 20 practices in total). On the other hand, **best practices mostly affect the value proposition and the revenue model for the tourism sector** (11 out of 13 practices).

This trend is explained by the difference of proposed value between sectors. Primary sectors like agriculture or salt production rely essentially on the creation of products. The main impacts on water of those sectors are related to the process (notably activities and resources) to create those products. The product itself (food and salt) will be less affected by new practices than the process to create them.

For tertiary sectors like tourism and especially sub-sectors like hotels which rely on services they offer, change to best practices will affect much more the services themselves (the value proposition) and indirectly the revenue model of the hotel which is based on these services.

The choice of new sustainable business models must therefore be adapted considering each sector specificities. The proposed value of the company (notably if it is products or services that are created) and how this value affects or is affected by water (direct consumption, use for leisure activities, impact on quality etc.) define the most impacting business models' components on sustainability.

As a conclusion, business models for transition must be based on :

- a **sustainable value chain** for agriculture and salt production sectors;
- a **sustainable value proposition** for tourism sector.

1.4.2 Impact on business models' components and effort needed to implement the practice

The second finding refers to the range of efforts that each companies' operator (either farmer, salinas' manager or hotels and golf courses director), would need to carry out in order to implement the practices.

Each sector presents easy-to-implement practices, that generally only affect one component of the business model, up to more complex ones that can affect all three components. Although being selected as the most impacting and sustainable practices, this diversity of effort required is observed for all sectors.

On companies' operator point of view, two main strategies can then be suggested to transform their business models:

- Implement "effortless practices" that target the most impacting business model's components on sustainability for each sector (described above).
- Implement practices that will require more efforts but will have a systemic and long-term effect on the companies' sustainability by impacting all three business models' components.

Watershift Project will explore those strategies that meet companies' operators needs and means.

1.4.3 Characteristics of business models for transition

Business models for transition rely on practices that impact the economic, socio-territorial and environmental sustainability of companies at the same time. Those practices affect specific components of business models. Components that are the most impacting for water-related challenges vary between sectors, according to the type of activities and value provided. Based on our findings, the level of a practice's impact and the needed effort to implement it do not seem to be scientifically correlated. However, one tendency can be identified: the more effort a practice requires, the more long-term effect is generated which affects the companies' business models.

Strategies to define relevant sustainable business models must then be based on both easy-to-implement practices, and more systemic ones. By understanding companies' needs and willingness to change, the WaterShift project will compare these assumptions with economic realities and will then be able to design sustainable and ready-to-implement solutions, by and for companies.

3. Synthesis of the framing study and inclusion in the overall framework of the Watershift project

I. Practices' classification according to WaterShift objectives

1.1 Practices' classification framework

As a summary of our key findings, we decided to combine both impact assessment results and business models' analysis for the 33 best practices of the WaterShift project. It results in a **best practices typology based on their impact on water resources and their easiness to be implemented**. With this projection, the partnership pursues the hypothese that practices are the link between companies' impact on water resources and their business models:

- From the water resources' side, the IDEA Score quantifies the practices' impact on water resources. It illustrates the interaction **between the practice and the water resource**. It is the x-axis scale: *the higher the IDEA Score is, the better the impact on water resources is and thus, the more the practice is placed on the right side of the figure.*
- From the companies' side, the number of business model's components concerned by practices' implementation demonstrates the practices' impact on business models. It illustrates **the effort that the company needs to do to implement those practices**. It is the y-axis scale: *the more business model's components are concerned, the harder the practice is to be implemented and thus the more the practice is placed at the top of the figure.*

This will result in different types of practices per sector, as described in Figure 15.

Figure 15: Best practices typology projection

Based on the previous figure, the partnership will **spot the practices that bring the best positive impact on water resources while quantifying their easiness to be implemented and thus disseminated amongst companies**. Then, some different levers and solutions are to be found in the next steps of the project to facilitate those best practice's implementation.

1.2 Best sectorial practices' typology projection

The following figures (see Figure 16; Figure 17; Figure 18) represent the projection of the ten (or 13 for tourism) best practices per sector. The best practices' legend is summarized in a joint table for each figure (see Table 13, Table 14 and Table 15).

For each sector, three groups of practices can be distinguished. WaterShift will focus first on the green practices group, and may also consider the blue practices group:

- The **green** group of practices gathers the best ones regarding their impact on water resources, which can be hard to be implemented. WaterShift's partnership is willing to use those practices and their features to identify the **levers** that could ease their implementation.
- The **blue** group of practices gathers the "in-middle" practices both regarding their impact on water resources and their easiness to be implemented. WaterShift's partnership can also deepen some levers that could easily be implemented.
- The **red** group of practices is not going to be necessarily deepened because they seem to require more effort to be implemented than the blue group and with a lower impact on water resources.

