THE WATER SCARCITY AND SUSTAINABLE TOURISM IN THE GREEK ISLANDS: FOCUS CYCLADES ISLANDS

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UNIVERSITAT ROVIRA i VIRGILI

The Water Scarcity and Sustainable Tourism in the Greek Islands: Focus Cyclades Islands

ITRI ATAY

DOCTORAL THESIS

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DOCTORAL THESIS

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I STATE that the present study entitled **"The Water Scarcity and Sustainable Tourism in the Greek Islands: Focus Cyclades Islands"**, presented by **Itri Atay** for the award of the degree of Doctor, has been carried out under my supervision at the Department of Geography of this university.

HAGO CONSTAR que el presente trabajo, titulado "**The Water Scarcity and Sustainable Tourism in the Greek Islands: Focus Cyclades Islands"**, que presenta **Itri Atay** para la obtención del título de Doctor, ha sido realizado bajo mi dirección en el Departamento de Geografía de esta universidad.

FAIG CONSTAR que aquest treball, titulat **"The Water Scarcity and Sustainable Tourism in the Greek Islands: Focus Cyclades Islands"**, que presenta **Itri Atay** per a l'obtenció del títol de Doctor, ha estat realitzat sota la meva direcció al Departament de Geografia d'aquesta universitat.

Vila-seca 15 December 2023

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"Never stop because you are afraid - you are never so likely to be wrong. Never keep a line of retreat: it is a wretched invention. The difficult is what takes a little time; the impossible is what takes a little longer."

Fridtjof NANSEN

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ABSTRACT

This study focuses on tourist management and water management in the Cyclades Islands, which have faced environmental externalities in the previous 15 years. Since the 2008 financial crisis, tourism has been an important element of Greece's economic recovery, with Cyclades Islands such as Mykonos and Santorini playing important roles. Mykonos and Santorini have dry or semi-arid climates, with practically little rain during the summer months when the islands are inundated with tourists. Water shortages have been a problem on the islands for the last 15 years, and public and water authorities often make supply-based decisions to boost availability by depending on solutions such as shipping water and installing desalination plants. These solutions may be permanent ones in areas where the tourist population rate is not more than ten times of normal residents over a certain period. Hence, desalination plants may be a temporary solution to the Cyclades Islands' constantly rising tourist water demand. Thus, seasonality of tourism may continue to have an impact on water availability until demand-based measures are implemented. Supply-based strategies may have significant environmental consequences, endanger sustainability, and shorten the destination's life cycle in the future. Consequently, the actions of key stakeholders and decision makers are critical for the long-term viability of tourism and the availability of water resources.

The overall objective of the study is to explore the complex relationship between tourism management and water resources management by having an insight into the perceptions of the stakeholders and decision-making progress in tourism and environmental management in island tourism destinations such as Mykonos and Santorini. Both qualitative and quantitative methodologies are employed in this study. After a comprehensive literature review, the research is conducted by questionnaires and in-depth interviewing. Mykonos and Santorini Islands in Greece are chosen as case study areas. The questions that were related to climate change, water resources management, and tourism management were asked to key stakeholders in both of the islands. The results show that the interaction between tourist management and water resource management is very complicated, and the majority of stakeholders are well aware of water shortage issues and the effects of climate change on tourism activities. Nonetheless, the findings also indicate that there are significant differences in stakeholders' perceptions of solutions to the water scarcity problem on the islands, with the majority of hospitality stakeholders not viewing the installation of desalination plants as the primary remedy, in contrast to public and water authorities.

Keywords: water resources management; tourism management and planning; climate change; water scarcity; desalination; seasonality of tourism; Mykonos; Santorini.

RESUM

Aquest estudi es centra en la gestió turística i la gestió de l'aigua a les Illes Cíclades. Des de la crisi financera del 2008, el turisme ha estat un element important en la recuperació econòmica de Grècia, i les illes Cíclades, com Mykonos i Santorini, han tingut un paper important. Mykonos i Santorini es troben en la zona climàtica seca o semiàrida, amb poca precipitació durant els mesos d'estiu, quan reben un important contingent de turistes. L'escassetat d'aigua ha estat un problema greu a les illes durant els darrers 15 anys. Tant les autoritats públiques com les encarregades de la gestió de l'aigua han pres decisions basades en el subministrament de l'aigua, que permet augmentar-ne la disponibilitat, però que depenen de solucions com el transport d'aigua en vaixell i la instal·lació de plantes de dessalinització. Aquestes solucions poden ser permanents en zones on la població turística no sigui superior deu vegades a la dels residents durant un període determinat. Per tant, les plantes de dessalinització podrien ser una solució temporal a la creixent demanda turística d'aigua. L'estacionalitat del turisme pot continuar influint negativament en la disponibilitat d'aigua fins que no s'apliquin mesures basades en la demanda. Les estratègies basades en l'oferta poden tenir conseqüències ambientals molt negatives, posant en perill la sostenibilitat de la destinació turística i escurçar el cicle de vida. Les accions dels principals actors encarregats de la presa de decisions són fonamentals per garantir la viabilitat a llarg termini del turisme i la disponibilitat de recursos hídrics.

L'objectiu general de l'estudi és explorar la relació complexa entre la gestió del turisme i la gestió dels recursos hídrics a partir de l'anàlisi de les percepcions dels actors de dues destinacions turístiques insulars: Mykonos i Santorini. En aquest estudi es fan servir metodologies qualitatives i quantitatives. Després d'una revisió exhaustiva de la literatura acadèmica, la recerca es duu a terme mitjançant la realització de qüestionaris i entrevistes en profunditat, que han comptat amb preguntes relacionades amb el canvi climàtic, la gestió dels recursos hídrics i el turisme. Els resultats mostren que la interacció entre la gestió turística i la gestió dels recursos hídrics és molt complexa, i que la majoria dels actors són molt conscients dels problemes d'escassetat d'aigua i els efectes del canvi climàtic en l'activitat turística. Tot i això, les conclusions també indiquen que hi ha diferències significatives en les percepcions sobre les solucions al problema de l'escassetat d'aigua a les illes. La majoria dels actors del sector dels allotjaments consideren que la instal·lació de plantes de dessalinització no és la principal solució, al contrari del que pensen les autoritats públiques i de la gestió de l'aigua.

Paraules clau: gestió de recursos hídrics; gestió i planificació del turisme; canvi climàtic; escassetat d'aigua; dessalinització; estacionalitat del turisme; Mykonos; Santorini.

RESUMEN

Este estudio se centra en la gestión turística y la gestión del agua en las Islas Cícladas. Desde la crisis de 2008, el turismo ha sido un elemento importante en la recuperación económica de Grecia, y las islas Cícladas, como Mykonos y Santorini, han desempeñado un papel importante. Mykonos y Santorini se encuentran la zona climática seca o semiárida, con escasa precipitación durante los meses de verano, cuando reciben un importante contingente de turistas. La escasez de agua ha sido un problema en las islas durante los últimos 15 años. Tanto las autoridades públicas como las encargadas de la gestión del agua han tomado decisiones basadas en el suministro del agua, que permite aumentar la disponibilidad, pero que dependen de soluciones como el transporte de agua en barco y la instalación de plantas desalinizadoras. Estas soluciones pueden ser permanentes en zonas en las que la población turística no sea superior diez veces a la de los residentes durante un período determinado. Por tanto, las plantas desalinizadoras podrían ser una solución temporal a la creciente demanda turística de agua. La estacionalidad del turismo puede seguir influyendo negativamente en la disponibilidad de agua hasta que se apliquen medidas basadas en la demanda. Las estrategias basadas en la oferta pueden tener consecuencias ambientales muy negativas, poniendo en peligro la sostenibilidad del destino turístico y acortar su ciclo de vida. Las acciones de los principales actores encargados de la toma de decisiones son fundamentales para garantizar la viabilidad a largo plazo del turismo y la disponibilidad de recursos hídricos.

El objetivo general de este estudio es explorar la compleja relación entre la gestión del turismo y la gestión de los recursos hídricos a partir del análisis de las percepciones de los actores de dos destinos turísticos insulares: Mykonos y Santorini. En este estudio se emplean metodologías cualitativas y cuantitativas. Después de una exhaustiva revisión de la literatura académica, la investigación se lleva a cabo mediante la realización de cuestionarios y de entrevistas en profundidad, que han contado con preguntas relacionadas con el cambio climático, la gestión de los recursos hídricos y el turismo. Los resultados muestran que la interacción entre la gestión turística y la gestión de los recursos hídricos es muy compleja, y que la mayoría de los actores son muy conscientes de los problemas de escasez de agua y los efectos del cambio climático en la actividad turística. No obstante, las conclusiones también indican que hay diferencias significativas en las percepciones sobre las soluciones al problema de la escasez de agua en las islas. La mayoría de los actores del sector de los alojamientos considera que la instalación de plantas desalinizadoras no es la principal solución, al contrario de las autoridades públicas y de la gestión del agua.

Palabras clave: gestión de recursos hídricos; gestión y planificación del turismo; cambio climático; escasez de agua; desalinización; estacionalidad del turismo; Mykonos; Santorini.

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CHAPTER 1 – INTRODUCTION

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1 – INTRODUCTION

1.1. GENERAL CONTEXT

Tourism has become a global phenomenon in the 21st century, and it is an essential part of the global economy (Hall, 2019). At present, there are many countries that have high dependence on the revenues of the tourism sector, and it is crucial for these countries to manage their tourism sector activities in a sustainable way. The sustainable management of natural resources (such as water resources) has significant importance for the continuation of tourism activities (Gössling, 2012). Hence, one can notice that there is an interrelation between tourism management and natural resources management, and it is vital for the continuation of each tourist destination's lifecycle.

Tourism can have a positive impact on the economy and can be also seen as a remedy for struggling economies such as in the case of Greece (Borboudaki et al., 2005; Dodds and Butler, 2019; Gössling and Hall, 2006). Nevertheless, commercial tourism development is closely linked with residential housing, transport infrastructure and public utilities such as power and water supply as well as waste water treatment (Buckley, 2008; Ezeah et al., 2015). As a result, there is the possibility that the positive impact of tourism can bring a negative impact on environment in the long term unless rational decisions are taken. At the same time, this possible negative impact can spread on economy and as well as on the daily lives of the society in the long term (Archer et al., 2004; Dodds and Butler, 2019).

As Dodds and Butler (2019) underlined over tourism phenomenon is becoming a complex issue when there is tourism based economic growth and employment. In addition to this, a financial crisis or a recession such as in the case of Greece in 2008 make over tourism phenomenon more complex. In the long run, climate change may eventually decrease the overall level of flying but this can affect only international tourism but not domestic tourism in locations such as South Aegean Islands where there is substantial amount of domestic arrivals through cruise ships (Buhalis, 2001; Dodds and Butler, 2019). As a matter of fact, facing over-tourism phenomenon may not be an easy objective to reach in locations where there is considerable domestic tourism in addition to international tourism.

Tourist destinations may lose their attractiveness if they lose their image by becoming an overcrowded location with poor environment quality (Butler, 1980). Environment quality is essential for a tourist destination's survival and existence in the market as a competitor to other tourist destinations. As Butler (1980) underlined, tourism areas are dynamic; they can evolve and change within time. This evolution can lead to either positive or negative change which will determine the life cycle of a tourist destination. As a matter of fact, decisions regarding the tourist destinations future should be taken in a delicate way with a long term perspective.

Furthermore, there can be short term environmental impacts which may not be easily determined by some actors such as entrepreneurs of the touristic resorts or administrative units that involve in the decision making processes (De Freitas, 2003). This may lead to long term impacts on tourism, damaging the environment quality, and threating the sustainability of the destination. On the other hand, many actors in the tourism sector such as entrepreneurs of the touristic resorts can choose to take daily basis decisions to solve short term impacts and they can see the decisions for the long term impacts as rather unnecessary or not cost effective since they may not have determined the environmental impact (De Freitas, 2003).

This kind of short term basis decisions can be more frequent when there are serious economic matters such as a recession and different perceptions among the different actors involved in these tourism policies, programs and projects. The different perceptions of the actors can collide with each other as well due to their certain interests and needs (De Freitas, 2003). Local population may be in favor of an improved infrastructure, different culture and life-styles of foreign visitors in the beginning of tourism development in their homeland but over tourism phenomenon and seasonality of tourism can turn local residents' life into chaos and their positive sentiments can turn into negative ones (Chao, 2004).

As a matter of fact, massive streams of tourists' arrivals can lead local population to view tourists and tourism infrastructure (hotels, resorts, etc.) as threats to their daily lives if there are cases of externalities (Chung, 2009). Tourism can lead to many externalities which may hamper the daily lives of local residents. As Schubert (2009) underlined, there are many environment related

externalities because of tourism such as crowding and congestion of roads, noise, litter, property destruction, pollution, increased water consumption per person, CO2 emissions, overbuilding, land use loss, increased urbanization, changes in landscape, etc.

Seasonality of tourism can have positive effects but also negative effects which can be related to employment, investment and environment (Butler, 1994). Employment in tourism cannot be throughout the year since majority of tourists' arrivals takes place in a particular time period because of seasonality (Pearce, 1989). As an example, one cannot expect hundred thousands of tourists' arrivals to a beach resort when there is rainfall and no sunshine because it is winter season. Therefore, it is possible to hire employees only during the tourist season.

On the other hand, there is another negative effect of seasonality in relation to investments. As Butler (1994) highlighted, tourism resources have potential risk of under-utilization because of instability of revenues year-around. This indicates that investments can bear risks to tourism entrepreneurs because there is no certainty of high annual returns on capital. For that reason, seasonality of tourism can be an obstacle for new investments to arrive tourist destinations. However, there can be also possibility of additional investments if previous investments receive high annual returns on capital and this is highly related to success of tourism management in the destination (Healy, 1994).

Seasonality of tourism has also negative effects on environment but this is highly linked to over tourism phenomenon as it was discussed above. Pearce (1989) stressed that; seasonality of tourism can create over tourism and can lead to overuse of natural resources such as water resources. At the same time, seasonality of tourism can create negative impacts on the daily lives of local residents because additional tourist population may add additional stress on various things such as waste disposal, air pollution, road traffic etc. (Pearce, 1989). Hence, current capacity of the tourist destination can be exceeded and create stress on social and economic activities of local residents.

Mediterranean is one of the most popular tourist destinations with more than 120 million visitors every year (Hof and Schmitt, 2011; Klein et al., 2016; Perry, 2006). There are certain factors that

make Mediterranean region as one of the most popular destination in the world. One of the main factors is the warm climate of the region since it attracts many tourists from Northern European countries such as United Kingdom, Germany and Scandinavian countries (Perry, 2006). However, current IPCC reports show that the climate will not be that much favorable in the future. The future climate scenarios show that the region will face frequent heat waves and it will be too hot and will not be comfortable during the summer months (Hein et al., 2009; Iglesias et al., 2007; IPCC, 2019; Klein et al., 2016; Scott and Becken, 2010).

IPCC, (2019) estimates that the impacts of climate change on runoff (stream discharge) in southern Europe will lead to a reduction up to 36% for annual flow. This can lead to water stress and droughts in the region. As March et al., (2014) underlined, the amount of rainfall is already declining from the North (around 600 mm/year) to the South (300 mm/year and less). This means that the Mediterranean basin is already facing the negative impacts of climate change. Consequently, as Perry (2006) mentioned, the region may lose its attractiveness to other regions in the world within a +2 °C increase in scenario.

As a matter of fact, Mediterranean region has been identified as one of the world's regions most vulnerable to climatic and anthropogenic changes (Correia 1999, Milano et al., 2013). This indicates that in addition to the climatic change, the social and economic development of the region is actually creating stress on the environment. Extended heat waves are happening more than 10 days during the summers and they are becoming more frequent in the region (Perry, 2006).

Water is essential for human life and it is not possible to survive without enough water. For that reason, a substantial increase in water consumption per person in a tourist destination where water resources are limited can become a serious externality. As a result of this, massive arrivals of tourists to a tourist destination that has arid or semi-arid climate and has very limited natural resources availability can lead to dramatic consequences on the lives of local residents (Hadjikakou, et al., 2013). In addition to this, water consumption per person tends to be higher in tourist accommodations since tourists tend to use considerably more water on average compared

to local residents (Emmanuel and Spence 2009; Essex et al., 2004; Gössling et al., 2005; Hadjikakou, et al., 2013).

It should not be forgotten, Common Pool Resources (CPRs) have already issues of individualism in which individual users may act independently according to their own self-interest and may behave contrary to the common good of all users by depleting the shared resource through their mutual action (Hardin, 1968). As Ostrom (1990) underlined, CPRs have open access and resources use is unrestricted which means that there is the case of *Free Riding.* One can notice that there are plenty of CPRs such as air and the atmosphere, water resources, oceans, ecosystems, fisheries, forests, wildlife, grazing fields and irrigation systems (Briassoulis, 2002).

Water resources are one of CPRs that has issues of individualism and many academic works focus on this topic through analyzing externalities of other economic sectors such as agriculture or industry. However, externalities on water resources due to tourism sector have not been analyzed as much as other economic sectors. This is directly linked to limitations with datasets since water and tourism data sets are relatively coarse and lack detail to provide detailed comparisons of tourism and non-tourism use (Becken, 2014; Gössling et al., 2012). For that reason, it is not an easy task to calculate the very exact amount of tourists' water consumption. Consequently, there is only range of estimates available for direct water use and indirect water use and it is only possible to estimate total amount of tourist water consumption (Becken, 2014; Gössling et al., 2012).

Hadjikakou et al., (2013) underlined that the, majority of tourists do not even know how much water they consume and it is not easy to convince tourists to control their water consumption when they are on "holiday mode". It is evident that holidaymakers bear burden since majority of tourists are using their yearly vacation rights, saving money throughout the whole year or even taking loans to make their holidays. For that reason, one can notice that, tourists cannot be easily under pro-environmentalist behavior since there is already burden. In addition to this, the absence of financial incentives to promote prudent use is another factor that makes pro-environmental behavior unlikely to exist (Hadjikakou et al., 2013; Miller et al., 2010).

As a matter of fact, it is a difficult task to convince tourism complexes' owners not to provide enough water to their customers (holidaymakers) when they are earning through their customers' overnight stays in their premises. Healy (1994) associates this as an "investment incentive problem" since investors (in this case tourism entrepreneurs) are discouraged from improving or controlling their use of CPRs when resources are unrestricted for use and open for *Free Riding*. Moreover, the situation gets more chaotic when one adds tourism as the most dominant sector in the economic development. As a result, it becomes another difficult task for a water authority or a local government official not to supply the water demands of tourism complexes and not to give them priority over local residents where local economy is only based on revenues of tourism (Briassoulis, 2002). For that reason, one can notice that management of water resources in relation to tourism demand is a complex issue to assess.

Briassoulis (2002) underlined, majority of tourism complexes are erected within environmentally sensitive areas which requires sets of laws and strong governance since there is the risk of overuse and eventually destruction of CPRs. Nevertheless, majority of tourist destinations do not possess these sets of laws or strong governance due to various indicators. Mediterranean region is one of these tourist destinations where these kind of implementation issues are occurring ever since tourism development in 1960s (Briassoulis, 2002; De Stefano, 2004).

Gössling and Hall (2006) estimated that average tourist water consumption in the Mediterranean countries is 440 liters per capita per day. This is clearly higher than the global average in domestic water consumption since it is around 161 liters per capita per day (FAO, 2009; Hadjikakou et al. 2013). On the other hand, there are studies such as Gössling (2001) and Cashman (2014) which have similar results that show tourists' water consumption is high in other regions than Mediterranean. Average per capita daily water use in hotels in Zanzibar Island (Tanzania – Indian Ocean) resembles to around 15 times the daily per capita from the local population (Gössling, 2001). In addition to this, Saint Lucia and Barbados Islands (West Indies – Caribbean Sea) have at least 3 times higher daily water use in hotels than local population (Cashman, 2014).

Another aspect that should be taken into account is related to direct and indirect water usage. It has to be noted that, majority of the academic research on this topic concentrates on direct usage of water resources in tourism industry. Nevertheless, the amount of water resources that is needed for tourism is much higher if one adds indirect water usage into the scheme. Gössling (2015) mentioned, there are direct and indirect consumptions of water in the tourism industry. Many of the scholars usually take the direct usage of water resources in the hotel rooms as their main reference point for calculating the tourists' water consumption per overnight stay.

However, there are many different indicators that can be used for calculating the total consumption of tourists. Tourists consume indirectly water embodied in infrastructure (accommodation, roads, airports, etc.), food, fuel, consumption goods and other services (Cazcarro et al., 2014; Chapagain and Hoekstra 2008; Gössling, 2012; Gössling, 2015; Pigram, 1995; Tortella et al., 2016; Worldwatch Institute, 2004). There are many different indicators that can be used for calculating indirect water use and one of these variables is the construction of infrastructure. As Rosello-Batie et al. (2010) estimated, each hotel construction can need from 85 to 97 liters/m^2 after an analysis of three hotels in the Balearic Islands. Consequently, the whole tourism infrastructure which includes the construction of airports, museums, ports, roads, restaurants, cafes, etc. can require huge sum of liters of water per m^2 (Gössling, 2015).

Another indicator for calculating the indirect water use is transportation. Transportation is a must for tourism and majority of the tourists are using planes to reach touristic destinations. As Gössling et al., (2012) and Hadjikakou et al., (2013) calculated, it requires 3 to 5 liters of water to produce 1 liter of oil and 18 liters of water to produce gasoline. Hence, this means a lot of water is needed even for a car to reach a destination which is only 50 km far away and a lot more is needed for a plane that is scheduled to a touristic destination 3000 km far away. For that reason, Gössling (2015) estimates that fossil fuel water usage is around 130 liters of water per guest per night on global average. Furthermore, Gössling et al., (2012) estimates that every 1000 km of travel by air or car requires 750 liters of water.

There are studies such as De Stefano (2004) and Aguilo et al., (2005) which have similar results for Mediterranean region. Tourists consume more than 10 times than local population during their overnight stays in hotels or resorts in Cyclades Islands (Greece) and Cote d'Azur (France) (De Stefano, 2004). On the other hand, Aguilo et al., (2005) stated that tourist water demand in Balearic Islands (Spain) is 10 times higher than local residents water demand which led to significant decrease in the level of groundwater by 90 meters fell. Therefore, one can notice that Mediterranean tourism seasonality plays a significant role behind these results since majority of the tourists visit Mediterranean region during summer months when air temperature is much higher and annual rainfall is much lower than winter months.

Environmental impact of tourism should be assessed within different time intervals. In other words, environmental impact of tourism should be analyzed in short term and long term basis since there can be adverse effect of tourism on the environment. For that reason, tourism needs to be managed with a broader perspective in particularly in the Mediterranean region. There can be dramatic consequences of short term based decisions and many indicators such should be taken into consideration before a critical decision is made. This leads us to another issue of managing CPRs in relation to tourism: decision making process and commitment of the stakeholders.

Gnanapala (2015) underlined, tourism is a multidisciplinary sector consisting of many different stakeholders such as travel agents, entrepreneurs, employees, media, government, etc. The commitment of each stakeholder can differ while there is diversity of socio-economic factors inside the society. In other words, there may not be an existing consensus among stakeholders that will enable them to take decisions always in the favor of the environment or local residents (Briassoulis, 2002). As a result of this, tourists can be seen as high value users than the local residents and they can be given priority over CPRs (such as water resources) which raise problems of inequity (Hadjikakou et al., 2013; Miller et al., 2010). Meanwhile, CPRs such as water resources can be overused and can be even depleted. These depend on the stakeholders perceptions that involve in the decision making progress.

There can be clear differences among stakeholders' perceptions which can evolve into conflicts among them (Gnanapala, 2015). As an example, Portuguese hotel industry faced certain inefficiencies which were caused by bad management and short term based wrong decisions (Barros and Machado, 2010). As a result, these inefficiencies created dramatic economic instability and environmental problems in Portugal. This created certain disagreements among stakeholders and conflicts rose among tourism entrepreneurs, government officials and local residents (Barros and Machado, 2010). Portuguese example can be witnessed anywhere in the world if decisions are not taken in coordination of many stakeholders with many different indicators. Consequently, management of tourism and management of water resources are highly linked to each other and if one of them fails the other one will fail later on. In other words, there can be a "domino effect" which may end the life cycle of tourist destination unless there is a mutual cooperation and coordination among stakeholders.

Geographical location, climate and resource availability of the tourist destination are three major indicators behind the effects of seasonality on environment (Essex et al., 2004). Seasonality of tourism in the Mediterranean region takes place during the summer months since Mediterranean region is famous for beach and water sports (Shaw and Williams, 2002). South Aegean Islands (Cyclades and Dodecanese Islands) are among the most popular tourist destinations in the Mediterranean Region (Buhalis, 2001).

Tourism sector requires good infrastructure and nature resources availability as it is in the case of other economic sectors. As a result, it is important to ensure high quality infrastructure as well as natural resources availability since many touristic resorts in Greece are located in the arid and semi-arid climate areas such as South Aegean Islands. The natural resources availability such as water resources availability and quality are limited and this can be a challenging factor for the development of tourism (Borboudaki et al., 2005; Gössling and Hall, 2006). As Coccossis and Parpairis (2000) underlined, the carrying capacity of a tourist area may be identified as the point at which the minimum infrastructure/superstructure requirements, as well as natural resources assets that generate demand, become inadequate to meet the demands of both the resident population and

the visiting tourists, at which point the threat of environmental externalities appears. For this manner, it can be crucial to have a sophisticated understanding of the complex relationship between tourism sector and water availability for the success of tourism policies and projects.

1.2. HYPOTHESIS AND OBJECTIVES

Greece is one of the most important tourist destinations in the world since it has a rich history and exotic beaches. For that reason, tourism has specific importance for Greece since it contributes 21% of Gross Domestic Product (GDP) and it also contributes to employment by 988.000 total jobs which is equal to 10.6% of total work force in Greece (INSETE, 2019). The total number of international arrivals to Greece gradually increases each year. In 2019, 33 million visitor visited Greece and this made Greece as one of the most visited countries in the world (Hellenic Statistical Authority, 2019).

Tourism has been an essential part of Greek economic revival since the financial crisis and South Aegean Islands play significant roles. Nevertheless, as Gikas and Angelakis, (2009) underlined, seasonality of tourism in South Aegean Islands often leads to issues with water availability because South Aegean Islands have arid or semi-arid climates with almost no rain during the summer months when there is massive streams of tourists' arrivals.

This research concentrates in particularly on Cyclades Islands' tourism management and water management since it has been facing environmental externalities in the last 15 years. Mykonos and Santorini Islands are selected as case studies for a detailed analysis since they have received almost 95% of all tourists that visit Cyclades Islands (Hellenic Statistical Authority, 2009). Mykonos and Santorini Islands' annual rainfall ranges between 400 to 550 mm per year and at the same time there is almost no rainfall during the summer months (Hellenic National Meteorological Service, 2023). Meanwhile, each year millions of tourists visit both of the islands during summer months. In 2019, 4 million tourists (domestic and international) visited Cyclades Islands during the summer months (Hellenic Statistical Authority, 2019). As a matter of the fact, there have been water scarcity issues in the islands and periodically new desalination plants are installed in order to match increasing seasonal tourist population's water demand in the last 15 years (Panagiotis, 2017). Desalination plants can have negative impacts on the environment through salinization of the seas

or oceans and they can also have negative effects on population's health since desalinated sea water high amounts of boron and bromide in the long run (Lattemann and Höpner, 2008).

Water companies and government officials take usually supply based decisions to increase availability by relying on remedies such as transporting water with ships, installing desalination plants with fossil fuels and installing desalination plants with renewable energy resources as it is in the case of South Aegean Islands (Arampatzis et al., 2017; Kaldellis, et al., 2004; Kaldellis and Kondilli, 2007; Panagiotis, 2017). These remedies may be permanent solutions in locations where the population is not increasing ten times higher than normal populations in a specific period of time (Hinkebein, 2004). Nevertheless, the significant increase in the population directly increases the total water demand as it was discussed above. Consequently, any type of desalination plants (fossil fuel or renewable energy resources (RES)) may be only temporary solutions to continuously increasing tourist water demand in Cyclades Islands.