1.2.1 Best farming practices' typology projection

Figure 16: Best farming practices' typology projection

Table 13 : Legend for agricultural best practices

Abreviations	Practice's description
Org.Agri	Implementation of organic agriculture techniques
AF.Tech	Implementation of agroforestry techniques
Ferti.Sys	Implementation of fertigation systems
Rea.Pest.App	Implementation of reasoned pesticide application plans for major crops.
Tact.Irri.Mngt	Tactical choices for controlled irrigation management
Reuse	Implementation of re-use systems
Cons.Agri	Implementation of conservative agriculture techniques
Design.Irri.Strat	Design and implementation of the irrigation strategy
Subs.Incenti	Subscription to existing water-saving economic incentives
Asso.Pioneers	Association with local pionnier farms to promote water-efficient agriculture

1.2.2 Best salt production practices' typology projection

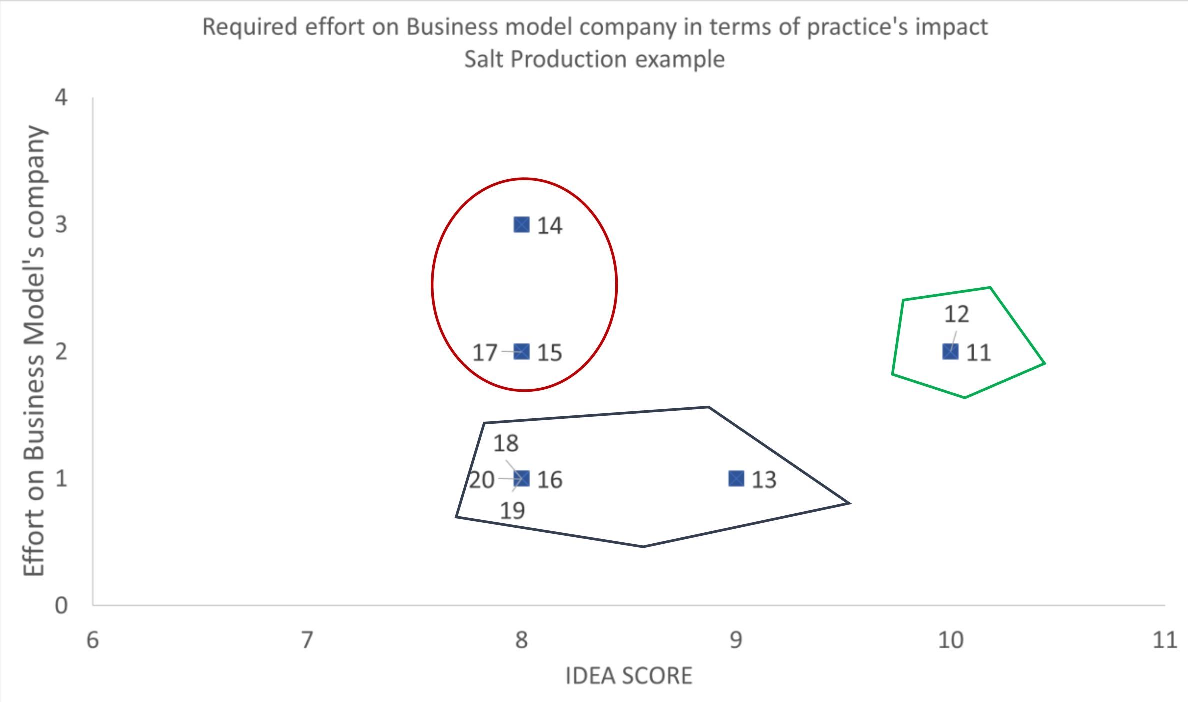

Figure 17: Best salt production practices' typology projection

Table 14 : Legend for salt production best practices

Number	Practice's description
11	Support managers in the integration of sustainable strategy
12	Maintaining infrastructure to avoid economic loss and for conservation gain
13	Monitoring water quality both within the saltpan operational space but also within the lagoon and buffer area
14	Diversification of business practices depending on the season
15	Artisanal production supported by smart strategies for marketing
16	Exploring Business model focused on reducing the footprint of the salina and the generation of products
17	Proper design of the saltpans to maintain gravitational water management to avoid water pumping, energy consumption and biodiversity disturbances.
18	Bring together professional salt producers, biologists, civil and water engineers, making it possible to optimise environmental management within saltworks
19	Development and enforcement of a biodiversity management plan focused on habitat restoration, and enhancement for the improvement of water use, water quality and conservation of associated species.
20	Make saltworks a tourist destination themselves, rich in history, culture, nature, gastronomy, landscape by considering them as natural heritage sites. Create events, such as cultural shows on site of salt making such as "Salt Fairs", salt museums or other options to create identity