For that reason, technological progress such as installation of renewable energy based desalination plants or new government policies such as the introduction of portable desalination plants may only increase the efficiency of water resources. However, they may not decrease the overall demand instead they may increase it and this is widely known as Jevons Paradox in environmental economics (York and McGee, 2015). Hence, seasonality and over tourism may continue to effect natural resources availability unless demand based policies are taken into account. The supply based policies may bring additional effects on environment, may damage the sustainability and may end the life cycle of the destination in the future. In short, there may be a paradox between tourism development and water resources management and it is a matter of research interest.

The long and the short of it is that the decisions of the key stakeholders hold vital importance for the sustainability of tourism and the availability of water resources. In this sense, this dissertation's main hypothesis is that, despite the fact that the great majority of stakeholders acknowledge that water scarcity poses a threat to the development of the Mykonos and Santorini Islands tourism industry, they differ significantly in how they choose to respond to the water scarcity problem. As a matter of this, the objectives to be achieved were:

1. Analyze the relationship between water resources management and tourism development in the Mediterranean basin and in particularly in the Greek Islands.
2. Investigate the perceptions of stakeholders regarding water shortages and climate change in island tourism destinations such as Mykonos and Santorini
3. Assess whether the same stakeholders feel that RES-based desalination plants are the solution to water scarcity in island tourism destinations such as Mykonos and Santorini
4. Explore the complex relationship between tourism management and water resources management by having an insight into the perceptions of the stakeholders and decision-making progress in tourism and environmental management in island tourism destinations such as Mykonos and Santorini.

The rest of this work is organized as follows. The second chapter is dedicated to the literature review. The third chapter is devoted to the theoretical framework and the fourth chapter is devoted to the data and methods. The fifth chapter is dedicated to the area of study and the sixth chapter is focusing on the EU Water Framework Directive 2000/60/EC and implementation of the directive in Greece. The seventh chapter presents the results and discussion where the main findings are discussed. The eighth chapter offers the conclusion, together with limitations, implications, and future lines of research. Finally, the ninth chapter contains the references that are used in this work.

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CHAPTER 2 – LITERATURE REVIEW

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2– LITERATURE REVIEW

2.1. INTRODUCTION

There has been an increase in the number of academic works which are focusing on the complex relationship between tourism sector and environmental management in particularly water resources management in the Mediterranean Basin in the last decade. This work aims to analyze this complex relationship in the Cyclades Islands especially in Mykonos and Santorini Islands. However, there are very few academic works which are principally focusing on Cyclades Islands. For that reason, majority of the academic works that are reviewed in this part of the work, are focusing notably islands that are located in the Mediterranean Basin since, these islands share similar geographical characteristics as Mykonos and Santorini Islands.

We have done a comprehensive search on three main databases which are respectively Scopus, Springer, and ScienceDirect, and we have selected 75 articles written in English that are focusing directly or indirectly on Water Resources Management and Tourism in the Mediterranean Basin (Islands) from 2002 until 2019. It has to be noted that, we have discarded many peer-reviewed articles that we thought that has no “direct” or “indirect” connection to this study’s objectives. As a matter of fact, we mention “directly or indirectly focus” because there are peer reviewed articles which are not essentially focusing on the main subject of this research. However, these articles contain relevant information regarding water resources management and tourism in the Mediterranean Basin. We have used the following 7 keywords to detect and choose the literature:

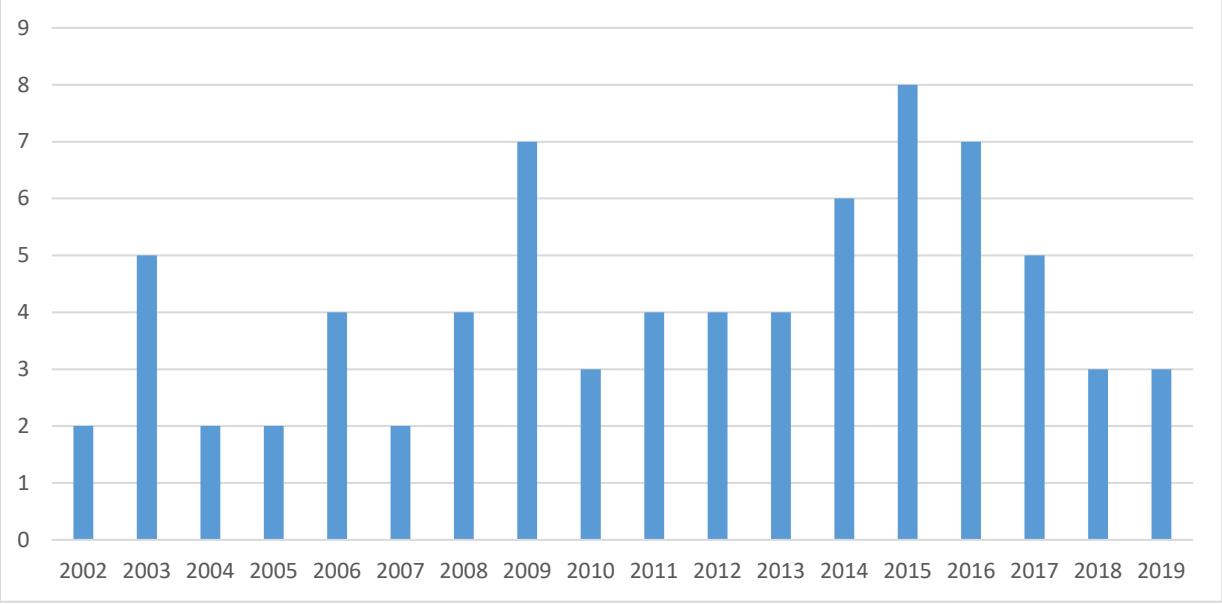
- Water Resources Management
- Water Scarcity
- Water Availability
- Tourism
- Mediterranean Region / Basin
- Islands
- Greece

We have selected the literature according to these 7 keywords and we excluded non-English written articles. In addition to this, we have used book chapters and books as supplementary resources and we have reviewed in particularly academic articles as the main resources. Hence, we will continue this chapter by characterizing the selected academic literature and then we will focus more on the effects of Tourism on Water Resources Management in the Mediterranean Basin (Islands).

2.2. CHARACTERIZATION OF THE ACADEMIC LITERATURE IN THE TOPIC

In the last 11 years, the number of peer-reviewed articles focusing directly or indirectly on Water Resources Management and Tourism in the Mediterranean Basin (Islands) has increased. We have decided to go over all of the English-language articles written between 2002 and 2019. We only chose peer-reviewed articles that are similar to the objectives of this study. Although there were additional papers that focused on the same field of research as this work, we opted to discard them because they bore no resemblance to the purpose of this work. From 2002 to the end of 2007, there were seventeen published articles connected to Water Resources Management and Tourism in the Mediterranean Basin (Islands), but starting in 2008, we discovered a rate of three to four studies per year (Figure 1). We registered eight published papers in 2015, which became the maximum number of published papers connected to Water Resources Management and Tourism in the Mediterranean Basin (Islands) until 2019.

Figure 1. Distribution of the Selected Peer-Reviewed Articles by Years.



Source: Author's own work.

We have noticed that there are different subject areas that focus directly or indirectly on the relation of Water Resources Management and Tourism in the Mediterranean Basin (Islands). Table 1 presents the subject area of the selected articles according to the journal area in Scopus. We have found that majority of the peer reviewed articles were published in four major subject areas. These four major subject areas are Environmental Management (14), Geography (12), Tourism (14) and Water Resources Management (14). Table 1 shows that out of seventy five articles, forty nine of them were published in these four major journal areas from 2002 till 2019.

Table 1. Subject Area of the Selected Peer-Reviewed Articles According to Scopus Journal Area.

Index	Name of the First Author and Date	Subject Area (According to the Journal Area in Scopus)
1	Karavitis and Kerkides (2002)	Water Resources Management
2	Kent et al., (2002)	Geography
3	Briassoulis (2003)	Tourism
4	Garcia and Servera (2003)	Geography
5	Tsartas (2003)	Tourism
6	Voivontas et al., (2003)	Desalination
7	Xu et al., (2003)	Water Resources Management
8	Essex et al., (2004)	Tourism
9	Tsagarakis et al., (2004)	Geography
10	Borboudaki et al., (2005)	Environmental Management
11	Körner et al., (2005)	Geography
12	Amelung and Viner (2006)	Tourism
13	Iglesias et al., (2006)	Water Resources Management
14	Karagiannis and Soldatos (2006)	Desalination
15	Perry (2006)	Tourism
16	Amelung et al., (2007)	Tourism

17	Kaldellis and Kondilli (2007)	Desalination
18	Baltas (2008)	Water Resources Management
19	Dodds and Kelman (2008)	Tourism
20	Gikas and Angelakis (2008)	Desalination
21	Sofios et al., (2008)	Environmental Management
22	Adamou and Clerides (2009)	Economics
23	Correia (2009)	Water Resources Management
24	Gikas and Tchobanoglous (2009)	Environmental Management
25	Navarro et al., (2009)	Tourism
26	Rico Amoros et al., (2009)	Geography
27	Royle (2009)	Tourism
28	Tolika et al., (2009)	Geography
29	Economou (2010)	Energy
30	Markantonis and Bithas (2010)	Environmental Management
31	Zachariadis (2010)	Water Resources Management
32	Amelung and Moreno (2011)	Climate Change
33	Hof and Schmitt (2011)	Geography
34	Tortella and Tirado (2011)	Environmental Management
35	Tsanis et al., (2011)	Climate Change
36	Hof and Salom (2012)	Tourism
37	Lelieveld et al., (2012)	Climate Change
38	Prokopiou et al., (2012)	Environmental Management
39	Rico Amoros et al., (2012)	Water Resources Management
40	Hadjikakou et al., (2013)	Environmental Management
41	Koutroulis et al., (2013)	Hydrology
42	Milano et al., (2013)	Hydrology
43	Xenarios et al., (2013)	Desalination

44	Klein et al., (2014)	Environmental Management
45	March et al., (2014)	Environmental Management
46	Roson and Sartori (2014)	Climate Change
47	Sofroniou and Bishop (2014)	Water Resources Management
48	Viola et al., (2014)	Water Resources Management
49	Zotalis et al., (2014)	Water Resources Management
50	Gössling (2015)	Tourism Management
51	Gössling et al., (2015)	Tourism Management
52	Hadjikakou et al., (2015)	Tourism
53	Hof and Salom (2015)	Tourism
54	Michailidou et al., (2015)	Environmental Management
55	Papadaskalopoulou et al., (2015)	Desalination
56	Stathatou et al., (2015)	Desalination
57	Stefanova et al., (2015)	Water Resources Management
58	Grillakis et al., (2016)	Meteorology
59	Koutroulis et al., (2016)	Hydrology
60	Köberl et al., (2016)	Environmental Management
61	Mentis et al., (2016)	Energy
62	Morote et al., (2016)	Geography
63	Tortella et al., (2016)	Water Resources Management
64	Vogiatzakis et al., (2016)	Biology
65	Enriquez et al., (2017)	Water Resources Management
66	Grofelnik (2017)	Geography
67	Kanakoudis et al., (2017)	Environmental Management
68	Michopoulos et al., (2017)	Energy
69	Panagiotis (2017)	Sustainable Development
70	Du and Ng (2018)	Environmental Economics

71	Kourgialas et al., (2018)	Environmental Management
72	Navascues and Morales (2018)	Geography
73	Gkoumas (2019)	Multidisciplinary
74	Kourtis et al., (2019)	Water Resources Management
75	Prokopiou et al., (2019)	Sustainable Development

Source: Author's own work.

On the other hand, we have decided to focus on the subject area more deeply by looking into the affiliation of the authors. As a consequence, Table 2 presents the subject area of the selected articles according to the authors' affiliations and we can notice that there are clear multidisciplinary approaches since we have found that there are four major subject areas which are Economics (9), Civil and Environmental Engineering (11), Geography (18), and Tourism (8). Table 2 shows that about two third of the articles which are directly or indirectly focusing on Water Resources Management and Tourism in the Mediterranean Basin (Islands), were published in these major four subject areas.

Table 2. Subject Area of the Selected Peer-Reviewed Articles According to the Affiliation of Authors.

Index	**Name of the First Author and Date**	**Subject Area (According to the Affiliation of the Authors)**
1	Karavitis and Kerkides (2002)	Civil and Environmental Engineering
2	Kent et al., (2002)	Geography
3	Briassoulis (2003)	Geography
4	Garcia and Servera (2003)	Geography
5	Tsartas (2003)	Tourism
6	Voivontas et al., (2003)	Chemical Engineering
7	Xu et al., (2003)	Hydrology

8	Essex et al., (2004)	Geography
9	Tsagarakis et al., (2004)	Water Supply
10	Borboudaki et al., (2005)	Water Studies
11	Körner et al., (2005)	Biology
12	Amelung and Viner (2006)	Tourism
13	Iglesias et al., (2006)	Civil and Environmental Engineering
14	Karagiannis and Soldatos (2006)	Economics
15	Perry (2006)	Geography
16	Amelung et al., (2007)	Tourism
17	Kaldellis and Kondilli (2007)	Environmental Management
18	Baltas (2008)	Civil and Environmental Engineering
19	Dodds and Kelman (2008)	Tourism
20	Gikas and Angelakis (2008)	Environmental Planning
21	Sofios et al., (2008)	Urban and Regional Planning
22	Adamou and Clerides (2009)	Energy Engineering
23	Correia (2009)	Water Studies
24	Gikas and Tchobanoglous (2009)	Civil and Environmental Engineering
25	Navarro et al., (2009)	Tourism
26	Rico Amoros et al., (2009)	Geography
27	Royle (2009)	Tourism
28	Tolika et al., (2009)	Meteorology
29	Economou (2010)	Urban and Regional Planning
30	Markantonis and Bithas (2010)	Environmental Planning
31	Zachariadis (2010)	Civil and Environmental Engineering
32	Amelung and Moreno (2011)	Tourism
33	Hof and Schmitt (2011)	Geography
34	Tortella and Tirado (2011)	Economics

35	Tsanis et al., (2011)	Civil and Environmental Engineering
36	Hof and Salom (2012)	Geography
37	Lelieveld et al., (2012)	Chemistry
38	Prokopiou et al., (2012)	Economics
39	Rico Amoros et al., (2012)	Geography
40	Hadjikakou et al., (2013)	Environmental Planning
41	Koutroulis et al., (2013)	Civil and Environmental Engineering
42	Milano et al., (2013)	Hydrology
43	Xenarios et al., (2013)	Electrical and Computer Engineering
44	Klein et al., (2014)	Geography
45	March et al., (2014)	Geography
46	Roson and Sartori (2014)	Economics
47	Sofroniou and Bishop (2014)	Computing and Technology
48	Viola et al., (2014)	Civil and Environmental Engineering
49	Zotalis et al., (2014)	Chemical Engineering
50	Gössling (2015)	Economics
51	Gössling et al., (2015)	Economics
52	Hadjikakou et al., (2015)	Environmental Management
53	Hof and Salom (2015)	Geography
54	Michailidou et al., (2015)	Civil and Environmental Engineering
55	Papadaskalopoulou et al., (2015)	Maritime Studies
56	Stathatou et al., (2015)	Geography
57	Stefanova et al., (2015)	Geography
58	Grillakis et al., (2016)	Civil and Environmental Engineering
59	Koutroulis et al., (2016)	Civil and Environmental Engineering
60	Köberl et al., (2016)	Water Studies

61	Mentis et al., (2016)	Industrial Engineering and Management
62	Morote et al., (2016)	Geography
63	Tortella et al., (2016)	Economics
64	Vogiatzakis et al., (2016)	Geography
65	Enriquez et al., (2017)	Urban and Regional Planning
66	Grofelnik (2017)	Geography
67	Kanakoudis et al., (2017)	Civil and Environmental Engineering
68	Michopoulos et al., (2017)	Civil and Environmental Engineering
69	Panagiotis (2017)	Economics
70	Du and Ng (2018)	Economics
71	Kourgialas et al., (2018)	Civil and Environmental Engineering
72	Navascues and Morales (2018)	Geography
73	Gkoumas (2019)	Tourism
74	Kourtis et al., (2019)	Water and Environmental Engineering
75	Prokopiou et al., (2019)	Maritime Studies

Source: Author's own work.

Analysis of the journals in which the studies were published reveals that almost one third of the papers were published in water studies journals; other one third of the articles were published in geography, and the remaining one third was published in journals in various fields primarily in environmental management and tourism. It is apparent that the research in this field has found its way to high-ranking journals in academic research and almost one third of the articles were published in journals such as Journal of Sustainable Tourism (7), Water (6), Desalination (4), Climatic Change (3) and Journal of Environmental Management (3).

There are other highly respected geography and tourism journals, which published papers related to Water Resources Management and Tourism in the Mediterranean Basin (Islands) such as The Professional Geographer (2), Land Use Policy (2) and Tourism Management (2). As it can be seen in List 3, there are other important water studies journals that published articles such as Water International (2), Water Resources Management (2) and Desalination and Water Treatment (2).

Table 3. Distribution of the Selected Peer-Reviewed Articles by Journals.

Index	Name of the First Author and Date	Main Journals
1	Karavitis and Kerkides (2002)	Water International
2	Kent et al., (2002)	Applied Geography
3	Briassoulis (2003)	Journal of Sustainable Tourism
4	Garcia and Servera (2003)	*Geografiska Annaler Series A* (Swedish Journal of Geography Studies)
5	Tsartas (2003)	Journal of Sustainable Tourism
6	Voivontas et al., (2003)	Desalination
7	Xu et al., (2003)	Water, Science and Technology
8	Essex et al., (2004)	Journal of Sustainable Tourism
9	Tsagarakis et al., (2004)	Agricultural Water Management
10	Borboudaki et al., (2005)	Environmental Management
11	Körner et al., (2005)	Regional Environmental Change
12	Amelung and Viner (2006)	Journal of Sustainable Tourism
13	Iglesias et al., (2006)	Water Resources Management
14	Karagiannis and Soldatos (2006)	Desalination
15	Perry (2006)	Journal of Sustainable Tourism

16	Amelung et al., (2007)	Journal of Travel Research
17	Kaldellis and Kondilli (2007)	Desalination
18	Baltas (2008)	International Journal of Water Resources Development
19	Dodds and Kelman (2008)	Tourism Review International
20	Gikas and Angelakis (2008)	Desalination
21	Sofios et al., (2008)	Environmentialist
22	Adamou and Clerides (2009)	Cyprus Economic Policy Review
23	Correia (2009)	Water International
24	Gikas and Tchobanoglous (2009)	Journal of Environmental Management
25	Navarro et al., (2009)	*Estudos Regionais* (Portuguese Journal of Regional Studies)
26	Rico Amoros et al., (2009)	Land Use Policy
27	Royle (2009)	Island Studies Journal
28	Tolika et al., (2009)	Geophysical Research Letters
29	Economou (2010)	Renewable and Sustainable Energy Reviews
30	Markantonis and Bithas (2010)	Environment, Development and Sustainability
31	Zachariadis (2010)	Water
32	Amelung and Moreno (2011)	Climatic Change
33	Hof and Schmitt (2011)	Land Use Policy
34	Tortella and Tirado (2011)	Journal of Environmental Management
35	Tsanis et al., (2011)	Climatic Change

36	Hof and Salom (2012)	Transforming and Managing Destinations (Book Chapter)
37	Lelieveld et al., (2012)	Climatic Change
38	Prokopiou et al., (2012)	Sustainable Tourism
39	Rico Amoros et al., (2012)	Water Resources Management
40	Hadjikakou et al., (2013)	Journal of Environmental Management
41	Koutroulis et al., (2013)	Journal of Hydrology
42	Milano et al., (2013)	Hydrological Sciences Journal
43	Xenarios et al., (2013)	Desalination and Water Treatment
44	Klein et al., (2014)	Environmental Model Assesment
45	March et al., (2014)	Environmental Management
46	Roson and Sartori (2014)	International Journal of Climate Change Strategies and Management
47	Sofroniou and Bishop (2014)	Water
48	Viola et al., (2014)	Water Resources
49	Zotalis et al., (2014)	Water
50	Gössling (2015)	Tourism Management
51	Gössling et al., (2015)	Tourism Management
52	Hadjikakou et al., (2015)	Journal of Sustainable Tourism
53	Hof and Salom (2015)	Journal of Sustainable Tourism
54	Michailidou et al., (2015)	Journal of Cleaner Production
55	Papadaskalopoulou et al., (2015)	Desalination and Water Treatment

56	Stathatou et al., (2015)	Desalination and Water Treatment
57	Stefanova et al., (2015)	Water
58	Grillakis et al., (2016)	International Journal of Biometeorology
59	Koutroulis et al., (2016)	Journal of Hydrology
60	Köberl et al., (2016)	Science of the Total Environment
61	Mentis et al., (2016)	Energy
62	Morote et al., (2016)	The Professional Geographer
63	Tortella et al., (2016)	Water Resources Research
64	Vogiatzakis et al., (2016)	Biodiversity Conservation
65	Enriquez et al., (2017)	Water
66	Grofelnik (2017)	*Hrvatski Geografski Glasnik* (Croation Journal of Geography Studies)
67	Kanakoudis et al., (2017)	Environmental Science and Pollution Research
68	Michopoulos et al., (2017)	Energy and Buildings
69	Panagiotis (2017)	European Journal of Sustainable Development
70	Du and Ng (2018)	Environmental Economics and Policy Studies
71	Kourgialas et al., (2018)	Science of the Total Environment
72	Navascues and Morales (2018)	The Professional Geographer
73	Gkoumas (2019)	Heliyon

74	Kourtis et al., (2019)	Water
75	Prokopiou et al., (2019)	Sustainable Development and Planning

Source: Author's own work.

Table 4 presents the distribution of the selected peer reviewed articles by area of the study. We have noticed that majority of the peer reviewed articles that focus directly or indirectly on Water Resources Management and Tourism in the Mediterranean Basin (Islands) concentrate in two countries which are Greece (34) and Spain (18) because of Greek Islands and Balearic Islands. On the other hand, we have peer reviewed articles which concentrate in particularly on Mediterranean region (14) and Cyprus (5). One interesting finding is the relatively low number of publications related to Croatia (1)[1] and Malta (1) in Table 4. Although, island tourism has significant importance in Malta and Croatia and it has been more than 10 years since the number of Water Resources Management and Tourism in the Mediterranean Basin (Islands) articles increased, there are still not enough publications from these countries. At the same time, there are no peer reviewed articles in English which are analyzing Corsica (France) or Sardinia Islands[2] (Italy) as main case study areas and it is noteworthy, since one might have expected a larger share research related to them.

We have also noticed that there can be further research opportunities with other Mediterranean Basin countries such as Tunisia and Turkey. There can be studies based on Djerba Island (Tunisia) which is one of the popular international tourism destinations in the Mediterranean Basin. On the other hand, we have noticed that there can be studies which are focusing on water resources management and tourism in Bozcaada and Gökçeada (Turkey). These islands are two domestic

[1] Although, Croatian Islands are located in Adriatic Sea, we consider Croatia as a Mediterranean country since island tourism and climate characteristics are very similar to other Mediterranean countries.
[2] There are articles such as Viola et al., (2014) and Köberl et al., (2016) which are focusing on Corsica and Sardinia Islands but these are relatively concentrating on the Mediterranean Basin with a region based analysis.

tourism destinations located in the Aegean and they are facing water scarcity issues from time to time.[3]

Table 4. Distribution of the Selected Peer-Reviewed Articles by Countries and Regions.

Index	Name of the First Author and Date	Area of the Study
1	Karavitis and Kerkides (2002)	Greece
2	Kent et al., (2002)	Spain
3	Briassoulis (2003)	Greece
4	Garcia and Servera (2003)	Spain
5	Tsartas (2003)	Greece
6	Voivontas et al., (2003)	Greece
7	Xu et al., (2003)	Spain
8	Essex et al., (2004)	Spain
9	Tsagarakis et al., (2004)	Greece
10	Borboudaki et al., (2005)	Greece
11	Körner et al., (2005)	Greece
12	Amelung and Viner (2006)	Spain
13	Iglesias et al., (2006)	Mediterranean
14	Karagiannis and Soldatos (2006)	Greece
15	Perry (2006)	Mediterranean
16	Amelung et al., (2007)	Mediterranean
17	Kaldellis and Kondilli (2007)	Greece
18	Baltas (2008)	Greece
19	Dodds and Kelman (2008)	Spain and Malta
20	Gikas and Angelakis (2008)	Greece
21	Sofios et al., (2008)	Greece
22	Adamou and Clerides (2009)	Cyprus

[3] Turkish government decided to pass a new water project in order to solve the water scarcity issue due to summer domestic tourism seasonality. For more information: http://www.canakkalehaber.com/bozcaada-nin-su-sorunu-cozuldu/3005/

23	Correia (2009)	Mediterranean
24	Gikas and Tchobanoglous (2009)	Greece
25	Navarro et al., (2009)	Spain
26	Rico Amoros et al., (2009)	Spain
27	Royle (2009)	Spain
28	Tolika et al., (2009)	Greece
29	Economou (2010)	Greece
30	Markantonis and Bithas (2010)	Greece
31	Zachariadis (2010)	Cyprus
32	Amelung and Moreno (2011)	Europe
33	Hof and Schmitt (2011)	Spain
34	Tortella and Tirado (2011)	Spain
35	Tsanis et al., (2011)	Greece
36	Hof and Salom (2012)	Spain
37	Lelieveld et al., (2012)	Mediterranean
38	Prokopiou et al., (2012)	Greece
39	Rico Amoros et al., (2012)	Spain
40	Hadjikakou et al., (2013)	Mediterranean
41	Koutroulis et al., (2013)	Greece
42	Milano et al., (2013)	Mediterranean
43	Xenarios et al., (2013)	Greece
44	Klein et al., (2014)	Greece
45	March et al., (2014)	Mediterranean
46	Roson and Sartori (2014)	Mediterranean
47	Sofroniou and Bishop (2014)	Cyprus
48	Viola et al., (2014)	Mediterranean
49	Zotalis et al., (2014)	Greece
50	Gössling (2015)	Greece
51	Gössling et al., (2015)	General Context
52	Hadjikakou et al., (2015)	Cyprus

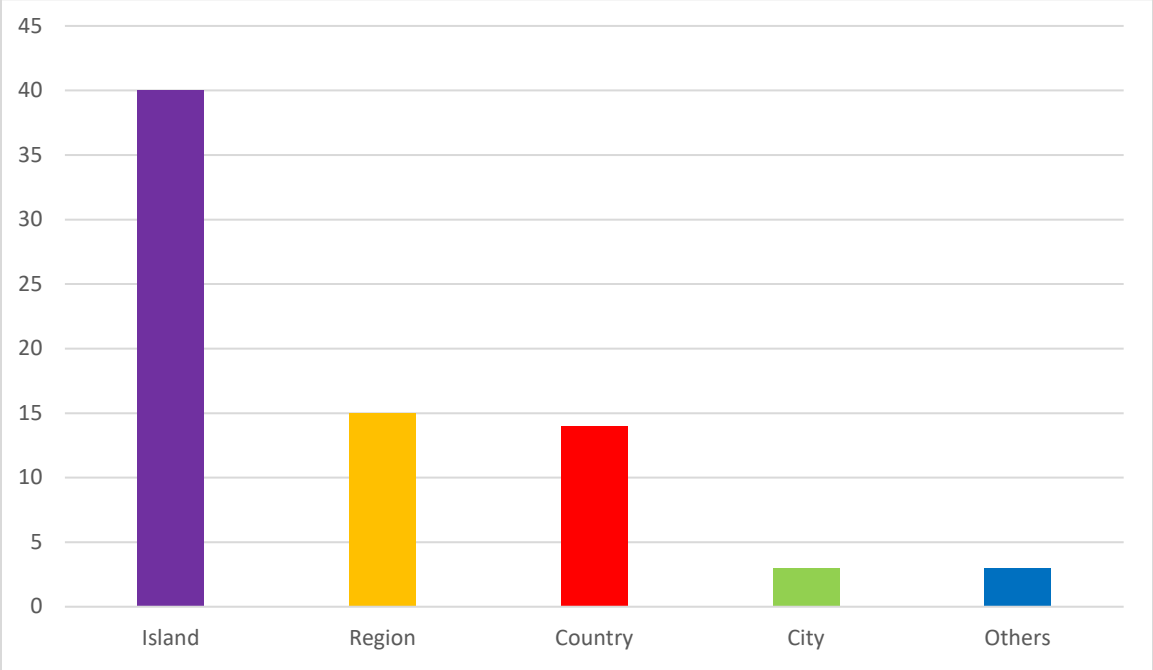
53	Hof and Salom (2015)	Spain
54	Michailidou et al., (2015)	Greece
55	Papadaskalopoulou et al., (2015)	Greece
56	Stathatou et al., (2015)	Cyprus
57	Stefanova et al., (2015)	Spain
58	Grillakis et al., (2016)	Mediterranean
59	Koutroulis et al., (2016)	Greece
60	Köberl et al., (2016)	Mediterranean
61	Mentis et al., (2016)	Greece
62	Morote et al., (2016)	Spain
63	Tortella et al., (2016)	Spain
64	Vogiatzakis et al., (2016)	Mediterranean
65	Enriquez et al., (2017)	Greece
66	Grofelnik (2017)	Croatia
67	Kanakoudis et al., (2017)	Greece
68	Michopoulos et al., (2017)	Cyprus
69	Panagiotis (2017)	Greece
70	Du and Ng (2018)	Spain, Greece and Turkey
71	Kourgialas et al., (2018)	Greece
72	Navascues and Morales (2018)	Mediterranean
73	Gkoumas (2019)	Greece
74	Kourtis et al., (2019)	Greece
75	Prokopiou et al., (2019)	Greece

Source: Author's own work.