1.2.3 Best tourism practices' typology projection

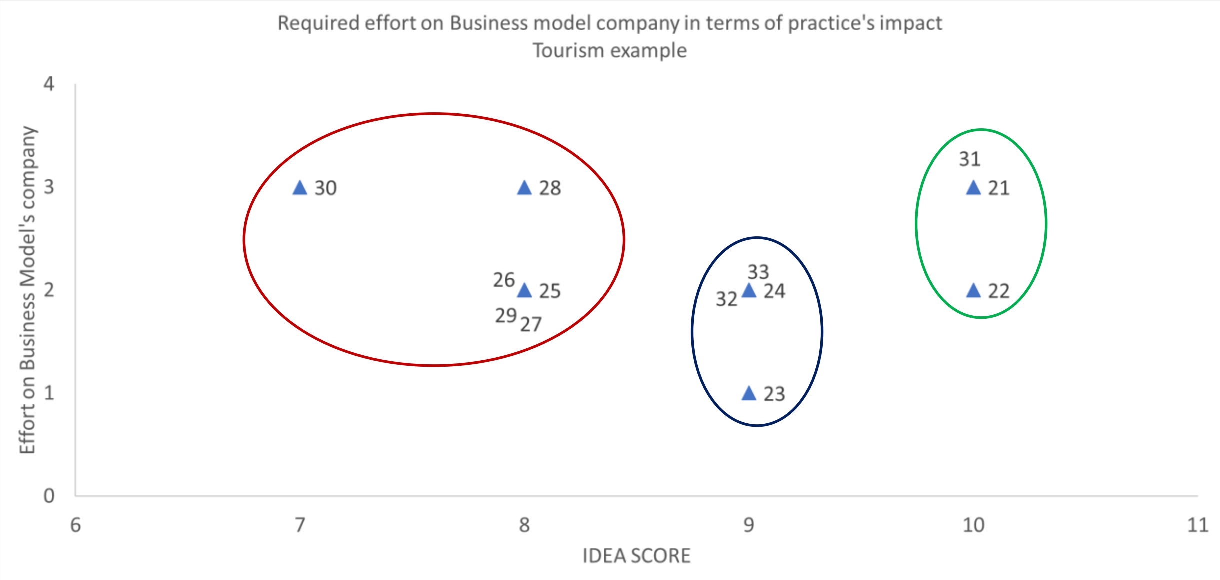

Figure 18: Best tourism practices' typology projection

Table 15: Legend for tourism best practices

Number	Practice's description
21	Installation of greywater recovery system for indoor use (e.g. toilet flushing and irrigation)
22	Installation of rainwater collection system
23	Pressure reduction on the main hotel's water supply
24	Using sea water or from own wells for swimming pools
25	Periodic review and monitoring to detect leaks
26	Installation of meters in areas of great consumption
27	Introduction of aerators and consumption reduction devices
28	Installation of low-flush systems in WC
29	Changing bathtubs for showers
30	Smart showering devices
31	Use of greywater for irrigation
32	Use of stored rainwater for irrigation
33	Use of surface runoff for irrigation

1.3 Analysis of the first results and main focuses for the WaterShift project

This analysis specifically highlights the practices that can have an important potential to be spread, viable and replicable. These practices will be further explored based on the project objective of analyzing further real case studies looking into **the financial levers** to be developed.

We believe that **the choice for transformation may be stimulated by a need for investment in production means**. Investment can be used as a lever to facilitate transition towards sustainable practices. This is why the WaterShift project also seeks to explore the potential for a financing mechanism to support the transition to water-sustainable sectors in the Mediterranean basin. Developing such a private financing mechanism may 1) enable to recruit new financing sources, and 2) help to reduce financing needs in the field.

II. From the framing study to guiding principles: presentation and objectives.

The next deliverable of the WaterShift project is the development of guiding principles by the end of 2021. The main objective of those guiding principles is to **provide assistance to economic actors in their transition** towards economic models and practices that have the greatest impact.

The goal of the framing study was to provide background information on water challenges, sustainable practices and business models in the Mediterranean. With the guiding principles, the WaterShift project aims to directly assist the transition of economic actors, by identifying sustainable economic models per sector and collecting feedback from field actors in their use of water saving practices and models. This document will be a practical guide that summarizes sustainable practices and business models for economic actors but also strategic actors for conservation (like the MAVA network) and investors at the Mediterranean scale.

The framework of those guidelines will include the selection of best practices and business models based on framing results and adjusted according to interviews with economic actors and experts. It will also include the drafting of the guide and its dissemination among partners, targeted actors and networks.

Conclusion

As a conclusion, the Mediterranean basin is a territory with strong interconnected issues related to water. In this context, the WaterShift project seeks to accompany the transition of three sectors that are both impacting and suffering from water-related issues: agriculture, salt production and tourism. Considering Mediterranean water-related issues, sectorial practices represent the main source of impact on water resources.

Sustainable sectorial practices are identified and assessed to select the ones that best overcome the main water challenges and ensure an environmental, economic and socio-territorial transition of sectors. This analysis highlights the practices that have an important potential to be spread, viable and replicable. From this selection of practices, strategies that enable their implementation and main characteristics of sustainable business models, technically and economically feasible, are defined.