As a consequence, we have decided to look more deeply into the territorial context. Figure 2 presents the distribution of the articles by territorial context. As it can be seen below, vast majority of the articles have rather island based case study analysis (40) or region based analysis (15).

Meanwhile, there are fourteen articles that have country based analysis and three articles have city based analysis in Water Resources Management and Tourism in the Mediterranean Basin.

Figure 2. Distribution of the Selected Peer-Reviewed Articles by Territorial Context.



Source: Author's own work.

Research approach is another subject that we have decided to look more deeply. We have discovered that vast majority of the articles (65) have empirical approach. On the other hand, there are (10) articles which are partly empirical and theoretical. This enabled us to notice that there can be further research opportunities through theory based articles that focus on Water Resources Management and Tourism in the Mediterranean Basin.

Methodology has importance in the peer reviewed articles that focus directly or indirectly on Water Resources Management and Tourism in the Mediterranean Basin (Islands). We have noticed that different types of methods have been used in the articles to analyze and assess the complex relationship between water resources management and tourism. The majority of the articles (65) are empirical studies, and these studies intend to use both of qualitative and quantitative approaches, with the data analysis of statistics, surveys, interviews and so on. We have noticed

that, most of the empirical articles have case study analyses and majority of the case study articles, use only qualitative approach or both qualitative and quantitative approaches.

Nevertheless, there are articles that are using only quantitative analysis such as Amelung and Moreno (2010), Lelieveld et al., (2012), Koutroulis et al., (2013) and Stefanova et al., (2015). These articles have significant contribution for the development of the literature in Water Resources Management and Tourism in the Mediterranean Basin (Islands) because they calculate the future impact of tourism development on water resources management through future climate change projections. On the other hand, there are articles that are using comparative analysis such as Dodds and Kelman (2008), Hadjikakou et al., (2013), Viola et al. (2014) and Köberl et al., (2016).

These articles analyze the impact of tourism development and climate change on the water resources availability through comparisons of different islands that are located in the Mediterranean Basin. Furthermore, there are articles such as Adamou and Clerides (2009), Tortella et al., (2016) and Du and Ng (2018) that is using econometric models for analyzing the current and future impacts of climate change and tourism on economies and water resources of Mediterranean Basin countries and these articles have also significant contribution for the development of the literature.

We have noticed that different variables were used by the authors in order to analyze the complex relation between water resources management and tourism. We can see that the following variables are mostly used as key variables among the reviewed articles:

1. **Meteorological Variables:**

- Annual or seasonal temperature (ºC)
- Annual or seasonal rainfall (mm/year or mm/month)

2. **Water Resources Variables:**

- Water Consumption per day, per year and/or per month (m^3 / day, month and/or year)
- Desalinated Water per day, per year and/or per month (m^3 /day, month and/or year)
- Transported/Imported Water per day, per year and/or per month (m^3 / day, month and/or year)

- Household water consumption per day, per year and/or per month (m^3 / day, month and/or year)
- Treated Waste Water per day, per year and/or per month (m^3 / day, month and/or year)
- Water use per guest night (m^3 /night)
- Water use per room[4]
- Water average price (€/m^3)
- Water marginal price (€/m^3)
- Price of Desalinated / Transported / Treated Water (€/m^3)

3. Tourism Sector Variables:

- Total Number of Tourists (Domestic and / or International)
- Tourism Revenue
- Overnight Stays
- Tourism Revenue per tourist arrival
- Average Stay
- Occupancy Rate %
- Number of hotels
- Number of rooms available
- Number of beds available
- Hotel Price Index
- Hotel Star Ratings (Small – Medium – Big Chains)
- Existence of swimming pools
- Existence of spa
- Existence of golf course

4. Other Key Variables:

- City / Island Surface Area

[4] This variable refers to the customers of hotels and resorts.

- Population Density
- Gross Domestic Product (GDP) per capita / Economic Development Level

As it can be noticed, many different variables are being used to analyze the complex relationship of tourism sector and water resources availability / management in the reviewed articles which are directly or indirectly focusing on the topic. However, we have mentioned that majority of these articles are published, in varied journals that have different subject areas and many authors of the articles have different affiliations. For that reason, we have decided to have Table 5 which will include our detailed review and study overview. We have classified each reviewed article according to their approach (empirical / theoretical), scale of the study, data sources, methodology, main findings and in particularly their results which show whether tourism has a positive or a negative on water resources availability.

Table 5. Detailed Review and Study Overview of the Selected Peer-Reviewed Articles

Study	Study Overview	Theoretical or Empirical	Scale of the Study	Country of the Study	Information used (and data source)	Method	Ex-ante or Ex-post	Main Findings	Positive or Negative Effect of Tourism on Water Resources
1.Karavitis and Kerkides (2002)	This paper aims to estimate the surface water resources potential in some of the major Aegean Islands in an effort to provide a means for the continuous development of the region and for other parts of the world.	Empirical	Islands - South Aegean Islands	Greece	Climate, water, demographic, agricultural and economic data from Ministry of Agriculture of Greece and Ministry of Environment of Greece.	Case Study Analysis of Greek Islands with quantitative approach to estimate the water potential of the islands	Ex-Post	The main finding is that there is urgent and continuous need for integrated water resources management for the case of Greek Islands since there is water scarcity potential due to socio-economic activities and changing climate conditions.	Negative Effect of Tourism on Water Resources.
2. Kent et al., (2002)	This paper aims to examine the relationship between tourist demand and water supply on the island of Mallorca and to assess whether the supply of water may ultimately constrain the long-term viability of the island's tourist industry.	Empirical	Island - Mallorca	Spain	Climate and water data from Government of Balearic Islands	Case Study Analysis of Mallorca with qualitative approach to examine the relationship between tourist demand and water supply on the island	Ex-Post	The main finding is that close attention must be paid to the conservation of water resources on Mallorca, as they are critical to environmental stability and the sustainability of tourism as its principal economic activity in the medium to long term. Water management is the key area of concern in the light of expanding populations, growth in tourism, and changing climate, particularly shifts in precipitation patterns.	Negative Effect of Tourism on Water Resources.

3. Briassoulis (2003)	The paper presents tourism and local development's impacts, evaluates them with a consistent set of sustainability criteria and probes into the essential requirements for securing the sustainability of development of Crete and of its tourist sector.	Empirical	Island - Crete	Greece	Previous Literature Review.	Case Study Analysis of Crete with qualitative approach to evaluate tourism and its impact on local development	Ex-Ante	The main findings are: Crete's self-reliance has weakened overall, pressures from tour operators and competition from other destinations have increased, and national and EU policy developments may become more stringent in the near future. Its overall spatial development pattern follows no formal plan. These and many other socio economic developments raise the question as to whether tourism, from a development motor, will become a source of unsustainability if it continues developing unchecked in such a broader context.	Negative Effect of Tourism on Water Resources.
Study	**Study Overview**	**Theoretical or Empirical** [1]	**Scale of the Study**	**Country of the Study**	**Information used (and data source)**	**Method**	**Ex-ante or Ex-post**	**Main Findings**	**Positive or Negative Effect of Tourism on Water Resources**
4. Garcia and Servera (2003)	This paper aims to discuss the impacts of tourism development on water demand and beach degradation on the island of Mallorca.	Empirical	Island - Mallorca	Spain	Statistical Data (Hydrological) from Department of Environment, Autonomous Government of the Balearic Islands and previous literature datasets.	Case Study of Mallorca with quantitative and qualitative approaches discuss the impacts of tourism development on water demand.	Ex-Post	The main finding is that the dwelling capacity of the island has been exceeded and the present levels of water demand and beach degradation are not sustainable. This indicates that tourism in Mallorca is becoming unsustainable and a water and coastal management policy is urgently required.	Negative Effect of Tourism on Water Resources.

5. Tsartas (2003)	The paper analyses two issues that have characterised tourism development in Greek insular and coastal areas in the period 1970–2000. The first issue concerns the socio economic and cultural changes that have taken place in these areas and led to rapid and unplanned tourism development. The second issue consists of the policies for tourism and tourism development at local, regional and national level.	Empirical	Country - Greece	Greece	Previous Literature Review and EOT data for the 1977–1994 period.	Case Study Analysis of Greece with qualitative approach to evaluate the sociocultural changes and crucial policy issues related to tourism development	Ex-Post	The main findings are that the considerable cultural, social and environmental impact of tourism in insular and coastal areas has led to changes in two key areas: changes of a social nature (social changes in tourist regions) and changes of an institutional nature (priorities and choices of tourism policies).	Negative Effect of Tourism on Water Resources.
6. Voivontas et al., (2003)	This paper aims to identify sustainable means to manage water resources in arid and semi-arid small islands which have water scarcity and high seasonal tourist water demand.	Empirical	Island - Paros	Greece	Water cost data from 94 operating storage reservoirs in Greece.	Case Study Analysis of Paros with quantitative approach by using an optimization model for the identification of the least cost water sources able to cover the anticipated water demand in a long-term planning horizon.	Ex-Post	The main finding is that that conventional water supply topped by versatile desalination schemes used for the particularly demanding water consumption peaks (tourism seasonal water demand) may be the focal area of responses for the island of Paros, and by extension for other areas around the world facing similar problems.	Negative Effect of Tourism on Water Resources.

Study	Study Overview	Theoretical or Empirical	Scale of the Study	Country of the Study	Information used (and data source)	Method	Ex-ante or Ex-post	Main Findings	Positive or Negative Effect of Tourism on Water Resources
7. Xu et al., (2003)	This paper aims to discuss the usage of non conventional water resources such as desalination and water reuse in the Mediterranean region due to increasing tourism water demand.	Empirical	Island - Mallorca	Spain	Statistical Data (Hydrological and Economic) from ITGM (Spain).	Qualitative Analysis of the usage of non conventional resources through the establishment of three models: hydrological, water demand and technical-economical	Ex-Post	The main finding is that water reuse is an effective and economical option compared desalinated seawater to address water scarcity in Mallorca.	Negative Effect of Tourism on Water Resources.
8. Essex et al., (2004)	This paper evaluates the physical and human factors that have contributed to the present water supply problems on Mallorca, with particular reference to the role of tourism in these issues	Empirical	Island - Mallorca	Spain	Climate Data from National Climate Data Centre, Asheville, NC and previous literature review	Case Study Analysis of Mallorca Island with qualitative approach to analyse the impact of climate change and tourists' seasonal water demand on water resources availability.	Ex-Post	The main findings are surface storage of water is a problem on Mallorca because of the high permeability of the dominant limestone geology. Peak visitor volumes and demand for water supply are concentrated in the season of low rainfall and high evapo-transpiration. On a per capita basis, tourists demand more water than local residents and Mallorca is under potential water scarcity risk.	Negative Effect of Tourism on Water Resources.

9. Tsagarakis et al., (2004)	This paper aims to present views on integrated water resources management in Crete, Greece including the potential for the recycling and reuse of treated wastewater.	Empirical	Island - Crete	Greece	Qualitative and quantitative data from major 13 Mixed Water Treatment Projects (MWTP) of Crete and literature review.	Case Study Analysis of Crete with quantitative approach for the introduction of non conventional resources in Greek Islands	Ex-Post	Crete has limited water resources availability due to temporal and spatial variations of precipitation. Also, the continued increase of domestic water, tourist summer water demand and agricultural demand can only be met through an integrated water management scheme in which non conventional water resources (such as recycled water) should be included.	Negative Effect of Tourism on Water Resources.
Study	**Study Overview**	**Theoretical or Empirical**	**Scale of the Study**	**Country of the Study**	**Information used (and data source)**	**Method**	**Ex-ante or Ex-post**	**Main Findings**	**Positive or Negative Effect of Tourism on Water Resources**
10. Borboudaki et al., (2005)	The paper discusses effluent management data, including quantitative and qualitative effluent characteristics, reuse, and economic aspects of the Hersonissos Wastewater Treatment Plant (WTP) in Crete, Greece.	Empirical	District - Hersonissos (Crete)	Greece	Wastewater Data from Municipal Enterprise of Water Supply and Sewerage of Iraklio	Case Study Analysis of Crete Island's Hersonissos WTP for analysing quantitative and qualitative effluent characteristics and economic aspects of wastewater as a non conventional water resource.	Ex-Post	The analysis of effluent quantitative data showed two flow peaks in the summer period (tourism season) and only one in winter. The WTP of Hersonissos was found to provide a reliable level of treatment wastewater for the development of tourism.	Negative Effect of Tourism on Water Resources.
11. Körner et al., (2005)	The paper discusses the consequences of accelerating drought on natural vegetation and agriculture and points at the interaction with fire dynamics and economy,	Empirical	Island - Samos	Greece	Combination of results from in depth interviews with 28 stakeholders, precipitation and climate	Case Study Analysis of Samos Island with qualitative approach to analyse the effect of climate change on water resources and	Ex-Ante	The combination of human misbehaviour, drought incidence and declining agricultural profit and thus land care, make enhanced fire impact the single largest risk factor in response to drought, severely affecting the most significant sources of income in this region, which is tourism.	Neutral Effect of Tourism on Water Resources.

	both likely to enhance the drought effect				data from Hellenic National Meteorology Service, Dendrological data and Ecophysiological data.	in the long run on tourism industry.			
12. Amelung and Viner (2006)	This paper examines future climate change scenarios for the Mediterranean region using the Tourism Climatic Index.	Empirical	Islands - Balearic Islands	Spain	1961–1990 Mean Monthly Climatology data, assembled by the Climatic Research Unit in Norwich.	Qualitative Analysis of TCI for analysing the future impacts of climate change on tourism	Ex-Ante	The main finding is that projections indicate that particularly in spring, TCI scores will improve in most of the Mediterranean region, in particular in Spain, Greece and Turkey.	Neutral Effect of Tourism on Water Resources.
Study	**Study Overview**	**Theoretical or Empirical**	**Scale of the Study**	**Country of the Study**	**Information used (and data source)**	**Method**	**Ex-ante or Ex-post**	**Main Findings**	**Positive or Negative Effect of Tourism on Water Resources**
13. Iglesias et al., (2006)	This paper aims to review and evaluate current and future social and environmental pressures on water resources, including climate change.	Empirical	Region - Mediterranean	Mediterranean	Statistical Data from Food and Agriculture Organization of the United Nations (FAO).	Quantitative Analysis of water scarcity and climate change focusing the Mediterranean region	Ex-Post	The main finding is that the water scarcity problem will be intensified with the on-going pressure due to socio-economic (agriculture and tourism demand) and technological changes. However, the pressure is not homogeneous across the region and sectors of use.	Negative Effect of Tourism on Water Resources.

14. Karagiannis and Soldatos (2006)	This paper presents the current status in Cyclades and Dodecanese, existing water demand and transported quantities of water, and the desalination units that exist in the Aegean Islands.	Empirical	Island - Milos	Greece	Statistical Data from the Ministry of the Aegean Islands.	Case Study Analysis of Milos Island (Part of Cyclades Islands) with qualitative approach to discuss the current water availability and future projections.	Ex-Post	Milos receives a lot of tourists, especially in summer. The drinking needs of the people in Milos are satisfied by imported bottled water because the water from the local network is not potable, but it is mainly used for domestic needs. Large amounts of water are transported every year, at a cost of almost 8 €/m³ and this cost will probably increase in the following years due to rises in the cost of fuels, inflation, etc. In the future, the local authorities in Milos plan to install a desalination plant with a water capacity of 1000–2000 m³/d.	Negative Effect of Tourism on Water Resources.
15. Perry (2006)	This paper aims to analyse whether climate change compromise the sustainability of Mediterranean Tourism or not.	Empirical	Region - Mediterranean	Mediterranean	Previous Literature Review.	Qualitative Analysis of Mediterranean Region in order to analyse the possible impact of climate change on the sustainability of tourism in the future.	Ex-Ante	The main finding is that Tourism in the Mediterranean may become less sustainable, both economically and environmentally, as a result of climate change.	Neutral Effect of Tourism on Water Resources.
Study	**Study Overview**	**Theoretical or Empirical**	**Scale of the Study**	**Country of the Study**	**Information used (and data source)**	**Method**	**Ex-ante or Ex-post**	**Main Findings**	**Positive or Negative Effect of Tourism on Water Resources**
16. Amelung et al., (2007)	This article explores the potential implications of climate change for global tourism, with special emphasis on seasonality focusing the Mediterranean Region.	Empirical	Region - Mediterranean	Mediterranean	Climate Data from Climatic Research Unit at the University of East Anglia.	Qualitative and Quantitative Analysis of TCI for analysing the future impacts of climate change on tourism.	Ex-Ante	The main finding is that climate change may bring some relief to extreme cases of seasonality, but only if institutions and tourists are sufficiently flexible; if they are not, climate change may even cause seasonality to intensify.	Neutral Effect of Tourism on Water Resources.

17. Kaldellis and Kondilli (2007)	The objective of the present work is to analyse the current status of water shortage problem in the South Aegean Islands and to provide reliable data concerning the water quantities being imported in the areas of Cyclades and Dodecanese.	Empirical	Islands - South Aegean Islands	Greece	Statistical Data from the General Secretariat of National Statistical Service of Greece.	Case Study Analysis of South Aegean Islands with quantitative and qualitative approaches to analyse the current status of water shortage problem	Ex-Post	As a feasible, cost-effective and sustainable alternative solution, RES powered desalination is proposed, since the final cost of the locally produced water from RES based desalination plants is expected to be quite lower than the corresponding transported water cost, without disregarding the considerable environmental, social and macro-economic benefits.	Negative Effect of Tourism on Water Resources.
18. Baltas (2008)	The paper aims to provide descriptions, first of the climatic conditions and second of the availability of water resources in the 14 water districts of Greece.	Empirical	Country - Greece	Greece	Climate data of 30-year time period (1965–95) were acquired from 40 meteorological stations across Greece.	Quantitative Analysis of changing climate conditions and water availability in 14 regions of Greece.	Ex-Post	The main finding is that the Pindos mountain range is a major contributing factor in the climatic variety, dividing the country into windward, high precipitation western areas and leeward, low precipitation eastern areas. This situation effects directly water availability in the Eastern Regions of Greece.	Neutral Effect of Tourism on Water Resources.
Study	**Study Overview**	**Theoretical or Empirical**	**Scale of the Study**	**Country of the Study**	**Information used (and data source)**	**Method**	**Ex-ante or Ex-post**	**Main Findings**	**Positive or Negative Effect of Tourism on Water Resources**
19. Dodds and Kelman (2008)	This paper aims to examine how sustainable tourism policies do, do not, and should factor in climate change in order to reduce the vulnerabilities of the tourism sector to	Empirical	Islands - Mallorca and Malta	Spain and Malta	Interviews with 23 actors in Malta (100% response rate) and 25 actors in Calvià / Mallorca (83% response rate) whom agreed to	Case Study Analysis of Mallorca and Malta with comparative approach	Ex-Post	The main finding is that climate change projections manifest for Mediterranean precipitation, then in the absence of cheap desalination, meeting tourists' water expectations could be challenging, as water consumption by tourists averages 440–880 liters per person per day, higher than the residents' average of 140 liters per person per day.	Negative Effect of Tourism on Water Resources.

	climate change focusing Mediterranean Island case studies of Calvià, Mallorca, and Malta.				complete a formal questionnaire followed up with semi structured interviews				
20. Gikas and Angelakis (2008)	The article summarizes the pressures on the water resources of the above geographical regions, and investigates the possibility for utilization of nonconventional water resources, like desalinated seawater, reclaimed wastewater and brackish water focusing South Aegean Islands and Crete.	Empirical	Islands - South Aegean Islands and Crete	Greece	Statistical Data from Hellenic Ministry of Mercantile Marine, the Aegean and Island Policy	Case Study Analysis of South Aegean Islands and Crete with qualitative approach to discuss the pressures on water availability.	Ex-Post	Water recourses management should be based on reliable data. They should follow the contemporary trends and the principles of sustainable development. The proposed unification of the RBDs of Crete and the Aegean Islands is expected to assist to the development of a more rationalized water resources management plan.	Negative Effect of Tourism on Water Resources.
21. Sofios et al., (2008)	This paper aims to describe and analyse the existing status of water resources in Greece, as well as, the framework of applied policy	Empirical and Theoretical	Country - Greece	Greece	Statistical Data from Eurostat and National Statistic Service of Greece (NSSG).	Case Study Analysis of Greece with qualitative approach to evaluate the applied policy and to propose measures and actions for the management of water resources in Greece.	Ex-Post	The main finding is that the implementation of a sustainable policy that will provide sufficient quantities of fresh water accessible to every citizen is a fundamental right. The quality of water resources should be considered as a high priority of the public authorities, too.	Negative Effect of Tourism on Water Resources.

Study	Study Overview	Theoretical or Empirical[1]	Scale of the Study	Country of the Study	Information used (and data source)	Method	Ex-ante or Ex-post	Main Findings	Positive or Negative Effect of Tourism on Water Resources
22. Adamou and Clerides (2009)	The objective of this paper is to present the latest findings of the economic literature investigating the link between tourism specialization and economic growth and to discuss their implications for Cyprus and its tourism sector.	Empirical	Country - Cyprus	Cyprus	Statistical Data from World Development Indicators, Penn World Tables.	Case Study Analysis of Cyprus with quantitative approach (econometric analysis)	Ex-Post	The main findings are that a successful transition away from mass tourism and toward a more diversified and higher quality product will benefit the Cypriot economy in a number of ways. Tourists impose several negative externalities such as congestion and use of scarce resources (water resources) that are not usually priced in the competitive marketplace.	Negative Effect of Tourism on Water Resources.
23. Correia (2009)	This paper focuses on the water needs and water availability in the Mediterranean region and the most relevant management issues raised by water scarcity are discussed	Empirical	Region - Mediterranean	Mediterranean	Water Data from WRI (1994) and Gleick (1993).	Qualitative Analysis of water scarcity and water availability in the Mediterranean region	Ex-Post	The main finding is that the profile of water uses contributes to the difficulties of water management. Irrigation and tourism have very seasonal trends in water demand which cause water scarcity in the Mediterranean region.	Negative Effect of Tourism on Water Resources.

24. Gikas and Tchobanoglous (2009)	This article aims to assess the benefits of water reclamation and reuse in small and medium size islands of the Aegean Sea (approximately below 1000 km2).	Empirical	Islands - Greek Islands	Greece	Statistical Data from Hellenic Ministry of Aegean.	Qualitative and Quantitative Analysis of water resources availability and tourism sector's water demand in Aegean Islands.	Ex-Post	The main finding is that water demands in the Aegean Islands are steadily increasing in the last decade, as a result of new holiday homes, hotels and resorts destabilizing past water manufacturing practices. Meanwhile, the use of reclaimed water could allow for an increase in the local population and tourism at the current levels of water production. Thus, over the long-term water reclamation and reuse must play an important role in the development of sustainable strategies for water management for insular regions of the Aegean, and possibly of other isolated areas of the Mediterranean basin.	Negative Effect of Tourism on Water Resources.
Study	**Study Overview**	**Theoretical or Empirical**	**Scale of the Study**	**Country of the Study**	**Information used (and data source)**	**Method**	**Ex-ante or Ex-post**	**Main Findings**	**Positive or Negative Effect of Tourism on Water Resources**
25. Navarro et al., (2009)	This paper aims to analyse the relationship between water quality and tourism focusing Spain.	Empirical	Country - Spain	Spain	Statistical Data from Spanish National Institute of Statistics.	Quantitative Panel Data Analysis of Spain's wastewater and treated water resources	Ex-Post	The main finding is that environmental impact of tourism must be taken into account as a relevant factor for competiveness and public health inequalities.	Negative Effect of Tourism on Water Resources.
26. Rico Amoros et al., (2009)	This paper aims to compare water consumption and the associated impacts of different tourist land use models, with a special emphasis on the concentrated model (hotels) and the dispersed model	Empirical	City - Benidorm	Spain	Water Demand and Supply Data from Aquaqest Water Company Benidorm.	Case Study Analysis of Benidorm, Spain with qualitative approach to evaluate tourist water demand	Ex-Post	The main finding is that tourist use of water can be varied ranging from 140 lpd to more than 600 lpd depending on the type of settlements. It has to be noted, lower consumptions per capita are found in campsites and hotels whereas higher consumption rates are more characteristic of single houses, and resort developments.	Negative Effect of Tourism on Water Resources (Residential Tourism).

	(residential housing).								
27. Royle (2009)	This paper aims to take Mallorca as an example of a 'mainland' island in tourism terms. At the same time, it aims to show that its history of tourism conformed broadly to the generalities of the Butler model.	Empirical	Island - Mallorca	Spain	Tourism (Arrivals) Data from CITTIB.	Case Study Analysis of Mallorca with quantitative approach	Ex-Post	The main finding is that Butler model's 'rejuvenation' phase was a response to a wide range of internal needs, including the necessity of protecting heritage and culture from the depredations of mass tourism, as much as to concerns about falling numbers of visitors in Mallorca.	Negative Effect of Tourism on Water Resources.
Study	**Study Overview**	**Theoretical or Empirical**	**Scale of the Study**	**Country of the Study**	**Information used (and data source)**	**Method**	**Ex-ante or Ex-post**	**Main Findings**	**Positive or Negative Effect of Tourism on Water Resources**
28. Tolika et al., (2009)	This paper presents an investigation into the record breaking winter and summer maximum and minimum temperatures of 2007 across the Greek region.	Empirical	Country - Greece	Greece	Climate Data from meteorological station located at the University of Thessaloniki (AUTh).	Quantitative Analysis of climate change and extreme hot waves on Greece's sustainability	Ex-Post	The main finding is that extreme heat waves can reoccur in Greece and they can have on Greece's economy and sustainability. Water scarcity can get worsen with the activities of agriculture and tourism.	Negative Effect of Tourism on Water Resources.

29. Economou (2010)	This research refers to the use of Renewable Energy Resources (RES), in the island of Mykonos. It focuses on the repercussions of RES on the environment as well as the economic sector.	Empirical	Island - Mykonos	Greece	Geographical Data from Ministry for the Environment Physical Planning and Public Works of Greece and Statistical Data from Center for Renewable Energy Sources of Greece.	Case Study Analysis of Mykonos with quantitative approach in order to evaluate the potential of new RES based energy (and desalinized water) production	Ex-Post	The area of Mykonos favours the development and expansion of RES due to the high level of the sunlight and wind. The RES can support Mykonos with electric power which will add additional capacity for desalinization of water since there is an increasing demand due to the intensive tourist activity during the summer months.	Negative Effect of Tourism on Water Resources.
30. Markantonis and Bithas (2010)	The paper examines the application of the contingent valuation method (CVM) for the monetary estimation of the Greek national mitigation and adaptation climate change costs as a result of the changing climate conditions and increasing tourism activity.	Empirical	Country - Greece	Greece	Surveys with 41 national experts representing different affiliations such as research, universities, environmental non-governmental organisations, public administration, etc.	Contingent valuation method (CVM) for the monetary estimation of the Greek national mitigation and adaptation climate change costs.	Ex-Ante	The main finding is that there will be additional costs on population due to climate change costs (adaptation and mitigation) and according to experts the national GDP's present 1.71% and future 2.75% should go towards mitigation and application measures.	Negative Effect of Tourism on Water Resources.
Study	**Study Overview**	**Theoretical or Empirical**	**Scale of the Study**	**Country of the Study**	**Information used (and data source)**	**Method**	**Ex-ante or Ex-post**	**Main Findings**	**Positive or Negative Effect of Tourism on Water Resources**

31. Zachariadis (2010)	This paper presents an assessment of the cost of water scarcity in Cyprus, today and in the next 20 years, taking into account the effect of projected climate change in the region.	Empirical	Country - Cyprus	Cyprus	Water Supply and Consumption Data from Municipal Water Boards.	Case Study Analysis of Cyprus with qualitative approach to determine the residential water Scarcity in Cyprus and the impact of climate change	Ex-Post	The main finding is that regional climate models forecast annual rainfall levels to decrease by 10% at about 2030, with more serious decreases happening later in the 21st century; using this forecast, scarcity costs up to 2030 were found to be 15 million Euros (or 22%) higher than the cost due to the already existing water scarcity in the country.	Negative Effect of Tourism on Water Resources (Residential Tourism).
32. Amelung and Moreno (2011)	This article stimulates the effect of climate change by the 2080s on outdoor international tourism expenditure within Europe.	Empirical	Continent - Europe	Europe	Climate Data from PRUDENCE Project.	Quantitative Analysis of TCI for analysing the future impacts of climate change on tourism	Ex-Ante	The main finding is that climate change could have significant impacts on the regional distribution of the physical resources supporting tourism in Europe (in particularly the Mediterranean Region).	Neutral Effect of Tourism on Water Resources.
33. Hof and Schmitt (2011)	The objective of the present paper is to compare per capita water consumption in quality tourist, mass tourist and residential urban areas, and to provide quantitative information on the magnitude of water consumption by gardens and swimming pools as water-related leisure structures.	Empirical	Island - Mallorca	Spain	Statistical Data from Calvia Municipality.	Case Study Analysis of Mallorca with qualitative approach for comparison of mass tourism and quality tourism	Ex-Post	The results show that quality tourism produces higher water consumption levels per capita than mass tourism. Garden irrigation is the single main cause of the high water consumption in quality tourist areas and accounts for more than 70% of these areas' total consumption in summer. But even in mass tourist and residential areas, garden irrigation accounts for up to 30% and 20%, respectively, of total water consumption in summer.	Negative Effect of Tourism on Water Resources.
Study	**Study Overview**	**Theoretical or Empirical**	**Scale of the Study**	**Country of the Study**	**Information used (and data source)**	**Method**	**Ex-ante or Ex-post**	**Main Findings**	**Positive or Negative Effect of Tourism on Water Resources**

34. Tortella and Tirado (2011)	The main purpose of this study is to develop a model to analyse hotel water consumption at a mature sun and sand destination with a strong seasonal pattern and scarcity of water; characteristics shared by some of the world's main tourist destinations.	Empirical and Theoretical	Island - Mallorca	Spain	Database from a survey distributed to a representative sample of 200 hotels in Mallorca.	Case Study Analysis of Mallorca with a model which includes a set of different hotel variables associated with physical, seasonal and management-related factors and it improves on the capacity to explain water consumption at such destinations.	Ex-Post	The main result is that the strategic move contemplated by many mature destinations (i.e., Mallorca Island) from the traditional low quality and high seasonal sun and sand tourism model, towards a higher quality and low-seasonal model, could have significant negative effects in terms of the sustainability of water resources.	Negative Effect of Tourism on Water Resources.
35.Tsanis et al., (2011)	The paper discusses the impact of changing climate conditions in the Mediterranean Region since the it has been described as one of the main climate change "hot-spots", with recent simulations showing a collective picture of substantial drying and warming.	Empirical	Island - Crete	Greece	Ensembles precipitation and temperature data	Case Study Analysis of Crete Island with qualitative and quantitative approaches to analyse the effects of climate change on water resources in arid or semi-arid locations.	Ex-Ante	The analysis of climate models data indicates that today's extreme events will intensify, i.e., precipitation on average is likely to be less frequent but more intense and droughts are likely to become more frequent and severe in some regions such as Crete Island. Tourism activity will add additional stress on water resources.	Negative Effect of Tourism on Water Resources.

36. Hof and Salom (2012)	This paper presents interdisciplinary research based on in-depth comparative analysis of water consumption and land use patterns over a range of urban tourist forms to illustrate current and future destination management challenges facing the paradigmatic Majorcan case study.	Empirical	Island - Mallorca	Spain	Land use database from Dirección General de Catastroand water consumption data from water providers ATERCA S.A., Calvia 2000 and EMAYA S.A..	Case Study Analysis of Mallorca Island's Calvia Municipality for an analysis of land use patterns and water consumption to expose the spatially uneven water demand	Ex-Post	The main findings is environmental stress in terms of water metabolism of the aesthetically pleasant quality tourism model in Mallorca shows us the empirical evidence of this contradiction, which results in a worsening of environmental and social threats due to its contribution to uneven geographical development.	Negative Effect of Tourism on Water Resources.
Study	**Study Overview**	**Theoretical or Empirical**	**Scale of the Study**	**Country of the Study**	**Information used (and data source)**	**Method**	**Ex-ante or Ex-post**	**Main Findings**	**Positive or Negative Effect of Tourism on Water Resources**
37. Lelieveld et al., (2012)	This paper aims to examine climate change and impacts in the Eastern Mediterranean and the Middle East.	Empirical	Region - Eastern Mediterranean	Mediterranean	Climatic Research Unit (CRU) TS3.0 Meteorological data.	Quantitative Analysis of CRU data for determining the future impact of climate change in the Eastern Mediterranean Region	Ex-Ante	The main finding is that the projected warming is approximately spatially uniform for night-time minimum temperatures (TN), whereas the increase of maximum daytime temperatures (TX) is more rapid in the north, e.g. the Balkans and Turkey, than in the south towards the end of 21st century.	Neutral Effect of Tourism on Water Resources.

38. Prokopiou et al., (2012)	The purpose of this paper is to apply the principles of coastal environmental management for the Islands in the central Aegean Sea via the carrying capacity assessment methodology in order to develop environmental performance indicators necessary for formulating a novel sustainable development policy proposal for Greek tourism.	Empirical	Islands - Greek Islands	Greece	Tourism (Arrivals) Data from Hotel Unions and Municipalities. Statistical Data from Hellenic Statistics Authority.	Comparative Analysis of carrying capacity indices for Greek Islands	Ex-Post	The main finding is that areas that are not yet massively developed should not necessarily develop to the same extent as the major tourist attraction areas, but should plan ahead in order that policy development and implementation, lead to a truly competitive and environmentally sound business. The target is a combination of typical and alternative tourist models related to the local community needs and the unique environment.	Negative Effect of Tourism on Water Resources.
39. Rico Amoros et al., (2012)	This paper aims to show an example of water management system that does not rely solely on conventional solutions but instead rely on agreements between potentially competing users and trade water of different qualities to satisfy the needs of all these users.	Empirical	City - Benidorm	Spain	Datasets of Rico Amoros et al. (2009) and data of the water agreements from Consorcio de Aguas de la Marina Baja, Comunidad General de Regantes y Usuarios de Callosa d'en Sarria, and Torregrosa	Case Study Analysis of Benidorm, Spain with qualitative approach to assess the water agreements between tourism and agriculture sectors	Ex-Post	The main finding is that Benidorm one of the most important tourist centres of the Mediterranean, obtains part of its water through agreements with farmers by which these trade their water with Benidorm and other towns' treated wastewater of enough quality to be used for irrigation, and obtain several compensations in return.	Negative Effect of Tourism on Water Resources.

Study	Study Overview	Theoretical or Empirical	Scale of the Study	Country of the Study	Information used (and data source)	Method	Ex-ante or Ex-post	Main Findings	Positive or Negative Effect of Tourism on Water Resources
40. Hadjikakou et al., (2013)	The aim of the paper is to present a simple methodology that allows an estimate of direct and indirect local water use associated with different holiday packages and to then discuss relevant management implications.	Empirical and Theoretical	Region - Eastern Mediterranean	Mediterranean	Data from previous literature on water use associated with different forms of travel, accommodation and tourist activities.	Case Study Analysis of Eastern Mediterranean Countries (Cyprus, Greece, Turkey, Syria) with the usage of the Water Footprint (WF) methodology to account tourist water consumption.	Ex-Post	The study highlights the importance of indirect water use in the tourism sector as well as the potential of life-cycle type water footprint calculations to complement existing Carbon Footprint (CF) and Ecological Footprint (EF) methodologies. The methodology outlined in the article has suggested ways in which to account for both the global and the local pressure of tourism demand on water resources using the import/export balance in food commodities.	Negative Effect of Tourism on Water Resources.
41. Koutroulis et al., (2013)	The article presents an assessment of the impact of global climate change on the water resources status of the island of Crete, for a range of 24 different scenarios of projected hydro-climatological regime is presented.	Empirical	Island - Crete	Greece	Three scenarios from The IPCC Third Assessment Report (TAR) were chosen based on the hydrologic simulation of the WATCH and ENSEMBLES climate model input data through continuous rainfall–runoff modelling.	Case Study Analysis of Crete with quantitative approach to evaluate the projected changes on water availability.	Ex-Post	The quantitative impact of the projected changes on water availability indicates that climate change plays an important role to water use and management in controlling future water status in a Mediterranean island like Crete. The results of the study reinforce the necessity to improve and update local water management planning (tourist water demand) and adaptation strategies in order to attain future water security.	Negative Effect of Tourism on Water Resources.

42. Milano et al., (2013)	This study highlights the importance of developing sustainable development strategies to cope with climatic and anthropogenic changes in order to explore their impacts at regional scales. It supports the need to focus on the most vulnerable areas within the Mediterranean basin.	Empirical	Region - Mediterranean	Mediterranean	Climate Data from IPCC Data Distribution Centre	Qualitative Analysis with Water Balance Model (WBM).	Ex-Ante	The main finding is that the southern and eastern rims of the Mediterranean region are currently under high water stress. Discrepancies between the northern and southern rims are likely to increase. If no sustainable development measures are taken, the water stress situation would quickly rise to severe water stress. At the 2050 horizon, climate change will most likely contribute to the depletion of freshwater resources in the Mediterranean region, especially in the already arid to semi-arid catchments.	Negative Effect of Tourism on Water Resources.
Study	**Study Overview**	**Theoretical or Empirical**	**Scale of the Study**	**Country of the Study**	**Information used (and data source)**	**Method**	**Ex-ante or Ex-post**	**Main Findings**	**Positive or Negative Effect of Tourism on Water Resources**
43. Xenarios et al., (2013)	This paper aims to discuss a methodology for the design of a wind desalination system that matches the needs of the local society	Empirical	Island - Mykonos	Greece	Energy data from the Public Power Corporation (PPC) in Mykonos and One-year wind data from a 10 m-high meteorological mast installed by CRES.	Case Study Analysis of Mykonos with quantitative approach to determine the possibility of using Renewable Energy Resources (RES) based desalination plants in the water scarce small islands in Greece	Ex-Post	The main finding is that the use of the wind energy technology to cover the energy requirements of desalination is possible and can be easily developed. The overcome of the restriction on the penetration level of the produced energy from RES to the islands' networks, expected to bring a rapid development of both technologies in the Greek Islands and especially in small islands of the Aegean Sea.	Negative Effect of Tourism on Water Resources (Residential Tourism).

44. Klein et al., (2014)	The paper aims to explore the coupled potential impacts of climate change and land-water management change on simulated groundwater storage and stream flow at the catchment scale.	Empirical	Region - South-western Messe-nia (Nava-rino Environ mental Observat ory (NEO)	Greece	Meteorolo gical data consisted of daily precipitatio n and average maximum and minimum daily temperatur e from the Mouzaki and Chora weather stations for an approximat ely 3-year period from April 2009 to December 2011.	Case Study Analysis of South-western Messenia (Navarino Environment al Observatory (NEO) with quantitative approach	Ex-Post	The main finding climate change could have a large impact on water resources at the local scale in Messenia, Greece, and nearby regions. This will potentially limit the land-water management choices available in the future and points to the importance of local-scale impact studies on combined climate/land-water management changes.	Negative Effect of Tourism on Water Resources.
45. March et al., (2014)	This article aims to discuss the results of a survey on the perception of climate change in the 14 ‘‘tourist zones’’ (as defined by the Spanish Statistical Institute, INE) that stretch from the French border to Gibraltar alongside the Spanish Mediterranean coast, including the Balearic Islands.	Empirical	Region - Mediterr anean	Mediterran ean	1,014 telephone interviews stratified according to the number of tourists staying in 14 tourist zones.	Qualitative and Quantitative Analysis of 1014 Telephone Interviews in order to assess the possible impact of climate change on households' and tourism's water demand.	Ex-Ante	The main finding is that climate change is perceived as an important factor to be taken into account in policies addressing tourism. Surveys respondents perceived that climate change would affect negatively their areas of residence.	Neutral Effect of Tourism on Water Resources.

Study	Study Overview	Theoretical or Empirical	Scale of the Study	Country of the Study	Information used (and data source)	Method	Ex-ante or Ex-post	Main Findings	Positive or Negative Effect of Tourism on Water Resources
46. Roson and Sartori (2014)	This paper aims to present and discuss some quantitative results obtained in assessing the economic impact of variations in tourism flows, induced by climate change, for some Mediterranean countries.	Empirical	Region - Mediterranean	Mediterranean	Datasets of Chapagain and Hoekstra (2004).	Qualitative Analysis with estimates by a regional climate model are used to build a tourism climate index, which indicates the suitability of climate, in certain locations.	Ex-Ante	The main finding is that more incoming tourists will increase income and welfare, but this phenomenon will also induce a change in the productive structure, with a decline in agriculture and manufacturing, partially compensated by an expansion of service industries. In addition to this, most countries, the decline in agriculture entails a lower demand for water, counteracting the additional demand for water coming from tourists and bringing about a lower water consumption overall.	Negative Effect of Tourism on Water Resources.
47. Sofroniou and Bishop (2014)	This article is a study of water scarcity in Cyprus, examining the implications on the demand and supply side of water under the transformations caused by economic development, urbanisation and environmental changes.	Empirical	Country - Cyprus	Cyprus	Statistical Data from Water Development Department (WDD) of Cyprus and data from previous literature.	Case Study Analysis of Cyprus with qualitative approach to analyse the water scarcity issue and future possibilities of adaptation to changing climate conditions.	Ex-Post	The main finding is that there is a need to design and implement a new water policy in Cyprus in order to meet the challenge of water scarcity and to plan for future needs, for domestic, tourism and agriculture water supply. Cyprus is under the risk of water scarcity due to less annual rainfall and increase in water demand.	Negative Effect of Tourism on Water Resources.
48. Viola et al., (2014)	This paper analyses the state of water resources in six Mediterranean islands: Corsica, Crete, Cyprus, Mallorca, Malta and Sicily.	Empirical	Islands - Corsica, Crete, Cyprus, Mallorca, Malta and Sicily	Mediterranean	Statistical Data from MEDIWAT Project.	Comparative analysis of the water availability prevailing in each of the islands participating in the MEDIWAT Project	Ex-Post	The main finding is that there is a need to establish the necessary structure to enable and facilate inter-island cooperation in the field of water management in the Mediterranean region.	Negative Effect of Tourism on Water Resources.

Study	Study Overview	Theoretical or Empirical	Scale of the Study	Country of the Study	Information used (and data source)	Method	Ex-ante or Ex-post	Main Findings	Positive or Negative Effect of Tourism on Water Resources
49. Zotalis et al., (2014)	This paper focuses on water desalination processes and projects in Greece.	Empirical	Islands - Greek Islands	Greece	Datasets of Angelakis (2008).	Case Study Analysis of Greek Islands with qualitative approach evaluate the potential impact of desalination plants on water resources availability	Ex-Post	The main finding is that desalination of sea and brackish water for both water supply and irrigation in arid and semi-arid coastal regions of the world seems to be a very promising technology in particularly for the case of Greek Islands.	Negative Effect of Tourism on Water Resources.
50. Gössling (2015)	This paper argues that such an approach overlooks the complexity of 'local' and 'global' water use, with local water use affecting sustainable water use in the destination and global water use representing the sustainability of water embodied in goods produced elsewhere, including fuels and food.	Empirical and Theoretical	Island - Rhodes	Greece	Qualitative and Quantitative data collected from Rhodes and Literature Review.	Case Study Analysis of Rhodes and comprehensive analysis of tourism indicators for calculating tourist water consumption	Ex-Post	The results suggest that upscale all-inclusive tourism models encourage higher-order food consumption, and concomitant high levels of both energy and water use for their production. Energy consumption aspects, including fossil fuels, and also including the future use of biofuels, deserve greater attention as contributing factors to overall water use. To address this situation, 8 new indicators have been suggested.	Negative Effect of Tourism on Water Resources.

51. Gössling et al., (2015)	This article reviews direct freshwater consumption in tourism from both quantitative and qualitative viewpoints to assess the current water demand of the tourism sector and to identify current and future management challenges.	Empirical	General Context	General Context	Statistical Data from World Trade Organization (WTO) and previous literature databases.	Qualitative and Quantitative Analysis of 54 countries which comprise the world's most important tourism countries (by arrivals) and a sample of highly tourism dependent islands (high percentage of GDP), the tourism sector was found to represent greater than 10 per cent of domestic water use in 19 of them.	Ex-Ante	The main finding is that even though tourism increases global water consumption, direct tourism-related water use is considerably less than 1% of global consumption, and will not become significant even if the sector continues to grow at anticipated rates of around 4% per year (international tourist arrivals).	Neutral Effect of Tourism on Water Resources.
Study	**Study Overview**	**Theoretical or Empirical**	**Scale of the Study**	**Country of the Study**	**Information used (and data source)**	**Method**	**Ex-ante or Ex-post**	**Main Findings**	**Positive or Negative Effect of Tourism on Water Resources**
52. Hadjikakou et al., (2015)	This paper aims to develop an original framework that integrates segmentation with an environmentally extended input output (EEIO) framework based on detailed tourism expenditure data and	Empirical and Theoretical	Country - Cyprus	Cyprus	Water Consumption Data from Cyprus Water Development Department (WDD).	Case Study Analysis of Cyprus with qualitative and quantitative approaches to identify the total (direct and indirect) economic impact and water use for multiple tourism segments	Ex-Post	The main finding is that tourists will always come in an assortment of different market segments and there is no "one-size-fits-all" management approach for reducing water use (and other environmental) impacts.	Negative Effect of Tourism on Water Resources.

	tourism satellite accounts (TSAs) in order to quantify the total (direct and indirect) economic impact and water use for multiple tourism segments.								
53. Hof and Salom (2015)	This paper presents interdisciplinary research based on in-depth, comparative analysis of water consumption and land use patterns over a range of urban-tourist forms in Mallorca.	Empirical and Theoretical	Island - Mallorca	Spain	Monthly water consumption data (2005 - 2007) for tourism and the residential urban sector were collected through fieldwork	Case Study Analysis of Calvia and Mallorca with comparative approach	Ex-Post	The main finding is that per capita water consumption across the whole range of urban tourism forms exposes the impact of second home and residential tourism on urban water consumption and its vulnerability to climate.	Negative Effect of Tourism on Water Resources (Residential Tourism).
54. Michailidou et al., (2015)	This work puts forward a generic methodological scheme, based on Life Cycle Assessment (LCA) principles, in order to estimate the environmental load in areas of considerable tourism activity.	Empirical and Theoretical	Region - Chalkidiki (Central Macedonia)	Greece	LCI data from SimaPro and Eco invent database.	Case Study Analysis of Chalkidiki with qualitative approach by using LCA as a tool to detect tourism's impact on environment	Ex-Post	The main finding is that the awareness of the environmental impact of tourism by policy makers is of great importance in order to avoid severe future load on the environment. Hence, LCA can play a crucial role in decreasing the complexity in the strategic planning of tourism.	Negative Effect of Tourism on Water Resources.

Study	Study Overview	Theoretical or Empirical	Scale of the Study	Country of the Study	Information used (and data source)	Method	Ex-ante or Ex-post	Main Findings	Positive or Negative Effect of Tourism on Water Resources
55. Papadaskalopoulou et al., (2015)	The aim of this study is to assess the impacts of climate change on the water resources of Cyprus with special emphasis on water availa-bility and to evaluate the capacity of the resource itself, adaptation to climate change.	Empirical	Country - Cyprus	Cyprus	Average precipitation data of the period 1960–1990 from IPCC and Projection data on precipitation produced by PRECIS.	Case Study Analysis of Cyprus with qualitative approach to determine the residential and agricultural water scarcity in Cyprus and the impact of climate change	Ex-Ante	The main finding is that water supply in Cyprus is considered to be very highly affected by climate change, while mountain areas have low adaptive capacity to cope with these changes mainly due to the insufficiency of Government Water Works (GWW) attributed to techno-economical reasons.	Neutral Effect of Tourism on Water Resources.
56. Stathatou et al., (2015)	This paper aims to investigate the potential for wastewater reclamation and reuse in the Aegean Islands and assess its anticipated contribution to water scarcity mitigation within the framework set by the Greek legislation on wastewater reuse.	Empirical and Theoretical	Islands - Greek Islands	Greece	Climate and Water data from Hellenic Ministry of Environment, Energy and Climate Change, and the Greek Biotope and Wetland Centre and statistical data from Hellenic Statistical Authority	Case Study Analysis of Aegean Islands with qualitative approach to determine the treated wastewater reuse potential	Ex-Post	The main finding is that peak irrigation water demand in these islands occurs during summer period, when the influent load exceeds the maximum treatment capacity of the WWTPs due to the high influx of tourists. As a result, wastewater is treated insufficiently and direct irrigation with reclaimed water cannot take place during this period.	Negative Effect of Tourism on Water Resources.

57. Stefanova et al., (2015)	This paper aims to assess the long-term average seasonal and annual changes in generated runoff, groundwater recharge and actual evapotranspiration in the catchment, as well as on water inflow and nutrients input to the Mar Menor lagoon.	Empirical	Region - Murcia (Mar Menor Lagoon)	Spain	Climate Data from Sistema de Informació n Agraria de Murcia.	Quantitative Analysis with Eco-hydrological Soil and Water Integrated Model (SWIM) driven by a set of 15 regional climate scenarios from the ENSEMBLE S project for one reference and three future scenario periods, of 30 years each.	Ex-Post	The main finding is that potential socio-economic changes (agricultural and tourism activities) can further intensify or reduce the climate induced impacts on total water inflow and nutrient input to Mar Menor lagoon, as well as on groundwater recharge and actual evapotranspiration in the catchment in the near future. This is due to the fact that the Mar Menor catchment is highly human influenced through intensive irrigation and mass tourism.	Negative Effect of Tourism on Water Resources.
Study	**Study Overview**	**Theoretical or Empirical**	**Scale of the Study**	**Country of the Study**	**Information used (and data source)**	**Method**	**Ex-ante or Ex-post**	**Main Findings**	**Positive or Negative Effect of Tourism on Water Resources**
58. Grillakis et al., (2016)	The study aims to quantify the positive or negative effect of a 2 °C global warming on summertime climate comfort in the sense of exercising activities that involve light body activity.	Empirical	Region - Mediterranean	Mediterranean	Climate Index for Tourism (CIT) and three variants of the widely used Tourism Climatic Index (TCI) were analysed.	Quantitative Analysis of CIT and TCI for analysing the future impacts of climate change on tourism	Ex-Ante	The results indicate improvement in the climate comfort for the majority of European areas for the May to October period. For the June to August period, central and northern European areas are projected to improve, while marginal improvement is found for Mediterranean countries. Furthermore, in specific cases of adjacent Mediterranean areas such as the southern Iberian Peninsula, the June to August climate favourability is projected to reduce as a result of the increase to daytime temperature.	Neutral Effect of Tourism on Water Resources.

59. Koutroulis et al., (2016)	This article aims to use a generalized cross-sectorial framework to assess the impact of climatic and socioeconomic futures on the water resources of an Eastern Mediterranean Island.	Empirical	Island - Crete	Greece	Regional climate model (RCM) data from five Euro CORDEX RCMs.	Case Study Analysis of Crete with quantitative Approach	Ex-Ante	The main finding is that there are clear evidences that +2 C or +3 C scenarios will lead to water scarcity issues. For that reason, it is essential to communicate and distribute climate change information to stakeholders and decision makers for converting and gaining commitment on the field.	Negative Effect of Tourism on Water Resources.
60. Köberl et al., (2016)	This paper assesses the potential impacts of climate change on tourism in the case study regions of Sardinia (Italy) and Cap Bon (Tunisia).	Empirical	Countries - Italy and Tunisia (South Mediterranean)	Mediterranean	E-OBS dataset from the EU-FP6 project ENSEMBLES.	Case study Analysis of Sardinia and Cap Bon with quantitative approach by applying a range of climate scenario data on the empirically estimated relationship between climatic conditions and tourism demand, using two different approaches.	Ex-Ante	The main findings suggest the climatic conditions for the dominant 3S tourism type to improve in shoulder seasons (spring and autumn), but deteriorate in the summer peak season (especially in July and August) due to increased heat stress. Hence, based on the currently observed relationship between tourism demand and climatic conditions, there is the potential for climate-induced revenue gains in the shoulder seasons and the threat of climate-induced revenue losses in the summer months.	Negative Effect of Tourism on Water Resources.

Study	Study Overview	Theoretical or Empirical	Scale of the Study	Country of the Study	Information used (and data source)	Method	Ex-ante or Ex-post	Main Findings	Positive or Negative Effect of Tourism on Water Resources
61. Mentis et al., (2016)	This study focuses on developing a tool capable of designing and optimally sizing desalination and renewable energy units in South Aegean Islands.	Empirical and Theoretical	Islands - Greek Islands	Greece	Energy and desalinated water data from Aegean Energy Agency.	Case Study Analysis of Greek Islands focusing to the issue of water scarcity issue with quantitative approach	Ex-Post	The main finding is that the water scarcity problem on the Greek islands is severe. The transportation of water from the mainland burdens economically the Hellenic state and in many cases it deteriorates the quality of life on the islands and affects tourism negatively. Hence, desalination plants can be alternative solutions to the water scarcity problem.	Negative Effect of Tourism on Water Resources.
62. Morote et al., (2016)	This paper aims to investigate the links residential tourism and water consumption through swimming pools, which constitute one key element of the new urban landscapes in the coast of Alicante.	Empirical	City - Alicante	Spain	Water Supply and Consumption Data from Hidraqua, Gestion Integral de Agua de Levante S.A. and Aguas de Alicante, E.M..	Case Study Analysis of Alicante with qualitative and quantitative approaches to investigate the complex relationship of tourism development and water demand.	Ex-Post	The main finding is that community swimming pools consume less water resources than single houses which have their own swimming pools in Alicante. Hence, residential tourism has a negative effect on water consumption in the case of Alicante.	Negative Effect of Tourism on Water Resources (Residential Tourism).
63. Tortella et al., (2016)	This paper aims to evaluate the impact of water price structures on hotel water consumption on the island of Mallorca (Spain).	Empirical	Island - Mallorca	Spain	Water Tariff Data from Official Bulletin of the Autonomous Government (BOIB) and Tourism Statistical Data from Tourism Council in Mallorca.	Case Study Analysis of Mallorca with quantitative approach by using an econometric regression model	Ex-Post	The main finding is that high water pricing did not mean less water withdrawal for the hotels in Mallorca.	Negative Effect of Tourism on Water Resources.