This study demonstrates the wide range of sustainable practices possible for each sector. The differences between practices are related to their different impacts on the sustainability of the sectors. There are also major differences in their ease of implementation, which are not always correlated with their level of impact.

However, this study only provides a first theoretical framework that will be adjusted and improved. Exchanges are planned with sectors' stakeholders to optimize this first characterization of sustainable business models. Finally, this study allows us to identify, in addition to the sustainable business models themselves, first elements to define the financial levers favoring the transition towards these models.

Subsequently, the WaterShift project will seek to directly assist the transition of economic stakeholders through the creation of guiding principles and the development of a financing mechanism to support the transition to water-sustainable sectors in the Mediterranean basin.

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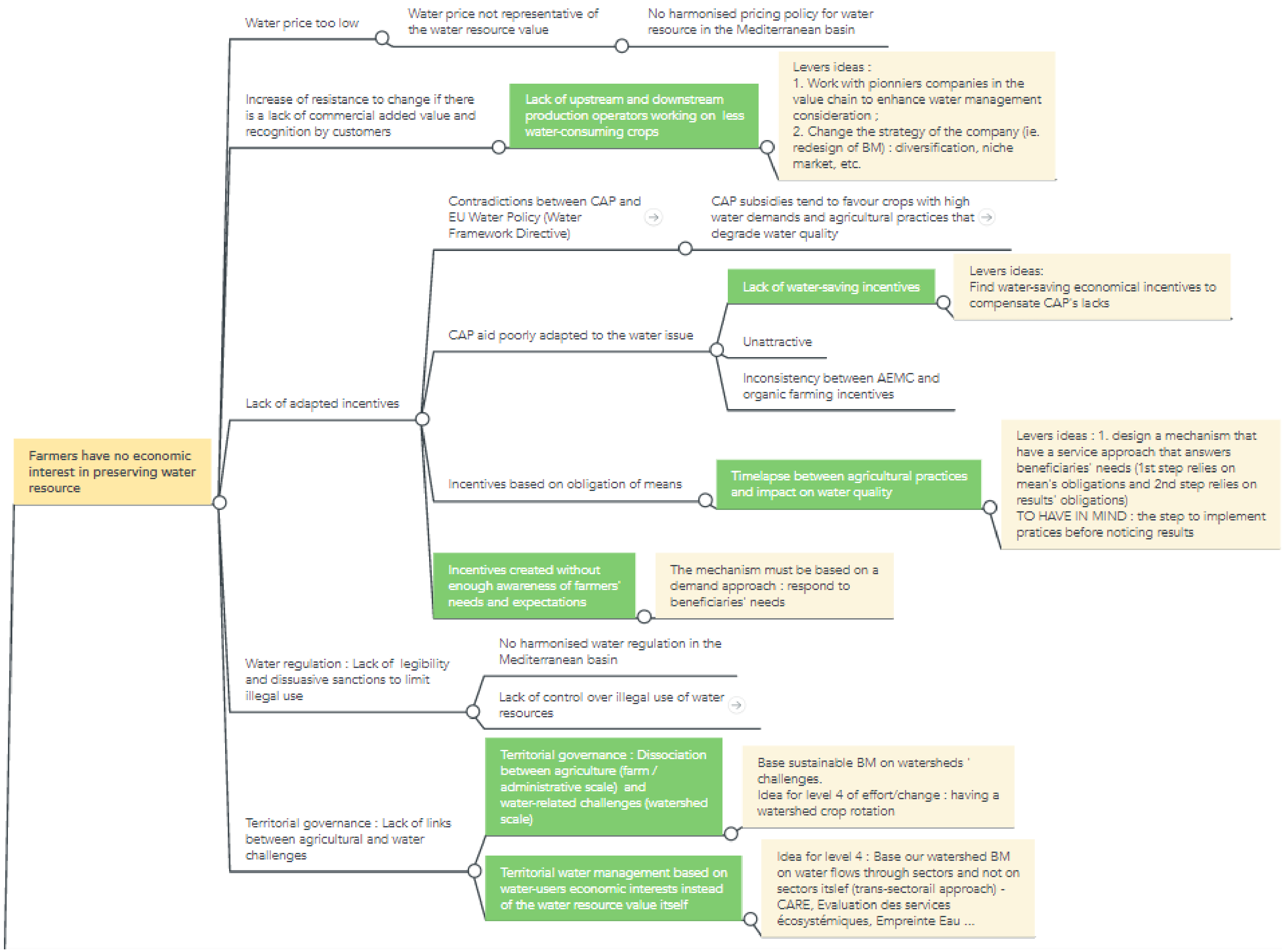
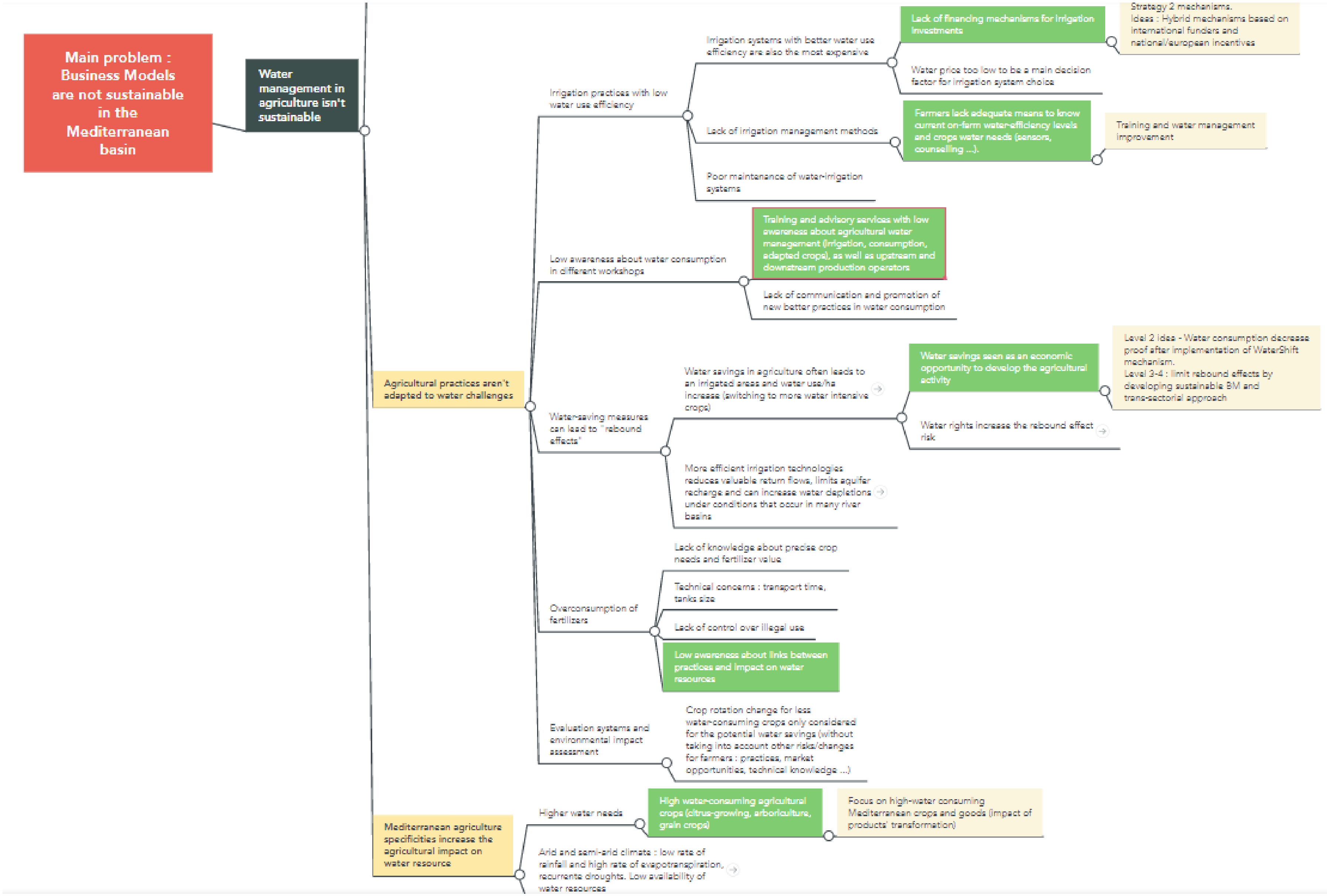
Annexes