Study	Study Overview	Theoretical or Empirical	Scale of the Study	Country of the Study	Information used (and data source)	Method	Ex-ante or Ex-post	Main Findings	Positive or Negative Effect of Tourism on Water Resources
64. Vogiatzakis et al., (2016)	This paper aims to assess Mediterranean island biodiversity and climate change from the last 10,000 years and the future.	Empirical	Region - Mediterranean	Mediterranean	Data sets related to marine sediment record, pollen/paleobotanical record and dendrochronology from previous literature.	Qualitative and Quantitative Analysis of climate change in the Mediterranean Region by using different records such as the marine sediment record, the pollen/paleobotanical record, dendrochronology record, etc.	Ex-Post	The main finding is that the reconstruction of past communities/ecosystems has become a valid methodological step in attempting to infer change and project species responses to present and future climatic conditions. However, it is recognised that the scale and intensity of human impacts (Impact of tourism is identified) is immensely challenging.	Negative Effect of Tourism on Water Resources.
65. Enriquez et al., (2017)	This paper explores the traditional legacy of rainwater cisterns that previous generations operated to create a resilient community-based model of water management. It explains how development of the tourism sector threatens water security, and how cistern preservation	Empirical	Island - Santorini	Greece	Statistical Data from Water and Sewage Authority of Thera (DEYATH).	Case Study Analysis of Santorini Island with qualitative approach to examine tourism industry's impact on water resources and usage of alternative methods to collect water such as rainwater harvesting.	Ex-Post	The main finding is that reinstating the use of cisterns at the household and community levels could appeal to the business and political actors invested in the tourism economy who might more easily endorse supplemental water storage solutions than adopt restrictive conservation mandates.	Negative Effect of Tourism on Water Resources.

	might foster a more sustainable model of heritage tourism.								
66. Grofelnik (2017)	The paper aims to examine a case study of the specific environmental impact caused by exploitation of Lake Vrana to satisfy the needs of the population and economies of Cres and Lošinj.	Empirical	Islands - Cres and Lošinj (Northern Adriatic	Croatia	Water Demand and Supply Data from Vodoopskrba i odvodnja Cres Lošinj (VOCL).	Qualitative and Quantitative Analysis of the sustainability of the water supply system and structures of water consumption in Cres and Lošinj Islands of Croatia	Ex-Post	The main finding is that further development of tourism, considering the potential of sustainable development of the water supply system on Cres and Lošinj as well as the protection of Lake Vrana on Cres, requires a necessary strategic redistribution of the tourist season to include the spring (April, May, June) and late summer/autumn (September, October) months, when the capabilities of the islands' water supply systems still have enough of their own potential.	Negative Effect of Tourism on Water Resources.
Study	**Study Overview**	**Theoretical or Empirical**	**Scale of the Study**	**Country of the Study**	**Information used (and data source)**	**Method**	**Ex-ante or Ex-post**	**Main Findings**	**Positive or Negative Effect of Tourism on Water Resources**
67. Kanakoudis et al., (2017)	This paper assesses both present and future vulnerability of water resources with special focus on Corfu Island, Greece	Empirical	Island - Corfu	Greece	Historical climate data 1961 to 1990 from World Meteorological Organization and climate data from DRINKADRIA project.	Case Study Analysis of Corfu with quantitative approach by using different climate models	Ex-Ante	The main finding is that climate change is expected to impact negatively on water resources availability while at the same time, water demand is expected to increase.	Neutral Effect of Tourism on Water Resources.

68. Michopoulos et al., (2017)	This paper focuses on the energy and environmental performance of hot-water production systems utilized by high class hotels in Cyprus in order to formulate appropriate carbon emis-sion mitigation strategies.	Empirical	Country - Cyprus	Cyprus	Statistical Data from National Statistical Service of Cyprus and the Cyprus Tourism Organizati on.	Case Study Analysis of Cyprus with qualitative and quantitative approach to evaluate the hot-water production of hotels in Cyprus	Ex-Post	The main finding is that improving the sustainability of the tourism sector in Cyprus requires to phase out the usage of boiler systems that are currently in use in almost all four star and five star hotels and promote the use of solar thermal systems in combination with air-source heat pumps.	Negative Effect of Tourism on Water Resources.
69. Panagiotis (2017)	The aim of this paper is to bring forward the proposed solutions for desalination of sea water using renewable energy sources, as Greek islands have a great wind and solar potential that is hard to find in any other place on Europe.	Empirical	Islands - Greek Islands	Greece	Statistical Data Regulatory Authority for Energy, Greece.	Case Study Analysis of desalination plants located at Greek Islands by using The Life Cycle Assessment method	Ex-Post	The main finding is that water transportation with ships did not solve permanently water scarcity in Greek Islands. On the other hand, renewable energy resources based desalination plants have better capacity to tackle water scarcity since they are more cost effective and they have less environmental impact compared fossil fuel based desalination plants.	Negative Effect of Tourism on Water Resources.

Study	Study Overview	Theoretical or Empirical	Scale of the Study	Country of the Study	Information used (and data source)	Method	Ex-ante or Ex-post	Main Findings	Positive or Negative Effect of Tourism on Water Resources
70. Du and Ng (2018)	This paper aims to examine the future impacts of climate change on economies of Greece, Spain and Turkey.	Empirical	Countries - Greece, Spain and Turkey	Spain, Greece and Turkey	G-Econ dataset.	Case Study Analyses of Greece, Spain and Turkey with quantitative approach by using quantile regression model to evaluate future impacts of climate change on sustainabilit, tourism and economy.	Ex-Ante	The main finding is that climate change's adverse impact on Greece, Spain and Turkey is larger than its impacts on other types of economies, suggesting that Greece, Spain, and Turkey should engage in strong international cooperation to mitigate the adverse impact of climate change.	Neutral Effect of Tourism on Water Resources.
71. Kourgialas et al., (2018)	This work highlights the crucial role of groundwater footprint (GF) as a tool for the sustainable management of water resources, especially in water scarce islands.	Empirical and Theoretical	Island - Crete	Greece	Groundwater Data from Institute of Geology and Mineral Exploration (IGME).	Case Study Analysis of Crete with quantitative approach by using GF methodology as policy tool for balancing water needs (agriculture & tourism) in water scarce islands	Ex-Post	The main finding is that GF methodology creates an integrated approach for assessing groundwater footprints (iGF/A index) at aquifer scale that exhibit both water scarcity and contamination.	Negative Effect of Tourism on Water Resources.

72. Navascues and Morales (2018)	This paper identifies the determinants of water consumption on the Spanish Mediterranean coastline, focusing on the variables related to urban land uses and socioeconomic and socio-demographic variables at the municipal level.	Empirical	Region - Spanish Mediterranean Coast	Mediterranean	Statistical Date from Instituto Nacional de Estadistica (INE).	Case Study Analysis of Spanish Mediterranean Coast with Qualitative Approach by using geographically weighted regression (GWR) model.	Ex-Post	The main finding is that the most influential variables include the percentage of second homes or the percentage of residential properties with swimming pools at the municipal level.	Negative Effect of Tourism on Water Resources (Residential Tourism).
Study	**Study Overview**	**Theoretical or Empirical**	**Scale of the Study**	**Country of the Study**	**Information used (and data source)**	**Method**	**Ex-ante or Ex-post**	**Main Findings**	**Positive or Negative Effect of Tourism on Water Resources**
73. Gkoumas (2019)	This paper investigates the reasons for the failure of the Mediterranean Standard for Sustainable Tourism (MESST), a European Union initiative to create sustainable certification schemes for tourism destinations and local enterprises in Southeast Europe.	Empirical	Island - Rhodes	Greece	A total of 50 interviews with tourism stakeholders.	Case Study Analysis of Rhodes with qualitative approach to examine the reasons behind failure of MESST	Ex-Post	The main finding is that there is need of local governance to adopt endogenous sustainability through which local professional, stakeholders and civic society will have a voice in decision making. As a result of this, the creation of a Destination Management Organization (DMO) for Rhodes using Public-Private-Partnerships (PPPs) model would be a step into the right direction.	Negative Effect of Tourism on Water Resources.

74. Kourtis et al., (2019)	This paper aims to evaluate five different water resources management (WRM) scenarios for meeting the increasing water demand in small remote islands of the Aegean Sea.	Empirical	Islands - South Aegean Islands	Greece	Climate and Precipitation data from Hellenic National Meteorological Service and Institute of Environmental Research and Sustainable Development of the National Observatory of Athens.	Case Study Analysis of Greek Islands with qualitative and quantitative approaches to evaluate different WRM scenarios for the islands.	Ex-Post	The main finding is that the current water supply practices (mainly water hauling via ships) is neither sustainable nor economical. At the same time, among the different alternatives, wind-powered desalination was found to be the most efficient in most of the cases.	Negative Effect of Tourism on Water Resources.
75. Prokopiou et al. (2019)	This paper aims to propose the implementation of the Prokopiou-Tselentis Model as the economic, social and tourism situation demands data to estimate the development of tourism and its impact on the Greek islands of Cyclades.	Empirical and Theoretical	Islands - Cyclades Islands	Greece	Tourism Data (Arrivals and Hotels Bed Capacity) from Association of Greek Tourism Enterprises (SETE).	Case Study Analysis of Cyclades Islands with quantitative approach by using the Prokopiou-Tselentis model is an integrated assessment system for environmental management and impact estimation of a tourism destination.	Ex-Post	The main finding is that tourism sector's target should be a combination model of typical and alternative tourist development that takes into account the local community's needs and the uniqueness of the Cycladic environment.	Negative Effect of Tourism on Water Resources.

Source: Author's own work.

2.3. EFFECTS OF TOURISM SECTOR ON WATER RESOURCES AVAILABILITY AND MANAGEMENT IN THE MEDITERRANEAN BASIN (ISLANDS)

Water demand varies in different places and it is a factor of development, societal value and human behavior (Molle and Mollinga, 2003). The main problem with water resources lies in the unequal distribution across space and time (Postel et al., 1996). As Sofoniou and Bishop (2014) mentioned, water scarcity can be defined when water resources do not fully satisfy water demand or minimum requirements by all sectors. Water scarcity can be anywhere in the world and Mediterranean Basin has already water scarcity due to difference between precipitation and potential evapotranspiration (Correia 1999; Milano et al. 2013).

As Milano et al., (2013) predicts, severe water stress due to climate change will cause 30-50% decline in freshwater resources which will lead to severe droughts and water shortages by 2050s. At the same time, there is increased risk of habitat loss due to decreased water levels in lakes and wetlands, decreased soil moisture and altered near shore marine environment due to reduced groundwater outflow. (Klein et al., 2016). Consequently, water stress gets more intense when extensive water withdrawal as a result of anthropogenic activities when it is added to the impact of climate change on natural resources availability.

Even though, there are current debates related to the causes of climate change, there is a general perception that anthropogenic activities are seen as one of the main contributors to climate change (Milano et al., 2013**)**. Hence, anthropogenic activities can determine the severity of climate change and climate change can determine the severity of water stress. In other words there is an *interrelation* between anthropogenic activities, climate change and water stress (Sofroniou and Bishop, 2014). Hence, if existing socio-economic development continues to follow existing trends, global temperature could increase by 3 C by the 2050s (IPCC, 2019). This temperature increase will determine the intensity and frequency of extreme events. At the same time, the temperature

increase will decrease the availability and exploitability of water resources, particularly in tropical and Mediterranean Basin (Giorgi 2005; IPCC 2019; Milano et al., 2013; Milly et al., 2005).

Mediterranean Basin faced changes in land-water management, a decline of dry farming as well as forests and an intensification of irrigated agriculture (Klein et al., 2016). For that reason, agriculture sector has been usually seen as the major actor in the extensive water withdrawals in the Mediterranean Basin. As Correia (1999) mentioned irregularities in space and time associated with Mediterranean climates play a major role in the water availability and uneven distribution of rainfall and runoff through the year requires the construction of costly water storages.

It should not be forgotten that Mediterranean Basin does not have problem with average volume of water per capita due to precipitation levels but does have problem with the high cost of making water available in the right place since precipitation is not evenly distributed (Correia, 1999). Hence, Mediterranean Islands are the main areas which have arid and semi-arid climates and face the risks of water stress and droughts that can end up in desertification and land abandonment (Correia, 1999). As a consequence, the region may become less economically sustainable and more environmentally unstable in long run (Perry, 2006).

The tourism development of the Mediterranean Basin goes back to 1960s (Hof and Schmitt, 2011). Since 1960s, the Mediterranean had seen a transformation from agriculture-based economy to service industry based economy in which tourism has an essential part (Buhalis, 1999). Hence, agriculture sector has been losing its importance to tourism sector in the Mediterranean region. The main reason behind this transformation lies in the economic revenues. As Hadjikakou et al., (2013) and De Stefano (2004) mentioned, 25% of global revenues from international tourism are in the Mediterranean and this make the region as the world's leading holiday destination.

In the Mediterranean Basin, international and domestic tourism have been significantly increased in the last 30 years and seasonality has started to play a significant role (Correia, 1999; Klein et al., 2016). The rising air and sea temperatures are likely to encourage longer tourist seasons in the Mediterranean (Perry, 2006). The rising temperatures will prolong the tourist seasons which will

mean more tourist arrivals and revenues. At the same time, it will mean more natural resources usage until the moment the temperature is favorable. Hence, the growth and sustainability of any tourist destination is ultimately dependent upon an adequate water supply and it is a regulating factor in the tourism life cycle model (Essex et al., 2004; Rico Amoros et al., 2009; Tortella and Tirado, 2011).

Tourism has become a leading economic sector and its promotion features the goal of achieving sustainable development (Briassoulis (2003). In other words, sustainable tourism is important to achieve the goals of sustainable economic development. Tourism is a continuously adapting industry and it responds to changing demographic and economic conditions (Perry, 2006). On the other hand, tourism responds to new demands and technologies so it has the capacity to be more sustainable. However, as Hajikakou, et al., (2013) mentioned, a holiday often comes as a hard-earned break and it can result in a more extravagant water consumption compared to normal water consumption of an individual. As a result of this, water demand of the tourists plays a crucial role in the matters of sustainability.

Water is the most important natural resource and it is vital for human life. It is also essential for all social and economic development as well as for maintaining ecosystems (Sofrinou and Bishop, 2014). Fresh water is an essential resource for tourism since each tourist directly consumes water for hygienic purposes such as showering or flushing toilets (Gössling, 2015). It is estimated that a luxury hotel consumes around 500 - 800 liters of fresh water per guest per overnight stay (Perry, 2006; Tortella and Tirado, 2011).

At the same time, there is need for water for filling the swimming pools, irrigating the gardens, irrigating golf courses, cleaning the rooms, washing bed and even table linen (Gössling, 2015). In general, hotel water consumption ranges from 900 to 99.500 m3 of water per year with a mean value of 25.154 m3 of water. For that reason, it is a complex task to calculate the exact amount of water that a tourist is consuming per overnight stay. However, there are several studies that are trying to determine the approximate amount that a tourist is consuming per overnight stay.

Garcia and Servera, (2003) is one of these studies that has calculated that tourist consumption per overnight stay, is between two and three times than the local water demand in developed countries. Meanwhile, another academic study by Gössling (2001) calculated that it is up to 15 times more than the local water demand in developing countries. It has been estimated that the world's direct water footprint of tourism amounted to 1 km3 of fresh water (Gössling, 2002). At the same time, Gössling et al., (2012) estimates that average consumption per guest and night amounts to 519, 12 liters of water.

It should be noted that, direct water use in touristic accommodation ranges between 84 and 2425 liters per tourist per day, including water use in rooms, for gardens and pools irrigation, with activities adding 10-875 liters per guest per night (Gössling et al., 2012; Gössling, 2015; Hadjikakou et al., 2013; Tortella and Tirado, 2011). As it can be seen, direct consumption per tourist per day can be up to 2425 liters depending on different indicators such as the services that are available (e.g. golf courses, exotic gardens, swimming pools, etc.). There are many indicators for calculating direct use of water. These include water use per guest night, water use per room, m3 per room and year, laundry in kg per guest night, total water volume consumed per day, volume of reused water, etc. (Gössling, 2015). Nevertheless, the amount of indirect water use is more complex to calculate than direct water use.

The amount of water that is being used for food production is another indicator for calculating the indirect water use (Gössling, 2015). It takes 400 to 2000 liters of water to produce 1 kg of wheat and 1000 to 2000 liters of water to produce 1 kg of meat (Mekonnen and Hoekstra, 2010). As it can be seen, wheat and meat are vital for human life and they require certain amount of water only to be produced. As Gössling et al., (2012) stated, it requires 2000 to 5000 liters of water per person per day to support human diet.

This means that huge amount of water has to be indirectly used for food production for the continuation of human life on earth. For that reason, Gössling (2015) and Hadjikakou et al., (2013) mentioned that food consumption by tourists have the most significant impact on overall water footprint and it accounts to 87% of total water consumption. Due to these factors, "All Inclusive"

formulas of the touristic resorts can create negative impact on the water consumption of the hotels since “All Inclusive” formulas requires higher consumption in meals and kitchens (Tortella and Tirado, 2011). It should be also remembered that food which is served at the hotels, requires much more additional water for kitchen activities such as washing vegetables and fruits, cooking, etc.

For that reason, another important aspect that has to be discussed here is related to the star ratings of the hotels and there are several studies among the reviewed literature that are focusing on the differences of water consumption among the hotels with different ratings. As it is known, each hotel has different star rating according to the services that they provide. Generally, Tortella and Tirado, (2011) estimates that hotels and holiday houses consume far more than 394 liters per overnight stay meanwhile campsites consume 174 liters per overnight stay. However, there are different consumption levels per overnight stay among the hotels due to the services that are being provided and luxury hotels do have more water consumption in the Mediterranean since they have services such as golf, spa, swimming pools, etc. (Tortella and Tirado, 2011).

This kind of water-intensive tourism is often seen as “water theft” by local people and can lead to conflicts if water scarcity gets intense with changing climate conditions (Klein et al., 2016). Hence, the tourist water demand can have higher environmental impact than local residents and it can create serious problems of overexploitation or depletion in places where water resources are limited such as island destinations (Essex et al., 2004; Garcia and Servera, 2003; Gikas and Tchobanoglous, 2009b; Gössling, 2001; Hajikakou, et al., 2013; Kent et al., 2002; Rico Amoros et al., 2009; Tortella and Tirado, 2011). Tourism can have serious negative impact on the environment in particularly to the water resources since the tourist demand can generate certain problems of sustainability. As Tortella and Tirado, (2011) mentioned, traditional water policies mainly focus on increasing water supplies in order to meet increasing water demands with big social, economic and environmental costs.

Hence, overexploitation and its consequences’ such as groundwater salinization, land subsidence and pollution can lead to critical environmental degradation (Esteller and Delgado, 2002; Tortella and Tirado, 2011). As a consequence, environmental degradation can put tourism life cycle under

the risk of total collapse in the long run. Benidorm can still be remembered as an example where tourism life cycle faced almost a total collapse due to environmental degradation (March et al., 2014). German tourists, whom were Benidorm's main visitors, stopped visiting Benidorm after 1970s water crisis (March et al., 2014).

As a result of these factors, we have decided to analyze all of the 75 articles' results to determine whether tourism has a positive or a negative effect on water resources availability and management. It has to be noted that, (62) out of 75 which is equal to 83% of the reviewed articles, have results which indicate the negative effect of tourism on water resources availability / management in the Mediterranean Basin. On the other hand, (13) out of 75 which is equal to 17% of the reviewed articles, have neutral effect of tourism on water resources in the Mediterranean Basin. The most interesting finding is that, there are no articles which have positive effect of tourism on water resources. One can notice from Table 5 that majority of the articles which have neutral effect of tourism on water resources are focusing on the effects of climate change on water resources and tourism and majority of these articles are climate projections. For that reason, these articles are not essentially focusing on the effect of tourism on water resources and these articles aim to assess the future effects of climate change on water resources availability, tourism development, sustainability, economy and so on. As a result of this, we believe that it is a necessity to look into the distribution of Ex-Ante and Ex-Post studies among the reviewed articles.

There are (56) Ex-Post papers out of 75 which indicate that 75% of the reviewed papers are Ex-Post studies. On the other hand, there are (19) Ex-Ante papers out of 75 which are equal to 25% of the reviewed papers for this work. There are some certain differences between the Ex-Ante and Ex-Post articles and one of these major differences is that Ex-Post articles tend to have a much more critical approach since they are not written according to future projections. Nevertheless, Ex-Post articles are written according to the results of the existing data (not according to future projections or forecasts) and because of this they may have more results with negative effect of tourism on water resources availability / management compared to Ex-Ante articles. We would like to look more deeply into these differences.

We have discovered (7) out of (19) which is equal to 64 % of Ex-Ante articles that has negative effects of tourism on water resources management / availability in the Mediterranean Basin. However, there are (12) Ex-Ante articles out of (19) that have neutral effect of tourism on water resources management / availability which is almost equal to 64% of the reviewed Ex-Ante studies. However, we have discovered much more negative results among the reviewed Ex-Post studies. There are (55) out of (56) Ex-Post studies which have negative effect of tourism on water resources management / availability that is equal to 98%. On the other hand, there is only (1) article out (56) Ex-Post reviewed papers which have neutral effect of tourism on water resources management that is equal to 2%. As a consequence, we can see that Ex-Post studies have certainly negative results compared to Ex-Ante studies and this indicates that tourism have negative effect on water resources availability and management in the Mediterranean Basin since majority of these Ex-Post studies were published after existing data analyses.

At this moment, we would like to look more into the case studies and as we can see from Table 5 that there are many different case studies from the Mediterranean Basin which are directly or indirectly focusing on the effect of tourism sector on water resources management / availability. For that reason, we have decided to discuss some of the findings among the case studies of the reviewed articles that are overlapping with our research.

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THE WATER SCARCITY AND SUSTAINABLE TOURISM IN THE GREEK ISLANDS: FOCUS CYCLADES ISLANDS
Itri Atay

2.4. MEDITERRANEAN BASIN (ISLANDS) CASE STUDY EXAMPLES FROM REVIEWED LITERATURE

2.4.1. GREEK ISLANDS

We can see from the selected peer-reviewed articles that there case study analyses of Greek Islands which are Milos Island, Kimolos Island, Rhodes Island, and Crete Island. We would like to look into these case study examples briefly in this sub-chapter.

a) Milos Island

Milos Island is one of the biggest islands among the Cyclades Islands with 5000 inhabitants and significant mass tourism during the summers (Kaldellis and Kondilli, 2007; Karagiannis and Soldatos, 2007). The island solves water issues during the peak season (June to September) through water transportation. There is an ongoing issue with potable water which has been crucial for the island. The drinking needs of the local people and the tourists that are visiting the island are satisfied by only imported bottled water due to the undrinkable water (Kaldellis and Kondilli, 2007; Karagiannis and Soldatos, 2007).

Milos Island has no drinkable water resources and there is only water for domestic needs. Nevertheless, water transportation tanks arrive more frequently to the island especially during the summers due to seasonality of mass tourism in the last years (Kaldellis and Kondilli, 2007; Karagiannis and Soldatos, 2007). This whole situation creates a burden on the local authorities since water transportation costs are around 8 €/m3. Local authorities have taken the decision to install a desalination plant with a water capacity of 1000-2000 m3/d (Kaldellis and Kondilli, 2007; Karagiannis and Soldatos, 2007). However, this will not be long term solution to rapidly increasing mass tourism water needs and the changing climate conditions in which the island receives less rainfall and losses more water due to evaporation.

b) Kimolos Island

Kimolos Island is another island that is part of the Cyclades Islands. It is a medium size island with a population of only 800 people (Kaldellis and Kondilli, 2007). However, the island receives many tourists during the summer which creates much more water demand. For that reason, Kimolos Island depends on the water resources of the Milos Island since the island has very limited water resources (Kaldellis and Kondilli, 2007). As a consequence, Milos Island's authorities' decision to build a desalination plant is a critical decision for Kimolos Island as well. Dodecanase Islands complex have limited water resources and high tourism water demand as it is in the case of Cyclades Islands (Kaldellis and Kondilli, 2007). Dodecanase Islands include most developed Greek Islands such as Rhodes and Kos Islands. As it can be seen above, small and medium sized islands were taken as examples from the Greek archipelago but it is a necessity to look at the situation in bigger islands as well.

c) Rhodes Island

Rhodes Island is one of the biggest Greek Islands and it has certain importance for tourism in Greece and Rhodes received 1.42 million tourist arrivals in 2010 and this was equal to almost 10% of all tourist arrivals in Greece (Gössling, 2015). Tourists arrivals do occur usually during the peak season which is July to August when temperature is highest and rainfall is lowest (Gössling, 2015; Hellenic National Meteorological Service, 2022). Tourism has become a major stimulant of Rhodes' economy and tourist arrivals continue to increase as in other Greek Islands. Nevertheless, tourism in Rhodes is quite intense as it is in the case of Mykonos and Santorini. As Gössling, (2015) highlighted, 12.9 million guest nights are being spent annually in Rhodes. These statistics can give hints about the amount of water resources which are being used in Rhodes by tourism sector.

In order to analyze the situation more deeply, Gössling (2015) made a case study analysis based on three different hotels (with different star ratings) that are located in Rhodes. It was discovered that 100 m3 of water per day is used by one of the five star hotels only for garden irrigation purposes (Gössling, 2015). The same hotel has 338 liters of water per guest night while the other five star

hotel has 675 liters of water per guest night and the third hotel which has four star rating has 234 liters of water per guest night without kitchen consumption (Gössling, 2015). Hence, as it was discussed above, high star rated hotels do usually have more water consumption due to their high standard services. It is visible that, there is a gap between the four star and five star hotels in terms of water consumption based on this case study analysis in Rhodes.

In addition to direct water use, five star rated hotels have higher indirect water usage in Rhodes. As Gössling (2015) calculated, 4557 liters of water for foodstuff and 940 liters of water for beverages is needed (which is in total 5497 liters per guest night) in the five star hotels in Rhodes. These calculations reveal that "All Inclusive" formula leads to more water consumption as it was discussed above. On the other hand, five star hotels have higher energy consumption as well as higher energy water footprint in Rhodes. Hotel energy water footprint is 14 liters per guest night in the four star hotel while for the five star hotels, it is from 20 to 34 liters per guest night (Gössling, 2015). Consequently, Gössling's, (2015) case study analysis shows that there is extensive amount of direct and indirect water consumption by the tourism sector in Rhodes. In the long term, this extensive amount of water consumption in Rhodes will lead to environmental pressures with changing climate conditions as it was experienced in other touristic destinations.

d) Crete Island

Crete Island is one of the main touristic islands in the Mediterranean region and it has a growing economy due to tourism since the 1970's as it is in the case of Mykonos and Santorini islands (Briassoulis, 2003; Tsagarakis, et al., 2004). Since 2000s, Crete experiences often water imbalance because of temporal and spatial variations in precipitation, increases in evapotranspiration, changes in surface runoff and increases in water demand during summer months (Gikas and Angelakis, 2009; Tsagarakis, et al., 2004).

Crete has also faced similar issues with unsustainable tourism as it is in the case of many other Greek islands. The abuse, violation and lack of enforcement and implementation of land-use planning and environmental legislation opened many areas illegally to tourism in 1980s

(Briassoulis, 2003). On the other hand, as Tsagarakis, et al., (2004) mentioned, there is existent demand for irrigation water from agriculture sector and there are major water loses occurring due to leakages and evaporation. Hence, the issues with water imbalance in Crete are far more complex than small and medium sized islands in the Aegean archipelago due to existence of many different factors such as climate change, issues with water and land governance as well as seasonal water demand from both of the sectors (agriculture and tourism).

Reclaimed water has been used as an alternative water resource by the local authorities in Crete as it is in the case other Greek Islands. The wastewater treatment plants produce reclaimed water and reclaimed water is being used for irrigation purposes instead of fresh drinking water (Gikas and Tchobanoglous, 2009). As Gikas and Tchobanoglous (2009) calculated, the cost of treated water for small and medium size wastewater treatment plants (100-5000 m3/d) is from 0, 15 € to 0, 35 € per m3 which is much more cheaper than water transportation or desalinated water costs in Greece. For that reason, the coverage of municipal wastewater treatment in Crete has increased dramatically[5] and there are 46 operating municipal waste treatment plants in Crete (Gikas and Tchobanoglous, 2009; Tsagarakis, et al., 2004). Nevertheless, reclaimed water can only be used for irrigation purposes both in agriculture and tourism but not for drinking purposes or shower purpose in the hotels or holiday resorts.[6]

[5] The number of the wastewater treatment plants have increased dramatically in the mainland Greece as well. For further information **Gikas and Tchabonoglous (2009).**
[6] Irrigation of golf courses and gardens in the case of tourism.

2.4.2. BALEARIC ISLANDS

Greek Islands are not the only touristic island destinations that are facing the negative effect of tourism and changing climate conditions on water resources management / availability in the Mediterranean Basin. Spain is one of the countries that her economy is based on tourism sector and Balearic Islands have similar issues and there are many articles that are focusing directly or indirectly on these issues. Balearic Islands have become one of the top touristic destinations not only in Spain but also in the whole Mediterranean. Mallorca and Ibiza Islands are probably the most important touristic destinations among Balearic Islands since they receive impressive numbers of tourists during the peak season.

Balearic Islands ranked second position after Catalonia in the number of tourists received in Spain and Mallorca Island received 9.67 million international tourists and 2.9 million domestic tourists by itself back in 2014 (Tortella et al., 2016). Mallorca has 1617 accommodation establishments with 140.000 rooms and 288.578 beds capacity and as a result, Mallorca leads occupancy rates among the other Balearic Islands (Tortella and Tirado, 2011; Tortella et al., 2016). Mallorca has high numbers of hotels that belong to chain groups in particularly domestic chain groups such as *Sol Melia, Barcelo, Riu Iberostar* and *Fiesta* (Tortella and Tirado, 2011). As a consequence, there are lots of high star rated hotels located in Mallorca. These luxury chain hotels provide more high quality services (e.g. golf courses, swimming pools, exotic gardens, spa, etc.) than ordinary hotels as it is in other touristic destinations in the world. Hence, as it was mentioned above the more services lead to more water consumption per guest per overnight.

Mallorca tourism model is mainly based on the “mass tourism” market segment which is based on the traditional sun and sand combination (Tortella, et al., 2016). Hence, tourists visit Mallorca usually during the summer months. As a consequence, tourist arrivals are around 67% of total arrivals from June to September (Tortella, et al., 2016). Balearic Islands and in particularly Mallorca Island have similar issues with “mass tourism” and water availability. Mallorca has a calcareous lithology that allows water infiltration and formation of a network of temporary streams (Tortella, et al., 2016). As a result of this, the island is lack of a sustainable surface water supply.

Hence, groundwater from aquifers is the main natural water resource available and groundwater is equal to 75% of the total water supply of the island (Tortella et al., 2016).

As Tortella, et al., (2016) mentioned, groundwater availability depends on very irregular precipitation and during drought periods water reserves can decrease to 30% to 50% of their average volume in Mallorca. It has to be noted that, there is excessive amount of water consumption during summer months when there is no precipitation at all. As an consequence, tourist water consumption was 20% of one year's total consumption of the local population back in 1999 and these values have risen almost two times in the last 10 years in Mallorca (Hof and Schmitt, 2011; Tortella and Tirado, 2011). Furthermore, according to Coccossis and Mexa (2004), an average tourist visiting Mallorca required almost 180 liters of water per day back in 2004 which is gradually much higher today.

The existence of services such as golf courses as well as swimming pools in these high star ranked chain hotels generate an increase of 87% in total hotel water consumption (Tortella and Tirado, 2011). It has to be noted that there is such an increase because there is certain amount of evapotranspiration of water in the swimming pools as well as in golf courses in particularly during the warm summer months. On the other hand, as Essex, et al., (2004) and Hof and Schmitt (2011) mentioned, there is seasonality of rainfall and Mallorca receives much less rainwater during the high season of tourism (From June to September). As a matter of fact, groundwater was extensively used in the mid-80s and this led to chronic shortages of water, overexploitation and salinization of groundwater resources in long run which resulted in the "stagnation" period of tourism in the Balearic Islands (Essex, et al., 2004; Garcia and Servera, 2003; Tortella et al., 2016).

This whole situation was a result of poor quality planning and unchecked mass tourism. As Essex, et al., (2004) highlighted, the rapid growth of cheap package holidays in the late 1970s resulted in poor quality infrastructure, architecture and planning. As a consequence, Mallorca began to acquire a down market image as it is happening in the case of some Greek Islands today. Mallorca became overcrowded, over-commercialized and faced poor standards as well as anti-social behavior by visitors as it happened in Crete (Briassoulis, 2003; Essex, et al., 2004). The situation led the island

to lose its attractiveness and the visitor volume growth dropped from 8.3% to 2% (Hof and Schmitt, 2011). Consequently, local authorities took significant decisions to make a shift from mass tourism to quality tourism.

The diversification of promotion and provision of high-quality services came into agenda of local authorities (Hof and Schmitt, 2011). As a result, the Balearic Islands faced an extension of the tourist base by the proliferation of second homes, golf courses and yacht tourism to so called "quality tourism" in the mid-1990s which led to low-density residential tourist land uses associated with second homes and more dwellers around the mass tourist urban center (Hof and Schmitt, 2011). This shift from mass tourism to quality tourism changed the image of Mallorca but also changed the demand for water resources. According to Hof and Schmitt (2011), quality tourism produces higher water consumption levels per capita than mass tourism since it includes high housing standards. These high housing standards include water consumption for outdoor uses such as for gardens and swimming pools. Hence, urban water consumption on Mallorca increased by 30% from 1998 to 2007 since the land use changed dramatically (Hof and Schmitt, 2011).

As it was mentioned above, the shift from mass tourism to quality tourism changed the water demand in Mallorca. Several studies such as Rico-Amoros et al., (2009) indicate that the highest water consumption figures are usually found in tourist areas with single houses that has gardens and swimming pools. It has to be noted that, similar results were discovered in the case of Benidorm where there are high number of second houses belong to British tourists (Rico-Amoros et al.,2009). For that reason, Mallorca is still under the risk of facing similar situations even though there has been a shift in tourism type and there have been decisions related to water resources management as it was summarized above.

As Hof and Schmitt (2011) and Rico-Amoros et al., (2009) mentioned there is an interrelation between tourist land use pattern and water demand. It has to be noted that, anthropogenic activities can influence the water cycle directly by water withdrawal and indirectly by land cover change and water management (Klein et al., 2015). This indicates that, more second houses with gardens and swimming pools, more increase in water consumption as a result of land use pattern. It is important

to highlight that evaporation leads to a loss about 70 m^3 of water per year in an average pool (6, 2 m by 6,2 m and 1,5 m deep) (Hof and Schmitt, 2011). Nevertheless, it should not be forgotten that the swimming pools of the second houses are highly related to evapotranspiration losses which leads to more water demand and it should be also taken into account that the lavish and green gardens with turf grass and other water-demanding plants leads to more irrigation water demand since they are not adopted to the Mediterranean climate (Hof and Schmitt, 2011). It should be underlined that, Hof and Schmitt (2011) calculated that a swimming pool in Mallorca creates a daily loss of 5 liters of water (m^2/day) and an annual loss of 1.83 m^3/m^2/a.

2.4.3. CYPRUS

Cyprus is another example that is facing negative environmental outcomes due to over tourism (Hadjikakou et al., 2013). In Cyprus, a tourist consumes on average, one third more water than a local resident per overnight stay (EEA, 2010). Consequently, there is significant water footprint of tourists in Cyprus as it is in Greek and Balearic Islands. There are several studies that are focusing on the complex relationship of tourism and water resources management in the Eastern Mediterranean. One of these studies is Hajikakou et al., (2013) which calculates the water footprints of high quality tourism activities in Cyprus. According to this study, there is a great difference between luxury hotels and ordinary hotels in terms of water footprint.

Luxury hotels that have higher star ratings, have more water-intensive activities which lead to more water footprint of tourism in Cyprus (Hajikakou et al., 2013). Hence, a luxury hotel in Paphas, Cyprus with a golf course consumes around 8940 liters of water per day but if the imported food is excluded from this calculation then the impact on local water resources is relatively low, which is 3510 liters of water per day (Hajikakou et al., 2013). These results show that “All Inclusive” formula in the luxury hotel creates more indirect water use even though food is imported from other countries. In particularly, meat products require much more water and since “All Inclusive” formula has many meat products, the amount of indirect water use is relatively higher (Hajikakou et al., 2013). For that reason, it is more beneficial for countries with water scarcity (e.g. Cyprus), to import highly water-insensitive agricultural products from other countries. At the same time,

destinations like Cyprus can maximize their economic returns by food imports since it requires much more investments to produce certain food products in arid regions (Hajikakou et al., 2013).

In the last decade, there has been a rapid increase in the number of golf courses in Cyprus (Sofroniou and Bishop, 2014; Zachariades, 2010). In parallel to the increasing number of golf courses, the demand for water is increasing simultaneously since a golf course requires 10.000 to 15.000 m3 of water per hectare per year in Cyprus (Sofroniou and Bishop, 2014; Zachariades, 2010). As Klein et al., (2016) highlighted, golf courses in the Mediterranean region could be negatively affected by significant climate change already within the lifetime of investment projects. As a consequence, these water-insensitive tourism facilities can face certain environmental pressures as in the examples of Mallorca and Crete.

Nonetheless, the water footprint is much lower in ordinary accommodation facilities. According to Hajikakou, et al., (2013), a camping holiday in Polis, Cyprus has only 1000 liters of water consumption per day which is related to less food consumption and lack of water-intensive facilities such as golf courses and swimming pools. As it is mentioned above, water-insensitive activities and food consumption have the lion share of water footprint. Hence, Cyprus Tourism Organization changed its tourism regulations and started to inform the guests regarding their water footprint through information cards and discreet signs (Sofroniou and Bishop, 2014). In other words, Cypriot authorities started to focus on demand based policies to decrease the water footprint of the tourism sector. Supply based policies still exist in Cyprus but it is an important moment that demand based policies started to exist in order to lower the water consumption in the island.

2.4.4. SUMMARY

We have reviewed 75 articles that are directly or indirectly focusing on the complex relationship between tourism sector and water resources management. In the past, most of the academic works focused on carbon than water and water was usually neglected for sustainability analyses. Nevertheless, water is becoming an important parameter of sustainable tourism in the last decade

due to severe water shortages and droughts that are affecting daily life as Hajikakou, et al., (2013) underlined.

The reviewed literature has indicated that there is almost no positive effect of tourism on water resources availability / management in particularly for the case of arid and semi-arid locations such as island tourism destinations in the Mediterranean Basin. Even though, tourism has certain positive effect on economic development of these destinations, the impact of tourism sector on water resources should be viewed as a key local sustainability challenge that requires certain management in water scarce destinations. There are current studies such as Klein et al., (2016) which are using models for the future scenarios by converting agricultural land (e.g., olive trees) to water-intensive tourism (e.g. golf courses and swimming pools); the results reflect that much more water demand will appear due to the land transformation. Hence, Mediterranean can be particularly affected if tourism is allowed to grow unchecked and poor planned as it happened to Mallorca in the early 1990s and Crete in the 2000s (Perry, 2006).

The long and the short of it is that, we have taken a detailed look at some of the case study examples from the selected literature such as Balearic Islands, Crete, Cyprus, Cyclades Islands and Dodecanese Islands and these case study examples have proved that mass tourism and over tourism phenomenon together with tourism seasonality (summer season) have a certain negative impact on water resources availability and this can even lead to water scarcity with the changing climate conditions. Our study aims to focus on Cyclades Islands in particularly Mykonos and Santorini Islands that have similar environmental conditions and tourism activity. In the next chapter, we will try to demonstrate these similarities with the reviewed literature by focusing on the area of study of this research.

CHAPTER 3 – THEORETICAL FRAMEWORK

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3 – THEORETICAL FRAMEWORK

3.1. INTRODUCTION

Water is one of the most essential Common Pool Resources (CPRs) on which human lives rely, and it is analytical to investigate how CPRs like water resources are handled. It is also critical to investigate how *Tragedy of the Commons* can arise if CPRs are not handled effectively and if "rational individual policies or strategies" take place. In fact, because one of the goals of this study is to investigate the complicated interaction between water resource management and tourism development, this chapter will begin with CPRs management and then focus on the relationship of the commons with tourism and other activities.

This chapter will continue with *Butler's Tourism Lifecycle* model, which is vital for analyzing the evolution of a tourist destination, beginning with discovery, continuing with growth, and concluding with decline or rejuvenation. Therefore, this chapter will also evaluate the possibility of a tourist destination declining if CPRs, like water resources, are not managed effectively. The "Vicious Cycle of Renewable Energy Sources (RES)-Based Desalination Plants" section of this chapter will continue, with an emphasis on how the tourism sector's demands are met at the expense of supply-based water resource management through the overuse of RES-based desalination plants; which is another crucial objective of this study to evaluate.

As was mentioned, "rational individual policies or strategies" may even result in the total depletion of CPRs such as water resources and they can eventually lead to the decline stage of tourist destinations. Hence, the chapter will continue with *Hirschman's Exit and Voice* which will focus on the motivations behind these "individual rational policies". It should be underlined that "individual rational policies, strategies or even decisions" can be viewed as leaving the system; "exit is a logical option, and voice use declines". Finally, the chapter will conclude with "Unilateral Environmentalism and Regulatory Capture" which will also focus on the decision-making processes in water resources management and tourism management.

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3.2. COMMON POOL RESOURCES MANAGEMENT AND TRAGEDY OF COMMONS

Common Pool Resources (CPRs) are types of goods consisting of a natural or a human-made resources system that are generally large as to make it costly to prohibit prospective beneficiaries from acquiring benefits from its use (Ostrom, 1990). For that reason, CPRs can include fishing grounds, pastures, forests, the atmosphere, irrigation systems, and water resources. Nevertheless, as Ostrom (1990) underlined, it is crucial to differentiate between the resource system and the flow of resource units produced by the system since resource systems are like stock variables that are competent to produce a maximum quantity of a flow variable without harming the resource system itself.

There can be many examples of a resource system such as fishing grounds, irrigation canals, or oceans. Nevertheless, the main difference between the resource as a stock and the harvest use of units as a flow is related to replenishment rate, and the replenishment rate of the resource should not be exceeded by the withdrawal rate of the resource (Ostrom, 1990). In other words, the resource should be able to renew itself before the withdrawal and it should be sustained over time. It has to be noted that, the resource can even be depleted if it cannot replenish itself before the withdrawal and it can come to an unstainable resource due to overexploitation.

As a matter of fact, the beneficiaries of the CPRs and their actions play significant roles in the sustainability of the resource system. As Ostrom (1990) underlined, access to CPR can be limited to a single individual or to multiple individuals that benefit from the same resource system at the very same time and she defined the beneficiaries as “appropriators”. Nevertheless, there is a distinction related to the ownership of CPRs and there are two types of CPRs which are respectively “open access resources” and “common property resources” (Pearce, 1995, Berkes, 1998, and Holden, 2008). “Open access resources” have no owners such as the oceans but “common property resources” have a communal owner such as fishing ground or an irrigation canal. Consequently,

exclusion and exploitation are two important criteria that characterize CPRs (Ostrom et al., 1999 and Holden, 2008).

CPRs can be easily exploited and this can lead to even total depletion of the resource system. For that reason, Garrett Hardin (1968) emphasizes that each individual is locked into a system that compels him or her to increase his gains from the resource system without limit in a world that is limited and this is "Tragedy of Commons". As a matter of fact, Hardin (1968) mentions that freedom in a commons can bring ruin to all and he gives the example of the rational man who finds out that his share of the cost of the wastes he discharges into the commons (e.g. a lake or a river) is less than the cost of cleansing his wastes before letting them go.

Consequently, there have to be coercive laws or institutions to prevent the actions of the "rational man". According to Hardin (1968), the actions of the rational man can only be stopped by coercive laws or taxing devices that can create regulations but he adds that prohibition is easy to legislate but temperance is not that easy to legislate and there has to be the mediation of administrative law. In other words, CPRs can only be managed effectively through mutual coercive laws and taxes that are accepted by the whole community.

For that reason, Hardin (1968) gives the example of "robbing a bank" and he underlines that this action is not seen as acceptable by the whole community and there have to be similar perceptions and moral judgments regarding the management and exploitation of CPRs. According to Hardin (1968), every new enclosure of commons by a "rational man" or a "rational group" means violation of somebody's personal liberties. This indicates that unregulated CPRs management can deplete not only the resource system but also the rights of individuals who cannot access the resource system after it is exploited. As a result of this, Holden (2008) underscores that the benefits of nature and CPRs are not limited to purely economic.

The nature and CPRs have a variety of different values and these values can differ from each other. According to Rolston (1988), there are a range of other values in nature such as life-support value, life value, scientific value, aesthetic value, historical value, etc. These values create the necessity

for stable CPR management because each value has significant importance for the continuation of life on earth. For that reason, Elinor Ostrom (1990) identified eight design principles that are prerequisites for a stable CPR arrangement:

1. Clearly defined boundaries

2. Effective monitoring by monitors who are part of or accountable by the appropriators

3. Minimal recognition of rights to organize

4. Graduated sanctions for appropriators who do not respect community rules

5. Congruence between apparition and provision rules and local conditions

6. Collective-choice arrangements allowing for the participation of most of the appropriators in the decision-making process

7. Conflict-resolution mechanisms which are cheap and easy of access

8. Organization in the form of multiple layers of nest enterprises, with small, local CPRs at their bases

Clearly defined boundaries are a must for governing effectively because each actor has to know that their appropriations are limited and they cannot exceed their rights. In other words, each appropriator has to respect other appropriators' rights and they should not lead to the depletion of the CPRs by overexploitation (Ostrom, 1990). On the other hand, effective monitoring is another must for governing CPRs because it is a sign of credible commitment. According to Ostrom (1990), there can be no credible commitment without monitoring and without credible commitment, there is no reason to propose new rules to govern CPRs.

For that reason, each actor involves in the CPR management has to agree to set up independent monitoring mechanisms which will monitor their commitments to CPR management. The independence monitoring mechanisms are essential and they should not be on the side of any actors (even central or local governments) that benefit from the CPRs. At the same time, there have to be

sanction mechanisms for appropriators who do not respect community rules and often lead to overexploitation of CPRs.

As Ostrom (1990) highlighted, the sanctions can differ depending on the seriousness and context of the offense. As an example, a farmer who stole water by digging illegal boreholes cannot be sanctioned at the same level as a farmer who released toxic materials to the irrigation system. As a consequence, the context and the seriousness of the offense are important for determining the levels of sanctions.

Furthermore, there have to be conflict resolution mechanisms that can resolve conflicts among appropriators and officials (Ostrom, 1990). The rapid access and low cost of these conflict resolution mechanisms are vital because high costs and uneasy access to the conflict resolution mechanisms can lead to less commitment and it can lead to Hardin's "rational man" scenario. Hence, the institutions and their mechanisms are important for governing CPRs, and Ostrom (1990) underlines that an important step is to assume that all repeating situations are shaped by a set of institutional rules which forbid, allow, or require some action or outcome.

The lack of these institutional rules can lead to Hardin's "Tragedy of Commons" because this is an indication that actions or outcomes are not defined as correct or incorrect. In other words, a farmer can believe that digging an illegal borehole and stealing water from the community is not an incorrect action if there are no institutional rules that forbid him. At the same time, there has to be a mutual commitment of the appropriators and officials to these institutional rules to protect the community's rights and define the correct and incorrect actions.

According to Ostrom (1990), there is no commitment to these institutional rules in a corrupt regime in which bribes may be enough to get officials to authorize a rule change or even removal of these rules. As an example, an influential person (or a firm) can easily bribe officials in a corrupt regime to release chemicals from his/her factory to the local river and this will harm the whole community. Nevertheless, a regime that respects the institutional rules and the rights of the community can regulate CPRs effectively compared to a corrupt regime. It is a known fact that in every community

there can be opportunists who will ignore norms and act selfish (Ostrom, 1990). Consequently, national governments (both at central and local levels) have significant importance for the order of these rules and to prevent the opportunists to exploit the CPRs.

Tourism is one of the fastest-growing economic sectors in the world and many countries' economies depend on tourism revenues. Tourism requires a sustainable environment and CPRs are vital for the continuation of the tourism activities in touristic destinations. However, tourism can create pressures on CPRs if tourism activities are not sustainably managed (Holden, 2008). According to Holden (2008), there are a variety of stakeholders involved in the tourism sector and each stakeholder can seek to maximize their gains. For that reason, there can be a variety of pressures on the environment and ecosystems which are coming from different actors involved in the management of tourism in a particular destination. As Holden (2008) underlined, there can be deforestation of mountainsides, the draining of coastal wetlands, the over-extraction of water resources, and even pollution (water, noise, air, and aesthetic pollution because of tourism products or activities).

Tourism management and CPR management should be coordinated in order to achieve sustainable CPR and tourism management. At the same time, environmental ethics and conservation ethics are essential for achieving sustainability goals because they are the collective action (with establishing the laws or agreements) of humans towards nature (Holden, 2008). Hence, it should not be forgotten that tourism can lead to the deterioration of CPRs and ecosystems unless there is collective action with rules and laws as it is in the case of other economic sectors. According to Briassoulis (2002), unsustainable tourism without any regulations can cause worsen environmental conditions, less economic wellbeing, more social injustice, and less tourist satisfaction. Unsustainable tourism can be severe through over usage of CPRs and lack of incentive of tourism stakeholders to invest in improving the conditions of CPRs (Healy, 1994).

Moreover, tourist commons are complex CPRs because they are being used by diverse groups for different purposes are they are heterogeneous since they are composed of natural and built material (both tangible and intangible) elements (Briassoulis, 2002). On the other hand, it is difficult to task

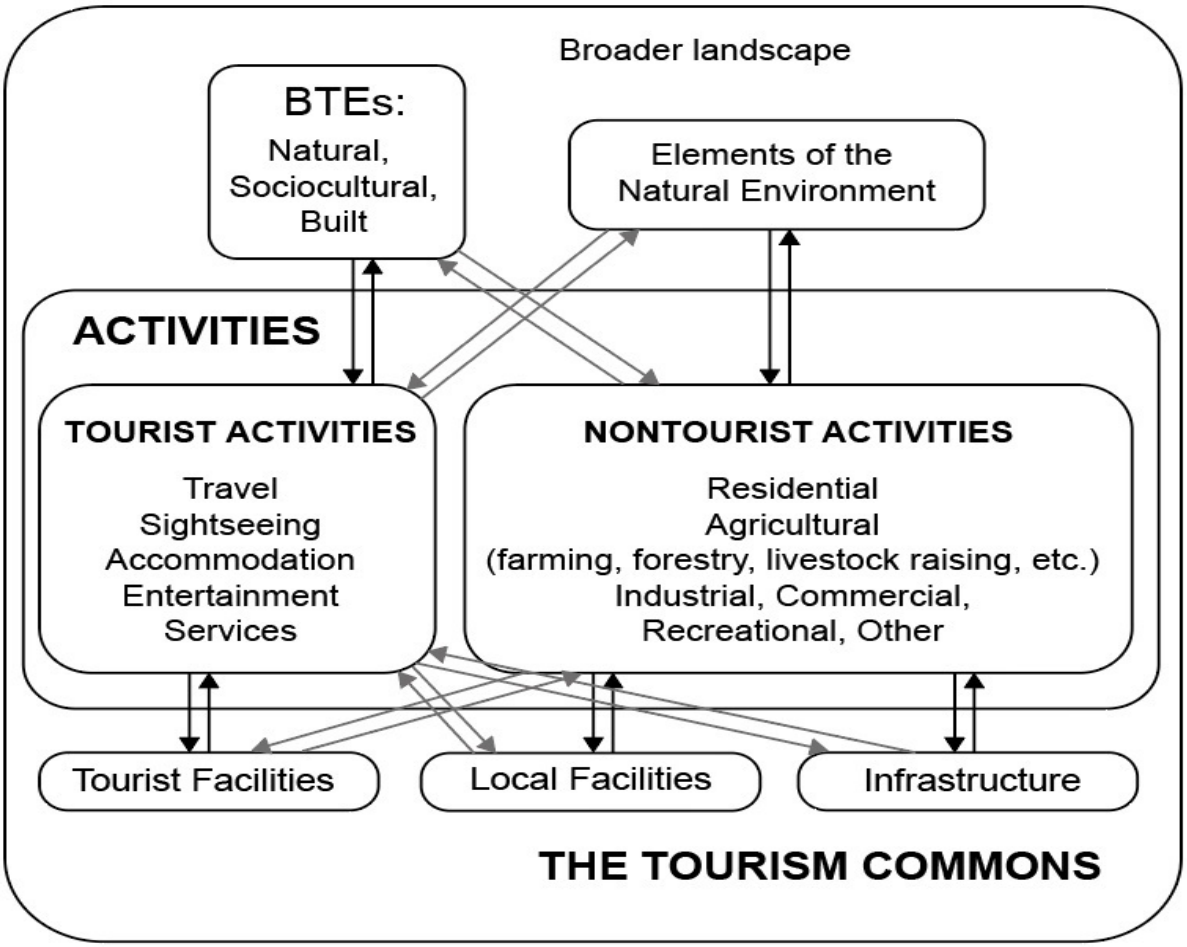
to determine how much tourists are benefiting from these commons compared to local communities in a tourist destination. As Briassoulis (2002) underlined, CPRs have characteristics of non-excludability and subtractability and it is not possible to exclude tourists from benefiting from the CPRs that locals and others benefit from. For that reason, the property regimes are important features (state, private, communal, or open access) of the commons before and after tourism development (Healy, 1994; Briassoulis, 2002).

Tourism commons can be at risk of depletion if there are no community rules that protect CPRs and there can be environmental, social, and economic externalities. Non-tourist activities (e.g. agricultural production) can even suffer indirectly from the environmental externalities of the tourism activity in particularly in arid or semi-arid regions where water resources are limited (Briassoulis, 2002). At the same time, externalities can cause tourism products with less quality, and tourism products with less quality can cause the end of the tourism lifecycle as Butler (1980) modeled.

Seasonality of tourism is another factor that can hamper CPRs if the destination has limited resources availability because the population of the touristic destination can be even doubled or tripled with the arrival of tourists in the peak season (Healy, 1994). As Briassoulis (2002) highlighted, more users can lead to exhaustion of the capacity available of tourism common and the smaller size of the common indicate the higher sensitivity to change.