Annex 1 – Problem tree for the agriculture sector.


Farmers have no economic interest in preserving water resource
Water price too low
Water price not representative of the water resource value
No harmonised pricing policy for water resource in the Mediterranean basin
Increase of resistance to change if there is a lack of commercial added value and recognition by customers
Lack of upstream and downstream production operators working on less water-consuming crops
Levers ideas :
1. Work with pionniers companies in the value chain to enhance water management consideration ;
2. Change the strategy of the company (ie. redesign of BM) : diversification, niche market, etc.
Lack of adapted incentives
Contradictions between CAP and EU Water Policy (Water Framework Directive)
CAP subsidies tend to favour crops with high water demands and agricultural practices that degrade water quality
CAP aid poorly adapted to the water issue
Lack of water-saving incentives
Levers ideas:
Find water-saving economical incentives to compensate CAP's lacks
Unattractive
Inconsistency between AEMC and organic farming incentives
Incentives based on obligation of means
Timelapse between agricultural practices and impact on water quality
Levers ideas : 1. design a mechanism that have a service approach that answers beneficiaries' needs (1st step relies on mean's obligations and 2nd step relies on results' obligations)
TO HAVE IN MIND : the step to implement pratices before noticing results
Incentives created without enough awareness of farmers' needs and expectations
The mechanism must be based on a demand approach : respond to beneficiaries' needs
Water regulation : Lack of legibility and dissuasive sanctions to limit illegal use
No harmonised water regulation in the Mediterranean basin
Lack of control over illegal use of water resources
Territorial governance : Lack of links between agricultural and water challenges
Territorial governance : Dissociation between agriculture (farm / administrative scale) and water-related challenges (watershed scale)
Base sustainable BM on watersheds ' challenges.
Idea for level 4 of effort/change : having a watershed crop rotation
Territorial water management based on water-users economic interests instead of the water resource value itself
Idea for level 4 : Base our watershed BM on water flows through sectors and not on sectors itslef (trans-sectorail approach) - CARE, Evaluation des services écosystémiques, Empreinte Eau ...