It should be noted that if the peak season is summer, the risk of depletion of tourism commons such as water resources is much higher. Summertime water use, according to Sebri (2014), is directly related to outdoor activities, which necessitate more water quantity and supply, usually requiring advanced water pricing in order to manage water resources sustainably. As will be discussed later in this work, the limited water resources of Mykonos and Santorini are at risk of depletion due to seasonal tourism, increased outdoor activities, and an inchoate water pricing system. As a result, these factors place a strain on the tourism commons, particularly water resources on both islands.

Figure 3 – The Relationship of the Commons with Tourism and Other Activities.



Source: Briassoulis, 2002

Furthermore, there can be even conflicts among tourists, tourism entrepreneurs, foreign investors, officials, and the local population over CPRs. As an example, foreign investors can have totally different perceptions of over-tourism commons and their perceptions can cause even misusage of the CPRs which can ultimately worsen the relationship between tourists, entrepreneurs, officials, and the local population (Briassoulis, 2002). On the other hand, tourism activities can require significant changes in the landscape and infrastructure and this can also create hostilities among the stakeholders (Edensor, 2000). As a result of this, the majority of the foreign and local tourism

entrepreneurs or investors adopt an approach of “wait and see” towards preserving the commons (Briassoulis, 2002).

Short-term decisions by public and water authorities are also critical for the sustainability of tourism commons. As Gössling et al., 2012 underlined, the growing conflict between the tourism industry and other users, including water rights and the food and water security of locals, creates basic issues about the ethics and politics of water access in tourist destinations. At the same time, public policies that focus only on tourism growth rather than resolving tourism commons issues can lead to conflicts among actors (Page et al., 2014). Hence, the short-term decisions by public and water authorities can have severe effects on the tourism commons and the local consumers in the long run. For that reason, there should be more research and development and a more holistic approach to governing tourism commons such as water resources (Briassoulis, 2002; Gössling et al., 2012).

On the other hand, a lack of awareness can create more unsustainability of tourism commons such as water resources, and there can be even the risk of depletion of the tourism commons (Page et al., 2014). Therefore, it is important for key stakeholders including public and water authorities to concentrate on raising awareness among hospitality stakeholders (hotel directors, hotel managers, and hotel owners), local consumers, and tourists, as well as on research and development.

Nevertheless, it is a challenge to create awareness and educate them on these matters particularly with tourists because they are visiting tourist destinations to have their vacation and they usually consume more water compared to home (Gössling et al., 2011; Page et al., 2014). According to Becken (2014), a tourist can consume directly water between 956 – 981 l/night, and indirectly between 5790-8940 l/night. It can be also noticed that few tourists are aware of their CPRs consumption, and the majority of the tourists are lacking environmental consciousness even when they are buying tourism products (Williams and Ponsford, 2009). Hence, we can clearly understand that it is not an easy task to create awareness in order to govern tourism commons such as water resources sustainably. As Coccossis and Parpairis (2000) highlighted, natural environmental

carrying capacity often imposes far more restrictive and less flexible constraints than man-made environmental carrying capacity.

As Ostrom et al., (1999) emphasized, the exploitation of commons by one user (It can be a sector such as tourism industry) reduces resource availability for other users, and short-term interests produce negative externalities on the long-term interests of all the users. Consequently, sustainable tourism and sustainable tourism commons will be elusive without stronger commitments and actions by all key stakeholder groups (Briassoulis, 2002; Williams and Ponsford, 2009). The tourism lifecycles of tourist destinations may easily enter “stagnation” phases as a result of unsustainable tourism. As Williams and Ponsford (2009) highlighted, degraded natural environment clearly affect tourist experiences in negative ways, and tourist destinations can lose their attractiveness because of the tourism-induced effects on tourism commons such as water resources.

The long and the short of it is that CPRs in tourism management has clear importance for the sustainability and longevity of tourism lifecycles of tourist destinations. As a matter of fact, we would like to look at Butler’s tourism lifecycle deeply in order to have a better understanding of the tourism commons such as water resources' importance in tourism management.

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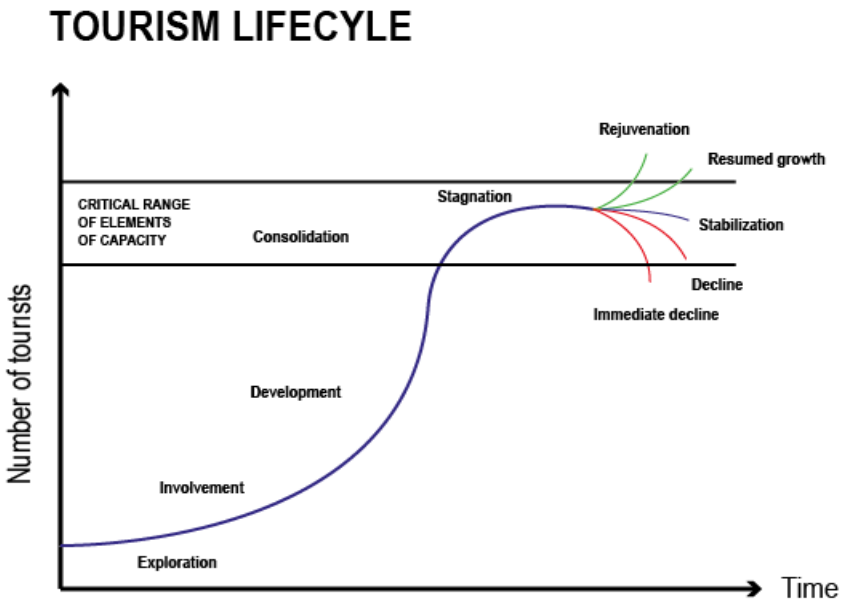
3.3. BUTLER'S TOURISM LIFECYCLE

Tourism destinations need sustainable tourism commons and efficient tourism commons management. Nevertheless, there can be cases in which tourism commons are not managed efficiently that can lead to the end of the tourism lifecycle. According to Butler (1980), there are six different stages of a tourism lifecycle which are respectively: exploration, involvement, development, consolidation, stagnation, decline or resumed growth.

As Butler (1980) modeled, a tourism destination starts with the "exploration" phase in which the area remains unspoiled and tourist facilities are minimum. This phase is actually the phase that tourism commons that are not threatened by tourism activity because there are few visitors. As an example, Cyclades Islands such as Mykonos and Santorini had their "exploration" phases during the 1960s and there were very few hotels and resorts and they received few visitors.

Figure 4 – Tourism Lifecycle Model



Source: Butler, 1980

The second phase is the “involvement” phase in which additional facilities are provided by the local population and small businesses, and a tourist season starts to be recognized (Butler, 1980). The second phase can be determinant because the pioneer tourism stakeholders may or may not govern tourism commons effectively and sustainably, and this can lead to the depletion of tourism commons in the long run. As an example, Mykonos and Santorini had their “involvement” phases in the beginning 1970s but tourism arrivals and tourist activities did not threaten tourism commons. Hence, this attracted more tourists in the following years to the islands.

The third phase is the “development” phase in which the area is acknowledged as a “tourist destination” and the host country starts the promotion of this tourist destination (Butler, 1980). The “development” phase has specific importance because this is the phase in which the tourism infrastructure is usually built and the destination starts to receive many tourist arrivals. The host country can build hotels, resorts, airports, roads, water treatment facilities, electricity infrastructure, etc. and the host country can put further investments to develop the destination (Butler, 1980). As Papatheodorou (2004) underlined, there is competition between hotels and resorts at one level, and competitiveness between individual enterprises another level in this phase.

Moreover, tourism destinations can receive popularity domestically and internationally in the “development” phase (Butler, 1980). The “development” phase can lead to environmental externalities such as excessive water resources usage and landscape change which can affect tourism commons in the long run (Gössling, 2012). As a matter of fact, the “development” phase requires long-term basis decision making that will sustain and protect tourism commons otherwise the tourism lifecycle can enter the “stagnation” phase. In general, Cyclades Islands started their “development” phases in the mid-1970s and the majority of the islands continue to receive many tourists as it is in the cases of Mykonos and Santorini Islands.

The fourth phase is the “consolidation” phase in which the tourist destination continues to receive tourist arrivals but the arrival rates are not high as it was in the “development” phase of the tourism lifecycle (Butler, 1980). In other words, tourism growth slows down but there is still significant tourism activity in the tourism destination. On the other hand, the slow tourism growth can be

intentionally created by the authorities in order to sustain and keep tourism products or tourism commons exclusive (Butler, 1980). On the contrary, it can be unintentional and the destination may start to lose its value in the tourism market.

Moreover, some of the destinations can depend on their economic gains only on the tourism sector in the "consolidation" phase and their dependency on tourism can cause unemployment and a higher inflation rate as a result of the slower tourism growth (Butler, 1980). As Szromek (2019) mentioned, Bornholm Island (Denmark) is usually given as an example to test the "consolidation" phase of Butler's Tourism Lifecycle Model and the island faced a consolidation period after 1994 with the significant decrease of the tourism growth trend and less tourist arrivals. Bornholm entered shortly the fifth phase of the tourism lifecycle which is "stagnation" phase.

The "stagnation" phase is the fifth phase of the tourism lifecycle. According to Butler (1980), this stage represents the start of a decline in tourism, and visitor numbers may have peaked and various capacities may have been met but tourist destinations may simply be no more desirable. It has to be noted that, the "stagnation" phase is usually related to over-tourism effects. As Butler (1980) underlined, the negative effects of over-tourism show themselves clearly, and falling tourism leads to economic decline and under-utilization of tourist infrastructure if a resort falls out of favor.

Hence, this will lead to unemployment and many businesses can be shut down. We can give the example of Daytona Beach, Florida, USA as a tourism destination that has entered the "stagnation" phase of Butler's Tourism Lifecycle because of the over-tourism phenomenon that created negative externalities on the environment, particularly with water pollution (Braun, 2002; Pennington-Gray, 2005). In addition to this, the environmental hazards led to economic losses in Daytona Beach and led a decline in tourism revenues.

The sixth stage of a tourist destination's lifecycle can be "rejuvenation" or "decline." The decisions of the key stakeholders are critical at this stage because they will determine the fate of a tourist destination. According to Butler (1980), "rejuvenation" can occur when new attractions are added, sustainable tourism approaches are implemented, or the tourist destination's target market shifts. If

all of these measures or decisions are taken by the key stakeholders, this type of "rejuvenation" phase can be viewed as a "complete rejuvenation." Nonetheless, some of these measures, but not all of them, may result in "modest rejuvenation." Cassar (2020) uses the example of Blackpool, UK, where a "complete rejuvenation phase" was achieved through key stakeholder decisions and major investments to regenerate Blackpool.

However, if the key stakeholders do not implement any of these measures, the tourist destination may enter a "decline" phase (Butler, 1990). Tourist facilities are disappearing during the "decline" phase, according to Butler (1990), but permanent residents' involvement in tourism may increase due to the availability of cheaper facilities in declining market conditions. At the same time, a tourist destination may experience a rapid decline as a result of a natural disaster, a war, or a pandemic (Zimmermann, 1997; Gössling et al., 2020). Unless additional measures are taken by decision makers, the decline stage of the tourism lifecycle will end with the end of tourism operations in that specific tourist destination (Butler, 1990).

As it was discussed above, there internal factors that are endogenous to tourism such as resource constraints, finance, overcrowding, etc. are at the center of internal factors while analyzing the tourism lifecycles of tourist destinations. In addition to the internal factors, there are external factors such as pandemics, economic crises, climate change, wars, earthquakes, floods, etc. that can impact tourism. According to Zimmermann (1997), two world wars severely disrupted European tourism products, and the "development" phase of European tourism was delayed until the 1960s. On the other hand, the oil crisis in the 1970s, the Gulf War, the Yugoslavian Wars, and the recession of 2007-2009 are among other events which were external to tourism but had a significant impact (Butler, 2011).

Furthermore, Gössling et al., (2020) consider climate change to be an external factor with varying effects on tourism. Butler (2011) emphasizes that climate change will have a more complex impact on tourism cycles, with the risk of tourism commons disappearing and tourist destinations losing their attractiveness. As a result, climate change mitigation and adaptation strategies (policies or plans) are required to combat the effects of climate change. Indeed, Butler (2011) stated that if

necessary steps are not taken by key stakeholders, there will be many failed tourist destinations, and "business as usual" is a potential threat to the sustainability and extended lifecycles of many tourism destinations.

Furthermore, Gössling et al., 2020 states that the COVID-19 pandemic resulted in a drastic decline in many tourism destinations and attractions, as well as significant economic losses because tourism revenues fell dramatically. As Butler (1990) stated, the rapid decline can occur in the event of external factors such as pandemics, wars, or natural disasters, and these types of events can significantly alter the tourist lifecycle of a tourist destination. It can noticed that external factors such as the Greek Economic Crisis or COVID-19 pandemic had certain impacts on the Cyclades Islands' tourism lifecycles back in 2012 and 2020. There were already issues with internal factors such as water scarcity and over-tourism phenomenon during the peak tourism seasons. Nevertheless, the internal factors were not able to decrease the tourist arrivals and Cyclades Islands continued to receive many tourist arrivals.

We cannot assess the impact of the pandemic as an external factor at this moment because the COVID-19 is still ongoing. However, we can see the negative consequences of the Greek Economic Crisis in 2012 on the Cyclades Islands. Tourist arrivals at hotels increased gradually from 2003 to 2011, as shown in Table 6, with 537.000 arrivals at hotels in 2011. Nonetheless, the Greek Financial Crisis had an impact on domestic tourists, and tourist arrivals fell to 453.000. It should be noted that there were major unrests in 2012, with many street demonstrations against government policies, which resulted in a decrease in international arrivals.

Furthermore, accommodated bed nights rose to 1928000 in 2011, but fell to 1655000 in 2012 as a result of the Greek Economic Crisis. As shown in Table 6, the average length of stay (days) did not change from 2003 to 2012, increasing from 3.5 to 3.8. Nonetheless, bed occupancy rates gradually declined to 33.7% in 2012, owing to daily cruise ship arrivals and a decreasing trend of domestic tourists as a result of the Greek Economic Crisis. According to Papadimitrou and Phoca (2014), Mykonos and Santorini Islands were among the least affected Cyclades Islands by the economic crisis.

Table 6. Tourism Statistics of Cyclades Islands (2003 – 2012).

YEAR	Arrivals at Hotels (000s)	Accommodated Bed nights (000s)	Average Length of Stay (Days)	Bed Occupancy
2003	318	1,176	3.7	51.6%
2004	321	1,118	3.5	42.8%
2005	338	1,269	3.8	55.7%
2006	327	1,216	3.7	57.8%
2007	447	1,635	3.7	52.5%
2008	462	1,680	3.6	50.1%
2009	511	1,871	3.7	46.3%
2010	518	1,856	3.6	42.5%
2011	537	1,928	3.6	41.0%
2012	453	1,655	3.7	33.7%

Sources: Hellenic Statistical Authority, 2012; Papadimitrou and Phoca, 2014

Nonetheless, the economic crisis had a different impact on both islands, and their tourist profiles changed dramatically as a result. As a result, Mykonos and Santorini began to attract high-spending international tourists, and Santorini became one of the world's top destinations for upscale weddings and honeymoons (Papadimitrou and Phoca, 2014). In other words, Mykonos and Santorini began to attract more "elite tourists" who can spend more than "modest tourists" who can spend less. As a result, Mykonos and Santorini had the highest international air arrivals in 2013, with a 24 percent increase over the other Cyclades Islands (Hellenic Statistical Authority, 2014). At the same time, this led many multinational (chain) hotels (5-star hotels or resorts in particular) to invest in Mykonos and Santorini.

At this point, it should be highlighted that 5-star hotels or resorts consume more water resources compared to lower-star categories (Deng and Burnett, 2002; Gössling et al., 2012). According to Deng and Burnett (2002), 5-star hotels or resorts consume 5.1 m3/m2 of water[7] while 4-star hotels or 3-star hotels consume 4.1 and 3.3 m3/m2. Hence, this indicates that the more stars a hotel has, the more water consumption it has because of the possibility of activities (both outdoor and indoor).

[7] This calculation is according to the annual water consumption divided by the total floor area of a hotel through using a Water Use Index (WUI, m^3/m^2). For further information please see: Deng and Burnett, 2002: Gössling et al., 2012.

At the same time, Tortella and Tirado (2011) underlined that small chain hotels consume less water due to the higher direct costs while large chain hotels consume more water due to lower operating costs. Consequently, there can be more water scarcity due to changing tourist profiles and products in tourist destinations such as Mykonos and Santorini because tourism commons such as water resources are at the heart of tourism lifecycles. Furthermore, the negative externalities of the tourism industry's activities can show up in the long term resulting in the "decline" phase of Butler's tourism lifecycle.

As a matter of fact, the Greek Economic Crisis is a good case study for examining how external factors can affect the tourism lifecycles of tourist destinations at various levels. Tourist destinations can have completely different lifecycle phases, as demonstrated by the examples of Mykonos and Santorini, even when external factors are present. As a result, as will be discussed further in this work, internal and external factors are critical for us to analyze and assess the tourism lifecycles of tourist destinations and tourism commons such as water resources are at the heart of tourism sustainability and longevity.

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3.4. VICIOUS CYCLE OF RENEWABLE ENERGY SOURCES (RES)-BASED DESALINATION PLANTS

Energy efficiency through technological advancements has been a topic of discussion since the publication of William Stanley Jevons' book "The Coal Question" in 1865. It's debatable whether energy efficiency has a "rebound effect." Renewable Energy Sources (RES)-based desalination plants consume less energy and have lower administrative costs than fossil fuel-based desalination plants (Kaldellis and Kondolli, 2007). As a result, energy efficiency has been achieved by using RES-based desalination plants instead of fossil fuel-based desalination plants to produce desalinated water in order to create water availability in water-scarce destinations.

"The Coal Question" focuses on Great Britain's coal resources, which were on the verge of depletion due to overuse in the iron industry. According to Jevons (1865), the iron industry consumed the majority of coal resources, implying that no coal would be available in the long run. Nonetheless, a technological advancement enabled a blast furnace to produce iron with less coal, causing iron prices to fall quickly, but this energy efficiency later added additional demand for coal. In other words, as industry becomes more efficient and people produce and consume more goods, energy consumption rises (Gillingham et al., 2012). And there is a paradox in relation to energy efficiency, this effect is named "Jevons Paradox."

Many academic scholars now refer to "Jevon's Paradox" as the "Rebound Effect," and it is one of the most contentious issues regarding whether energy efficiency is necessary for long-term growth. According to Gillingham et al., (2012), the rebound effect exists for real, but the rebounds are too small to derail energy efficiency policies. Furthermore, the rebound effect manifests in different ways, and there may not always be a direct effect, as William Stanley Jevons hypothesized (Gillingham et al., 2012). As a result of the primary energy efficiency, there may be additional energy efficiency opportunities or technological developments (Gillingham et al., 2012). However, there may be an indirect effect that leads to increased energy consumption. Gillingham et al., (2012) use the example of a new cell phone, which requires additional energy to manufacture and use.

Energy efficiency policies and technological advancements are critical to the long-term growth of many industries. However, this does not always imply that every energy efficiency measure will produce positive results. Holding demand constant, according to Alcott (2005), is gratuitous, and the "savings" are only on paper because lower costs increase demand. For example, Owen (2010) provides the energy efficiency of residential air-conditioning since the air-conditioning equipment improved 28%, but energy consumption for AC increased 37% for the average household.

However, the energy efficiency of air-conditioning equipment resulted in externalities, specifically environmental externalities. AC usage is well known to increase greenhouse gas emissions because it emits 100 million tons of carbon dioxide per year (New York Times, 2016). At the same time, even if the air-conditioning equipment is energy efficient, it contributes to ozone layer depletion if environmentally friendly natural refrigerants are not used (Bolaji and Huan, 2013). Nonetheless, these externalities are frequently overlooked because energy efficiency policies are important to economists who see them as necessary for long-term growth (Alcott, 2005).

According to Cowen (2020), an externality exists whenever the welfare of a firm or household is dependent not only on its own activities but also on the activities of another firm or household. There are numerous examples of environmental externalities associated with the management of Common Pools Resources (CPRs) (in particular water resources management). CPRs are distinguished by their non-exclusivity and divisibility. Non-exclusivity means that they can be exploited by anyone. Divisibility, on the other hand, implies that the capture of a portion of the CPR by one group deducts it from the amount available to other groups (Cowen, 2020). As a result, population growth, newly discovered or invented applications, and our desire to consume all play a role in analyzing "energy efficiency" and its "externalities" (Alcott, 2005).

Furthermore, if CPRs have unrestricted access, they may be overexploited. According to Cowen (2020), unlimited access destroys the incentive to conserve and can even result in total resource depletion. As a result, CPRs such as water resources must be managed without unrestricted access, and conservation plans must be implemented rather than providing an unlimited supply to meet sufficient demand. As a result, in response to "The Coal Question," Jevons (1865) emphasized that

Britain had to choose between "brief greatness and longer continued mediocrity." Jevons chose "longer continued mediocrity," which amounted to "sustainability" (Owen, 2010).

The average temperature over the Mediterranean basin has already increased by 1.5 to 4 degrees C in the last 100 years, while precipitation levels have gradually decreased in the last 50 years (Alpert et al., 2002). According to the IPCC (2019), the effects of climate change on runoff (stream discharge) in southern Europe will result in a 36% reduction in annual flow. This can cause water scarcity and drought in the region. As March et al., (2014) noted, precipitation levels are already declining from north to south (600 mm/year and less). This implies that the region is already witnessing the effects of climate change. As a result, as Perry (2006) stated, the region may lose its appeal to other parts of the world if temperatures rise by +2C.

In fact, the Mediterranean region has been identified as one of the most vulnerable to climatic and anthropogenic change (Correia 1999, Milano et al., 2013). This suggests that, in addition to climate change, the region's social and economic development is putting a strain on the environment. Extended heat waves lasting more than ten days during the summer have become more common in the region over the last decade (Perry, 2006).

The stress is manifesting itself in natural resources such as water. Water demand varies by location, and it influences development, societal value, and human behavior (Molle and Mollinga, 2003). The main issue with water resources is their unequal distribution over space and time (Postel et al., 1996). Water scarcity, as defined by Sofoniou and Bishop (2014), occurs when water resources do not fully satisfy water demand or minimum requirements by all sectors. As a result of the difference between precipitation and potential evapotranspiration, there is already water scarcity in the southern and southern-eastern Mediterranean (Correia 1999, Milano et al., 2013).

Tourism has emerged as a major economic sector, with the goal of achieving long-term development (Briassoulis, 2003). In other words, sustainable tourism is critical to achieving the goals of long-term economic development. Tourism is an ever-changing industry that responds to

changing demographic and economic conditions (Perry, 2006). Tourism, on the other hand, adapts to new demands and technologies, allowing it to be more sustainable.

The water consumption of tourists is critical in terms of sustainability. According to Hajikakou et al., (2013), a holiday is often a well-deserved break, and it can result in more extravagant water consumption than an individual's normal water consumption. As a result, tourist water demand can have a greater environmental impact than local residents, causing serious problems of overexploitation or depletion in places where water resources are limited, such as island destinations (Essex et al., 2004; Garcia and Servera, 2003; Gikas and Tchobanoglous, 2009b; Gössling, 2001; Hajikakou et al., 2013; Kent et al., 2002; Rico Amoros et al., 2009; Tortella and Tirado, 2011). Historically, most academic works focused on carbon rather than water, and water was frequently overlooked in sustainability analyses. Nonetheless, due to severe water shortages and droughts affecting daily life, water has become an important parameter of sustainable tourism in the last decade (Hajikakou, et al., 2013). As a result, the impact of tourism on water resources should be viewed as a critical local sustainability challenge that necessitates specific management in water-scarce areas.

Water is the most valuable natural resource, and it is essential for human survival. It is also necessary for all social and economic development, as well as the preservation of ecosystems (Sofrinou and Bishop, 2014). There are various components to estimate the amount of water consumed and even polluted. First and foremost, Blue Water refers to water found in rivers, lakes, and aquifers (Savenije, 2000; Hajikakou et al., 2013). Second, Green Water refers to the soil moisture in the unsaturated soil zone and is the primary source of water in rain-fed agriculture (Falkenmark and Rockström, 2004; Hajikakou et al., 2013). Third, Grey Water is the volume of water required to dilute the load of pollutants associated with the production of a specific good or service, and it is frequently used as a pollution indicator (Ercin et al., 2011; Hajikakou et al., 2013). As a result, each component is crucial in calculating the amount of available water, consumed water, and polluted water. In short, the effects of an industry like tourism on water resources can be quantified using these components.

Freshwater is an essential resource for tourism because each tourist directly consumes water for hygienic purposes such as showering or flushing toilets (Gössling, 2015). At the same time, water is required for filling swimming pools, irrigating gardens, irrigating golf courses, cleaning rooms, washing bed and even table linen (Gössling, 2015). In general, a hotel's water consumption ranges from 900 to 99.500 m3 per year, with a mean value of 25.154 m3. As a result, calculating the precise amount of water consumed by a tourist per overnight stay is a difficult task.

Several studies, however, are attempting to determine the approximate amount that a tourist consumes per overnight stay. One of these studies, Garcia and Servera (2003), calculated that tourist consumption per overnight stay in developed countries is two to three times that of local water demand. Meanwhile, Gössling (2001) calculated that it is up to 15 times greater than local water demand in developing countries. Tourism is estimated to have a global direct water footprint of 1 km3 of freshwater (Gössling, 2002). At the same time, Gössling et al., (2012) estimate that the average water consumption per guest and night is 519.12 liters.

This is the bare minimum of water calculated per guest per overnight stay because only direct water consumption is considered. According to Gössling (2015), there are both direct and indirect water consumptions in the tourism industry. Many scholars use the direct use of water resources in hotel rooms as their primary reference point when calculating tourists' water consumption per overnight stay. However, there are many different indicators that can be used for calculating the total consumption of tourists. Tourists consume water indirectly through infrastructure (hotels, roads, and airports, for example), food, fuel, consumer goods, and other services (Chapagain and Hoekstra 2008; Cazcarro et al., 2014; Gössling, 2012; Gössling, 2015; Pigram, 1995; Tortella et al., 2016; Worldwatch Institute, 2020). As a result, when indirect indicators are considered, tourism consumes more water.

The Vicious Cycle of Desalination Plants Use in Water Scarce Island Tourism Destinations necessitates three requirements, all of which might produce water shortage in an arid or semi-arid region. Seasonal tourism activity, short-term water resource management, and climate change are all necessary. Seasonal tourism activity has an important role in water shortage because the peak

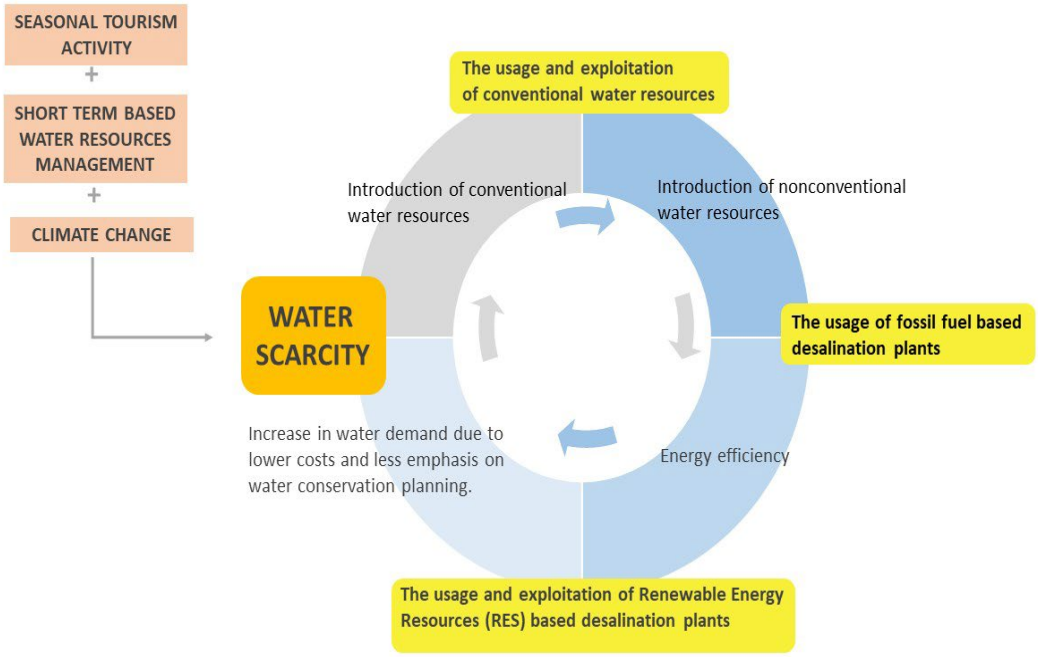
season of tourism is usually during the driest months of the year (Amelung et al., 2007). As a result, seasonality in tourism and increasing water demand in the tourism sector contribute significantly to water scarcity in, particularly water-scarce tourism areas.