Main problem : Business Models are not sustainable in the Mediterranean basin
Water management in agriculture isn't sustainable
Agricultural practices aren't adapted to water challenges
Irrigation practices with low water use efficiency
Irrigation systems with better water use efficiency are also the most expensive
Lack of financing mechanisms for irrigation investments
Strategy 2 mechanisms.
Ideas : Hybrid mechanisms based on international funders and national/european incentives
Water price too low to be a main decision factor for irrigation system choice
Lack of irrigation management methods
Farmers lack adequate means to know current on-farm water-efficiency levels and crops water needs (sensors, counselling ...).
Training and water management improvement
Poor maintenance of water-irrigation systems
Low awareness about water consumption in different workshops
Training and advisory services with low awareness about agricultural water management (irrigation, consumption, adapted crops), as well as upstream and downstream production operators
Lack of communication and promotion of new better practices in water consumption
Water-saving measures can lead to "rebound effects"
Water savings in agriculture often leads to an irrigated areas and water use/ha increase (switching to more water intensive crops)
Water savings seen as an economic opportunity to develop the agricultural activity
Level 2 idea - Water consumption decrease proof after implementation of WaterShift mechanism.
Level 3-4 : limit rebound effects by developing sustainable BM and trans-sectorial approach
Water rights increase the rebound effect risk
More efficient irrigation technologies reduces valuable return flows, limits aquifer recharge and can increase water depletions under conditions that occur in many river basins
Overconsumption of fertilizers
Lack of knowledge about precise crop needs and fertilizer value
Technical concerns : transport time, tanks size
Lack of control over illegal use
Low awareness about links between practices and impact on water resources
Evaluation systems and environmental impact assessment
Crop rotation change for less water-consuming crops only considered for the potential water savings (without taking into account other risks/changes for farmers : practices, market opportunities, technical knowledge ...)
Mediterranean agriculture specificities increase the agricultural impact on water resource
Higher water needs
High water-consuming agricultural crops (citrus-growing, arboriculture, grain crops)
Focus on high-water consuming Mediterranean crops and goods (impact of products' transformation)
Arid and semi-arid climate : low rate of rainfall and high rate of evapotranspiration, recurrente droughts. Low availability of water resources

Annex 2 - Synthesis of the revision of literature to select tourism sub-sectors.

ID	Source type	Promoter/responsible	Year	Title	Intervention name	Type of intervention	Audience
1	Technical report	Public (administration)	2003	Guía de ahorro y eficiencia energética en establecimientos hoteleros de la Comunidad Valenciana	Energy and water-saving guide for hotel establishments in the Valencian Community	Physical tool or mechanism and recommendation	Hotels
2	News	Private (public concession)	2006	Recogida de agua de piscinas en invierno para limpiar calles y regar jardines públicos	Reuse of water from private swimming pools for municipal uses	Policy (price, water management, environmental sustainability)	Other
3	Guide	Private (Spanish Association of Normalization and Certification)	2008	UNE 182001:2008	Voluntary environmental certification regarding service requirements in hotels and tourist apartments	Physical tool or mechanism and recommendation	Hotels
4	Guide	Private (Spanish Association of Normalization and Certification)	2009	EMAS reglamento	Voluntary environmental certification regarding Eco-Management and Audit Scheme	Physical tool or mechanism and recommendation	Hotels
6	Guide	Public (administration)	2013	Guía de ahorro y eficiencia energética en establecimientos hoteleros de la provincia de Alicante	Energy and water-saving guide for hotel establishments in Alicante province	Physical tool or mechanism and recommendation	Hotels
7	Guide	Private (Spanish Association of Normalization and Certification)	2015	ISO 14001	Voluntary environmental certification regarding environmental management systems — Requirements with guidance for use	Physical tool or mechanism and recommendation	Hotels
8	Technical report	Private (hotel)	2017	Memoria de Responsabilidad Social Corporativa de hoteles Hispania	Hispania hotels water-saving measures	Physical tool or mechanism and recommendation	Hotels
9	Technical report	Private (hotel)	2017	Annual integrated report	Melià hotels water-saving measures	Physical tool or mechanism and recommendation	Hotels
10	Technical report	Private (hotel)	2018/2019	Annual accounts report	NH hotels water-saving measures	Physical tool or mechanism and recommendation	Hotels
11	Technical report	Private (hotel)	2018	Sustainability report	Riu hotels & resorts water-saving measures	Physical tool or mechanism and recommendation	Hotels

12	Guide	Private (Spanish Association of Normalization and Certification)	2019	UNE.ISO 21401	Voluntary environmental certification regarding tourism and related services (requirements for sustainability management system in accommodation establishments)	Physical tool or mechanism and recommendation	Hotels
13	Technical report	Public	2013	Best Environmental Manangement Practice in the Tourism Sector	BEMP to minimize water consumption in accommodation	Physical tool or mechanism	Hotels
14	Technical report	Public	2017	Demonstrating integrated innovative technologies for an optimal and safe closed water cycle in Mediterranean tourist facilities	Technologies that help to save water in hotels	Physical tool or mechanism	Hotels
15	Technical report	Private (other)	2004	Freshwater and tourism in the Mediterranean	Opportunities to reduce water consumption and its impact on the environment	Physical tool or mechanism	Hotels
16	Technical report	Public	2009	MEDSTATTI-Water and tourism pilot study	Indicators to reduce water consumption	Physical tool or mechanism and recommendation	All
17	Technical report	Public	2020	GREENinMED-Water and energy-saving technologies:catalogue of solutions available for the hospitality industry	Catalogue of solutions available for the hospitality industry to save water and energy	Physical tool or mechanism	All
18	News	Public	2019	Nace GREENinMED, un proyecto para ahorrar agua y energía en las pymes hoteleras	Casos de exito que han logrado el ahorro de agua y energía	Physical tool or mechanism	All
19	News	Private (other)	2019	Ahorro de agua en el riego de zonas verdes	Sencillas pautas para regar zonas verdes y ahorrar agua	Physical tool or mechanism	Gardens
20	Blog	Private (other)	2017	Es sostenible el gasto de agua en los parques temáticos de ocio?	Plan de gestión del agua para el ahorro y reutilización del recurso	Physical tool or mechanism	Aquatic Parks
21	News	Private (other)	2014	La huella hídrica de un parque acuático	Integration of sustainable technologies	Physical tool or mechanism	Aquatic Parks
22	Blog	Private (other)	2018	Criterios para mejorar el uso y consumos uso de agua en los campos de golf	Different strategies to save water	Physical tool or mechanism	Golf courses
23	Technical report	Mixed	2012	Siting and design of hotels and resorts	Rainwater collection systems, greywater facilities and composting toilet systems	Physical tool or mechanism	Hotels
24	Technical report	Mixed	2012	Siting and design of hotels and resorts	Irrigation of golf field with greywater	Physical tool or mechanism	Golf courses

25	Technical report	Mixed	2012	Siting and design of hotels and resorts	Rainwater collection, water flow restrictions, composting toilet, and blackwater and greywater treatment	Physical tool or mechanism	Hotels
26	Technical report	Public	2012	Siting and design of hotels and resorts	Private saltwater swimming pools, a feature of many villas, reduce demands on freshwater supplies and also save on energy and carbon costs.	Physical tool or mechanism	Hotels
27	Guide	Private (other)	2017	OnCourse program for greater sustainability in golf worldwide (app also)	Use of sustainable sources for irrigation such as: harvested and stores for rainwater, greywater use, surface runoff and treated sewage effluent. Deployment of technologies such as water sensors and low-pressure fitments. Use of OnCourse app to monitor sustainability and best practices checklist.	Physical tool or mechanism	Golf courses
27	Guide	Private (other)	2017	GEO certified -Voluntary International Certified Standard-Gold facilities	1)Minimize water demand, 2) Maximize water efficiency and 3) source water responsibly	Physical tool or mechanism and policy	Hotels
28	News	Private (Tourism/hotel associations)	2018	French golf audits its biodiversity impact following Ryder Cup project	1) Partnering with irrigation system companies, 2) Replacing sprinkler heads and 3) storing rainwater in new storage reservoir.	Physical tool or mechanism	Golf courses
29	News	Private (other)	2017	Desmontando mitos sobre el uso de agua para los campos de golf	1) Riego de campos de golf con agua regenerada o con propios pozos, 2) uso y aprovechamiento de aguas pluviales	Physical tool or mechanism	Golf courses
30	Technical report	Private (other)	2016	Proyecto de reforma del sistema de riego en campos de golf	1) Sectorización de aspersores originales y 2) instalación de electroválvulas con aspersores en bloque	Physical tool or mechanism	Golf courses
31	Technical report	Private (other)	2018	Renovación de greenes y calles a Bermuda	Change greeners for Bermuda (grass)	Physical tool or mechanism	Golf courses
32	Technical report	Private (hotel)	2020	Safe the Water	Instalaciones para el ahorro de agua en funciones de lavado de equipos de piscinas.	Physical tool or mechanism	Hotels

Annex 3: Grid for analysis of interviewees' responses

Interviewee	Perception of water scarcity and need to implement best practices	Factors affecting the decision to implement best practices (motivation)	Limitations and challenges to implement best practices	Types of practices implemented
Interviewee # 1 (Hotel)	There is water scarcity in the Mediterranean Region, but not really where the hotel is located.	Environmental impacts and the type of technology.	The return of the investment.	-Use of regenerated water for gardening. -Device installation to increase water pressure but reduces flow -Hiring of staff dedicated only to inspections and control of leaks and maintenance. -Change of sprinklers for garden irrigation -General water pressure reduction. -General reduction of water flow. -Double toilet flushing (3 and 6 liters).
Interviewee # 2 (Golf)	There is water scarcity in the Mediterranean Region.	The cost and optimization of the systems.	No incentives, but a lot of obstacles to implement. The cost of regenerated water.	-Irrigation using regenerated water. -change of grass to species more tolerant to droughts. -Design optimization of irrigation systems. -Rainwater collection.
Interviewee # 3 (Hotel)	At the moment there is not water scarcity, but we need to work for the future in order to assure water supply.	Water demand reduction and costs.	The type of technology.	-Creating awareness within the staff and guests.

Interviewee # 4 (Hotel)	There is water scarcity in the Mediterranean but not like in other parts such as the Canary Islands.	The rentability and ecological and environmental awareness.	The budget defined for that. Innovation and becoming greener.	-Regular staff for water leaks revision. -Aerators in water taps. -Drop irrigators in gardens and usage of plants that require less water. -Automatic taps in common areas. -Mixing water for the pool with water from own wells.
Interviewee # 5 (Researcher)	There is water scarcity in the Mediterranean and it may become worse.	The investment and maintenance costs, as well as return of the investment time.	The type of technology depending on the place. Not all measures can be applied everywhere.	-Smart metering device per shower for the amount of time someone showers. The amount of water is calculated based on an average flow. -2 types of persuasive messages: 1) informative message, 2) solidarity message and 3) Personal message. -Combination of messages and device.

Annex 4: Bibliographical references used to carry out the agriculture impact assessment.

Main water challenges	Area of interventions	Bibliographical references
Limit freshwater overconsumption	Irrigation management and farmers knowledge of crops' water needs	(Ward and Pulido-Velazquez, 2008; Burak and Margat, 2016; Cardenas and Dukes, 2016; Fader *et al.*, 2016; Sui, 2017; Malek and Verburg, 2018; EEA, 2021)
	Irrigation systems	(Albaji *et al.*, 2010; Lecina *et al.*, 2010; Rodrigues *et al.*, 2013; Serra-Wittling and Molle, 2017; Son, Kim and Ahn, 2020)
	Crops	(Anadranistakis, Liakatas and Poulovassilis, 1997; CIHEAM, 2008; Harmanny and Malek, 2019; Hatfield and Dold, 2019; Tramblay *et al.*, 2020; Van Opstal *et al.*, 2021)
	Other farming expenditure spots with high margin for water savings	(Condom, Lefebvre Marianne and Vandome, 2012; National Research Council, 2012; Oweis, Prinz and Hachum, 2012; Ghimire and Johnston, 2013, 2019; Ait-Mouheb *et al.*, 2020)
	Alternative water sources	
Reduce agricultural impact on water quality and on watershed ecosystems.	Innovative fertilisation systems	(Hagin and Lowengart, 1996; Malato *et al.*, 2010; Magán *et al.*, 2019)
	Fertilisers and pesticides overconsumption	(Argov and Gazit, 2008; Marucci *et al.*, 2008; Jacas *et al.*, 2010; Thiébault and Moatti, 2016)
	Impact on ecosystems and biodiversity	(Mathevet, Tourenq and Mesléard, 2002; Marucci *et al.*, 2008; Jacas *et al.*, 2010; Casasús *et al.*, 2011; Sokos *et al.*, 2013; Froidevaux, Louboutin and Jones, 2017)
Improve economic interests from farmers to preserve water resources	Evolution of the global farm strategy to preserve water resource. Threatening of final product quality's decline Threatening of yields decreasing because of water availability's decline	(Tuberosa *et al.*, 2007; Meena and Singh, 2012; Duru, Therond and Fares, 2015; Iglesias and Garrote, 2015; Burak and Margat, 2016; DeLonge, Miles and Carlisle, 2016; Llop and Ponce-Alifonso, 2016; Benoit *et al.*, 2017; Cristofari, Girard and Magda, 2017; Lang, Rodinciuc and Humphreys, 2017; Azizi, 2018; Plumecocq *et al.*, 2018; Berry, 2019; Papadimitriou *et al.*, 2019; PEFMED, 2019; Borsellino, Schimmenti and El Bilali, 2020; Varia *et al.*, 2021)