Short term based decisions that contain the "saving the day" principle also lead to water scarcity because there is the need for long-term-based policies that have a more holistic approach to control water supply and demand sustainably (Katz, 2016). Furthermore, climate change is a global phenomenon and rising temperatures have an impact on the water resources availability of the tourist destinations (Scott, 2011). Island tourism destinations that are located in the arid and semi-arid zones are being dramatically affected as a result of lower precipitation rates and droughts (Uyarra et al., 2005).

The sustainable use of traditional water resources such as dams, reservoirs, and wells is critical for addressing water scarcity and increasing water availability (Morote et al., 2019). Unfortunately, one-sided water policies (focused on either supply or demand) frequently result in overexploitation and, in extreme cases, depletion of traditional water resources (Katz, 2016). As a result, the vast majority of water authorities decided to implement non-traditional water resources such as water transfer, wastewater treatment, desalination plants, rainfall collection, and so on (Jones et al., 2006). Water authorities continue to decide whether or not to develop desalination plants on water-scarce island tourist areas (Perez et al., 2020). The administrative expenses and environmental externalities of fossil fuel-based desalination plants, on the other hand, have become a point of contention.

Desalination plants are among the most commonly used non-traditional water resources at dry and semi-arid island vacation locations. According to Zotalis et al., 2014, fossil fuel-based desalination plants are most commonly utilized in the Gulf region (the Middle East), followed by the Mediterranean region. Desalination plants provide 70% of the water available to island countries such as Malta. Nonetheless, demand for fossil-fuel-based desalination plants is declining globally due to increasing energy consumption, maintenance costs, and environmental externalities such as greenhouse gas emissions (Kaldellis and Kondili, 2007). According to the same authors, a Seawater Reverse Osmosis (SWRO) unit has comparatively cheap capital costs but high operating and maintenance costs due to the high cost of energy and membrane replacement. As a result, fossil-fuel-based desalination plants are typically associated with increased water costs for consumers.

Figure 5 - Vicious Cycle of Desalination Plants Usage at the Water Scarce Island Tourism Destinations.



Source: Author's Own Work.

However, energy efficiency in the production of desalinated water was accomplished by the use of RES-based desalination facilities that run on solar and wind energy. Energy requirements are reduced as a result of this energy efficiency (Kaldellis and Kondili, 2007; Morote et al., 2019). As a result, numerous Gulf and Mediterranean countries began to invest in RES-based desalination plants (Morote et al. 2019). Because of the energy efficiency and desalination capability of RES-based desalination facilities, water is now available for many water-scarce destinations, including Greek islands.

According to Zotalis et al., (2014), the development of RES-based desalination facilities is a game changer for dry and semi-arid island tourism destinations because these islands historically acquired water through expensive ship transfers from the mainland. The Greek islands were among the destinations with high transferred water prices, with prices ranging from 4.91 EUR/m^3 to 8.32 EUR/m^3 (Kaldellis and Kondili, 2007; Zotalis et al., 2014). As a result, it is clear that RES-based desalination facilities can reduce maintenance expenses as well as consumer water expenditures.

The most critical point of the vicious cycle is the reduction in administrative costs for desalination plants and the reduction in consumer water prices due to energy efficiency (Von Medeazza and Moreau, 2007; Von Medeazza, 2005), and it is related to the water authorities' decision-making process. Water authorities may decide to lower water rates below the threshold level, as well as to place less focus on water conservation measures that attempt to reduce water demand. These decisions may eventually contribute to a rise in water demand, since local residents or tourists may assume there is enough water at reasonable costs. This rise in water consumption, in turn, has the potential to lead to serious water scarcity in the long run (Von Medeazza and Moreau, 2007; Von Medeazza, 2004).

As a result, a vicious cycle involving desalination plants is easily created if decision-makers do not base their decisions on existing real variables such as the geographical characteristics of the destination, population, occupancy rates, tourist arrivals, precipitation levels, availability of alternative water resources, and so on. Decision-makers can make judgments without considering these elements, and they can also make decisions based on the demands of the tourism industry or political issues (Park et al., 2018). In other words, the economic position and political climate can influence government decision-making, particularly in democratic countries where an electoral danger might cause decision-makers to ignore facts (Park et al., 2018). As a result of the authorities' short-term actions, an island tourism destination belonging to a country undergoing an economic crisis and/or political instability might easily become trapped in a vicious cycle.

3.5. HIRSCHMAN'S EXIT AND VOICE

Water is one of the most important common pool resources, and it necessitates collective management that works for the greater good. Individual rational policies or plans, on the other hand, introduce irrationality into collective strategies (Ostrom, 1990). As a result, these "rational individual policies or strategies" may even result in the total depletion of a common pool resource such as water. Nonetheless, Hirschman (1970) stated that these individual rational policies can be viewed as leaving the system; exit is a logical option, and voice use declines.

According to Hirschman (1973), deterioration in the taste of a firm's food product will lead to exit which means that people will not buy this product. However, the presence of a health risk such as poisoning from the firm's food will lead to voice which means that people will protest this (Hirschman, 1973). We can notice similar examples in the cases of common pool resources such as water. As an example, in Nafplion, Greece many farmers decided to quit from the main water supply system of the municipality water enterprise because of the water shortages (Atay, 2012).

Instead, they decided to dig illegal 12.000 boreholes to collect underground water rather than to demonstrate on the streets against the water supply policy of the municipality enterprise (Atay, 2012). As can be seen from this example, the farmers believed that digging illegal boreholes and opting out from the main water supply system was the logical option (exit) because they had alternative access to the very same resource which is underground water. It should be highlighted that farmers decided to exit because they had to produce agricultural goods and they had to earn money from these goods in other words they had their own rational individual strategies (policies or plans). However, they might have protested on the streets if they had no alternative solutions such as underground water. Hence, Hirschman (1970) underlines that if there are any exit possibilities available, people will prefer to exit rather than to voice (protest).

According to Dowding and John (2008), the voice may not successful and this can lead to a greater exit, and if the exit may not be satisfactory in the long term; it can lead to a greater voice. The consumer may immigrate to a different location rather than stay in the same place in order to receive better service or goods which means a greater exit (Dowding and John, 2008). As an example, a farmer in Nafplion may decide to move to Thessaloniki unless he cannot collect illegal water from boreholes and his protests may not grant him a water supply from the municipality supply. On the other hand, the consumers may exit from public provision to private provision, and this can be seen

as another greater exit (Dowding and John, 2008). As will be discussed later in this work, there are private hotels and resorts that decide to build their own private desalination plants rather than protest the water supply policies of the public and water authorities in Mykonos and Santorini. Instead, local populations and small chain hotels have been protesting the policies of the authorities. Consequently, private desalination plants choice of the hotels and resorts can be seen as a greater exit.

As Dowding and John (2008) underlined collective voice can occur in the form of voting or campaigning through a pressure group, and collective voice might occur to defend the environment or improve the services of private enterprises or public authorities. It has to be noted that a health hazard can lead to rapid collective voice because of the risks that are carried upon the population (Hirschman, 1970). As will be analyzed later in this work, there have been demonstrations in Mykonos because of the poor water quality and sewage leakage to the sea (Muddy water was running from the tap, and a sewer pipe leaked sewage water into the sea.) which is directly linked to the poor service of the municipality water enterprise and environmental degradation. Hence, we can observe that a rapid collective voice occurred directly when a health risk occurred in Mykonos.

In actuality, consumer happiness with a service or certain goods is closely related to exit strategies, and dissatisfaction can result in an exit and higher discontent can result in a greater exit (Dowding and John, 2008). It is vital to note that socioeconomic class, educational attainment, and employment status are significant factors to be considered when analyzing consumer satisfaction. According to Dowding and John (2008), higher education and higher social class tend to be less satisfied with services and this is directly linked to higher expectations, and these type of consumers usually exit and voice faster and more compared to consumers coming from lower education and lower social classes.

This is actually linked to their financial capabilities because exit and voice may cost less for them (Dowding and John, 2008). On the contrary, a consumer who is coming from lower education and lower social class may view exit and voice activity as very expensive, and he or she may not exit or voice and remain using the poor service or good. Nevertheless, Hirschman (1970) views these people as locked into the system and he underlines that these people are more likely to voice in the long run their because they have no other choice because they cannot exit, unlike in the case of the people with higher education, and higher social class status.

As will be discussed later in this work, private desalination plants are usually preferred by 5-star chain hotels or resorts because they have higher socioeconomic status compared to 2-star or 3-star hotels in Mykonos and Santorini. Hence, they were able to exit much faster and decided to build their own private desalination plants rather than remain in the system and face water shortages during the summer months. According to Hirschman (1973), dissatisfaction with public health and education services is directly linked to exit to the private sector. Hence, we can observe a similar trend with the public water supply in Mykonos and Santorini and the dissatisfaction with the public-based municipality water enterprises' water supply led 5-star hotels or resorts to exit to the private sector (which is in this case private desalination plants).

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3.6. UNILATERAL ENVRIONMENTALISM AND REGULATORY CAPTURE

Cooperation among key stakeholders is critical for avoiding an "exit and voice" situation. Flexibility, as Fischendler et al., (2011) emphasized, is most effectively achieved through collaboration with other partners and countries rather than unilateral actions or policies. Non-cooperative actions can be preferable when there are asymmetries among the affected parties, particularly in the cases of common pool resources (such as water resources) and environmental problems (such as water pollution) (Fischendler et al., 2011). Consequently, the abandoning of collaboration with possible partners in favor of individual efforts at environmental management is known as environmental unilateralism (Fischendler et al., 2011).

There may be a number of distinct reasons for actors to stop working together, which could eventually lead to unilateral environmentalism. It must be recognized that disagreements over sovereignty, a lack of care for environmental externalities by one party, the presence of several important governments, compliance costs, domestic politics, power imbalances, and hegemony may all further hinder collaboration; actors may have different political, religious, cultural, etc. views, and these distinctions may provide significant limitations (Fischendler et al., 2011). Fischendler et al., (2011) give the example of the wastewater treatment on the Israeli-Palestinian border example which ultimately resulted in failed cooperation among actors due to the Israeli-Palestinian conflict. As a result, Israel took unilateral environmentalist actions to solve the wastewater and pollution risk without the cooperation of Palestine.

The public and water authorities of Mykonos and Santorini are taking unilateral actions or policies (such as establishing new RES-based desalination facilities) without consulting with the hospitality or other sectors. These unilateral environmental activities by the public and water authorities on both islands, as will be described later in this study, are tied to compliance costs, domestic politics, power asymmetries, and hegemony. Although there are no transboundary water problems or serious environmental hazards in Mykonos or Santorini, there exist power imbalances and hegemony asymmetries among public and water authorities, 5-star hotels or resorts, lower-star hotel categories, and the local population.

At the same time, as previously discussed, 5-star hotels or resorts are adopting unilateral measures. It should be noted that over the last decade, more private desalination facilities have been erected by 5-star hotels or resorts due to their higher economic capacity, and geographical locations. The majority of the 5-star hotels or resorts that build private desalination plants have higher economic capacity due to being chain hotels and they do have geographical proximity to the seaside. As a result, unilateral environmentalism can be seen not only among public and water authorities but also among some hospitality stakeholders.

On the other hand, domestic politics, power asymmetries, and hegemony among actors can even lead to a regulatory capture situation. Regulatory capture is a type of authority corruption in politics that takes place; when a political organization, policymaker, or regulator is co-opted to serve the commercial, ideological, or political interests of a small constituency, such as a specific geographic area, industry or a profession (Dal Bo, 2006). In other words, government or public authorities can take actions (or policies) for the benefit of a small group that has strong ties with them which is actually against the will of the majority and their common good.

However, many hospitality stakeholders and other key stakeholders in Mykonos and Santorini do not view desalination facilities as the sole solution to the islands' water scarcity problem. Nonetheless, unilateral environmentalist decisions are still being made by public and water authorities, as well as 5-star hotels or resorts, without involving the local population or lower-star hotels, as will be examined further later. As Ostrom et al., (1999) emphasized, if rules are imposed by outsiders without consulting local populations or actors, local users may start a game of “cops and robbers” with authorities. Therefore, these unilateral decisions can even lead to conflicts over water rights as has been happening particularly in Mykonos as will be discussed later.

According to Dal Bo (2006), the personal characteristics of regulators and the capabilities of regulatory agencies play significant roles in cases of regulatory capture. It should be noted that a company may have prior knowledge of a problem, service, or good in a specific location before contacting regulators. As a result, key stakeholders' knowledge levels play critical roles because firms can easily convince and capture regulators with their high knowledge levels of a specific problem, service, or good (Dal Bo, 2006). As a result, regulatory capture can occur easily unless key stakeholders have sufficient knowledge of the problems, services, or goods in which the firms are interested in investing.

Furthermore, firms can employ former regulators as their employees in order to have easy access to the regulatory system. As Dal Bo (2006) underlined, the main motive behind this action is also related to the lobbying capabilities of the former regulators. In other words, the former regulators know some of the recent regulators and powerful groups inside the government, and they can use these connections to easily convince them for the benefit of the firms' interests. Hence, there is potential risk of net wealth losses and even total destruction wealth (Dal Bo, 2006).

It has to be noted that, these losses can also show up in the form of environmental degradation and total destruction of a touristic destination's lifecycle. Regulators can easily take decisions that can create environmental externalities and they may even believe that they are taking the right decisions because they are already captured by the firms or some interest groups. In addition to this, they can take these decisions or measures within the context of unilateral environmentalism which means that the decisions will be taken without any cooperation with the other key stakeholders as it was discussed above.

According to Dal Bo (2006), some of the agencies that play crucial roles in defending the interests and welfare of the public can be captured by the lobbying efforts of businesses or interest groups. For instance, the United States Environmental Protection Agency (US EPA) has stopped even referring to "climate change" as a result of the fossil fuel industry's persistent lobbying, which ultimately succeeded in persuading regulators and capturing them. This resulted in a decline in EPA enforcement actions and increased risks of higher greenhouse gas emissions that will eventually harm the public (The Globe Post, 2019).

As will be discussed further in this work, the public and water authorities in Mykonos and Santorini believe that desalination plants are the only way to solve the islands' water scarcity problems. As a result, more desalination plants are being built on the islands, and some desalination companies are reaping large profits as a result of these decisions. 5-star hotels or resorts, on the other hand, have been in favor of installing these desalination plants even privately on their premises, and they have lobbied for new desalination plants in both of the islands. In short, the regulatory capture situation is a recurring matter of discussion in Mykonos and Santorini, as will be assessed later in this work.

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CHAPTER 4 - METHODOLOGY

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4 - METHODOLOGY

4.1. IN-DEPTH INTERVIEWS AND STAKEHOLDER ANALYSIS

There can be limitations such as time, funding, etc. in any academic research. For that reason, many researchers can limit their scope but also they can use different research techniques to receive more data. As Boyle and Neale (2006) underlined an intense individual interviewing process known as "in-depth interviewing" is used in qualitative research to learn more about the viewpoints of a small group of respondents on certain ideas, programs, or situations. It has to be noted that a researcher may face certain difficulties with time and money to conduct interviews with 100 random interviewees. Instead, the researcher can choose 25 interviewees that have certain perceptions of certain ideas, programs, or situations if he is aware that these 25 interviewees have clear knowledge. Hence, this leads us to the classical academic research debate of quantity versus quality in scientific research.

It should be highlighted that in-depth interviews are useful when you want detailed information about a person's perceptions and compared to other data collection techniques, like surveys, they offer a lot more in-depth information (Boyle and Neale, 2006). Nevertheless, there are also disadvantages to using in-depth interviews in academic research. First of all, the interviewer must be well-trained in conducting in-depth interviews because the interviewer is responsible for making the interviewees comfortable while responding to the questions (Morris, 2015). Secondly, in-depth interviews can consume so much time to transcribe and analyze even if they take less than one hour to conduct (Morris, 2015). Third of all, in-depth interviews can be prejudiced which means there can be bias, and this can be a serious research issue unless precautions are taken by the researcher prior to the interviews.

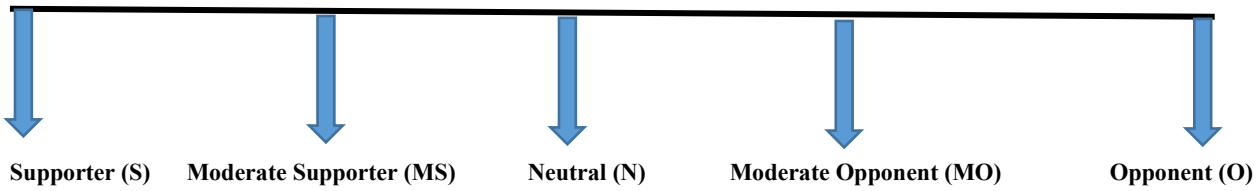
Stakeholder analysis is crucial for each researcher before they conduct in-depth interviews. Stakeholder analysis has eight important steps which are respectively planning the process, defining a policy, identifying key stakeholders, adapting the tools, collecting and recording the information, filling in the stakeholder table, analyzing the table, and using the data (Schmeer, 1999). For that reason, the researcher must have clear research objectives and well-organized stakeholder analysis prior to conducting in-depth interviews or questionnaires.

It must be emphasized that for any academic researcher, identifying the key stakeholders is essential since important stakeholders have specific knowledge and might even have a political impact on a certain issue. If a researcher wants to concentrate his or her research objectives on evaluating a specific policy (such as tourism policy), there are four categories of key stakeholders: policymakers (such as governors or tourism ministry representatives), commercial/private for-profit (such as hotel owners or hotel managers), community members and non-profit (such as activists or NGOs), and others who can affect the outcome of policymaking (such as journalists) (Schmeer, 1999; Cerna, 2013).

Questionnaires or in-depth interviews can be tested after the key stakeholders are identified. The researcher will analyze the data after conducting the questionnaires or in-depth interviews, and a stakeholder table is useful during this process (Schmeer, 1999). The stakeholder table will assist the researcher in the process of converting the complex and frequently protracted interview answers into a more succinct and systematic style. Hence, the researcher will be able to can finally produce unambiguous comparisons between the various stakeholders and succinctly communicate this data to the decision-makers who will use it (Schmeer, 1999). On the other hand, a stakeholder table has another advantage which is basically helping the researcher to identify the position of the stakeholders.

As an example, a researcher can be able to identify who is supporting a tourism policy or who is opposing a tourism policy while using the stakeholder table. For that reason, Schmeer (1999) mentioned that a spectrum of stakeholder positions can be achieved, after working on the stakeholder table and analyzing the questionnaire and in-depth responses of the stakeholders in academic research (See Figure 6).

Figure 6. Spectrum of Stakeholder Positions.



Source: Schmeer, 1999.

It is worth noting that the spectrum of stakeholder positions is useful in the discussion part of academic research (Journeault et al., 2021). Each stakeholder's position can be compared with different examples and the researcher can have a better assessment of the perceptions of the stakeholders. Furthermore, the stakeholder table has significant importance for the research by determining the roles among the key stakeholders which are respectively key, main, collaborative, and supporting roles (Journeault et al., 2021). On the other hand, the stakeholder table is also useful in the analysis of power and leadership as well as knowledge levels among the key stakeholders (Schmeer, 1999).

It should be highlighted that each key stakeholder can have different levels of knowledge of a certain topic even though he or she possesses very high power. As an example, a governor may possess very high power but may have limited knowledge about the desalination plants' externalities on the environment while an environmental activist may possess limited power but may have extended knowledge about the environmental externalities of the desalination plants. Hence, it is useful for the researcher to have a detailed analysis of power and leadership as well as knowledge levels because there can be certain differences among key stakeholders.

In short, in-depth interviews are an important research technique for gathering information from stakeholders. However, prior to conducting in-depth interviews, a researcher must conduct stakeholder analysis and develop a detailed research plan. We planned our research and analyzed key stakeholders prior to conducting questionnaires and in-depth interviews with the goal of having a detailed analysis of tourism management and water management in Mykonos and Santorini, as will be discussed below.

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4.2. QUESTIONNAIRE DESIGN AND STRUCTURE

Many academic scholars working on human geography and tourism studies use questionnaires in their research. As McLafferty Jr. et al., (2010) underlined, questionnaires can be used to collect original data about people, their behavior, experiences and social interactions, attitudes and opinions, and awareness of events. Hence, it was essential for this research to use questionnaires to collect original data about water resources management and tourism management in Mykonos and Santorini.

It has to be noted that using questionnaires have some advantages but also some disadvantages. As McGuirk and O'Neill (2016) highlighted, questionnaires have some limitations with gathering qualitative data but they are very essential for gathering quantitative data. Nevertheless, questionnaires can shed light on social trends, processes, values, attitudes, and interpretations, and they are practical, cost-effective, and allowing for extensive research across a large or geographically dispersed population (McGuirk and O'Neill, 2016). At the same time, questionnaires can be effectively combined with complementary, more intensive forms of qualitative research, such as interviews and focus groups, to provide more detailed perspectives on social processes and context (McGuirk and O'Neill, 2016).

There can be different types of questions in the questionnaires which can be closed questions or open-ended questions. Open-ended questions require respondents to establish and express their responses in their own words, either verbally or in writing (Züll, 2016). On the contrary, closed questions are those which can be answered by a simple "yes" or "no (Hyman and Sierra, 2016). Open-ended questions can be motivating because they are interactive and require the respondent to elaborate on his or her responses. As Züll (2016) underlined, open-ended questions are useful in measuring knowledge and allowing the respondents to express their criticisms about a certain topic.

Furthermore, open-ended questions are essential for opening new topics and debates because the respondent may give additional data on certain topics that are not even expected by the interviewer. Hence, open-ended questions are generally preferred by researchers that expect to learn more than they have already known about a particular subject (Züll, 2016). However, some researchers only use closed questions rather than open-ended questions because they believe they must limit their scope (Reja et al., 2003).

As McGuirk and O'Neill (2016) highlighted, closed questions elicit quantitative information about respondent characteristics or behavior. At the same time, the major benefit of closed questions is that the answers can be easily coded and analyzed (McGuirk and O'Neill, 2016). Closed questions can be useful for selecting categories as well, and these categories can be limited by the researcher unlike the open-ended questions which means in other words the respondent cannot go beyond the researcher's scope easily. On the other hand, closed questions rank items to represent attitudes or opinions, or select a point on a scale to represent the intensity with which an orientation or viewpoint is held (McGuirk and O'Neill, 2016).

Furthermore, there can be combination questions in the questionnaires. Combination questions are usually used by researchers to combine a closed question with the answer option "other, please specify". Hence, this will enable the respondent the chance to express himself or herself as it is in the case of open-ended questions. It has to be noted that this is one of the major criticisms to closed questions because they restrict the respondents when there is high possibility of getting further details on the research question (Bryman, 2012). Moreover, there are different variables which can be used in closed questions in questionnaires which are respectively nominal variables, ordinal variables, and interval variables (Brace, 2004).

As Brace (2004) underlined, nominal data is a collection of unparametric variables, whereas ordinal data is a collection of unparametric ordered variables. As an example, unsatisfied, very satisfied, neutral, satisfied, and very unsatisfied are all nominal data if we consider them individually. Nevertheless, we can scale them in a given order (very satisfied – satisfied – neutral – unsatisfied – very unsatisfied), this indicates that this is ordinal data. Hence, the major difference between nominal and ordinal data is that ordinal data has a set order to it (Brace, 2004).

As Brace (2004) mentioned, the composite data can be treated as quantitative data on an interval scale if there are more than five Likert-type questions in the research. Likert-type questions are generally used by the researchers to collect ordinal data in their questionnaires.

As an example: "*How much are you satisfied with the water quality in Mykonos?*"

a. Very satisfied
b. Satisfied
c. Neutral

d. Unsatisfied
e. Very Unsatisfied

Consequently, using Likert-type questions is important for the research objectives. Likert-type questions can be used to address research objectives, and they can be used for statistical hypothesis tests on interval or ratio data (Brace, 2004).

It is worth noting that leading questions should be avoided in the questionnaires. The leading questions can allow the researcher to collect data that is not objective but instead subjective (Brace, 2004).

As an example: "*There are already water scarcity problems in Mykonos for the past 5 years. Many tourists and local inhabitants faced water shortages, and they could not able to take showers for days. Do you think that the water authorities are successful in Mykonos?"*

As shown in the example, leading questions already include the answer to the question, and the researcher will only receive information that is relevant to his or her needs, losing objectivity in his or her research. At the same time, the questions should be focused and asked in a specific order. According to Brace (2004), unfocused and unordered questions can mislead respondents, causing them to give incorrect answers even when they know the correct answer.

The long and short of it is that questionnaires are useful for data collection and can assist researchers in meeting their research objectives. Researchers can benefit from either closed or open-ended questions. On the other hand, they can combine both and collect as much information as possible from the respondents. In fact, we decided to use both closed and open-ended questions in our research to collect as much information as possible from stakeholders in Mykonos and Santorini.

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4.3. DETAILS ON QUESTIONNAIRE DESIGN AND IN-DEPTH INTERVIEWS IN MYKONOS AND SANTORINI

Tourism activity contributes significantly to water demand in Mykonos and Santorini, and the majority of key stakeholders involved in both water resource management and tourism management are aware of the problem. As a result, at the start of the water crisis in 2014, we conducted surveys and in-depth interviews with hospitality stakeholders, public and water authorities, academicians, journalists, activists, and NGO members on both islands. We created two sets of questionnaires to collect data on water resource management, tourism management, and stakeholders' perceptions of important topics. These important topics include water scarcity, climate change impacts, seasonal tourism activity impacts, installation of renewable energy resource-based desalination plants, water quality issues, and pollution in Mykonos and Santorini. The questionnaires were adapted from Santos-Lacueva and Saladié (2016), who interviewed several Riviera Maya (Mexico) stakeholders.

The questionnaires contained 34 closed and open-ended questions and were designed for two distinct stakeholder subgroups: hospitality stakeholders and policymakers and stakeholders (see Appendix 1 and Appendix 2). Interviewees were asked questions about tourism activity, water shortages, water resource management, climate change, and desalination plants. It should be noted that the hospitality stakeholder subgroup includes hotel owners, managers, and directors who are directly involved in tourism management on Mykonos and Santorini. Policymakers and stakeholders, on the other hand, included a large number of stakeholders who play key, main, supporting, and collaborative roles in water resource management and tourism management.

Although the second stakeholder subgroup (policymakers and stakeholders) responded the same questionnaires, they were also planned to be divided into two separate groups: public and water authorities, and other stakeholders. Former and current local government officials, municipality representatives, and municipality private water company representatives (DEYATH and DEYAM) make up the public and water authorities subgroup. Other stakeholders include academics, activists, bloggers, journalists, and NGO representatives from various professional backgrounds.

We wanted to find out how interviewees felt about the coordination of tourism and environmental policies (Q1 and Q2). Following these two general questions, we asked two more general questions:

whether tourism policies and administration consider environmental issues, particularly water availability (Q3), and whether environmental policies and administration consider tourism activity issues (Q4). Then we asked a closed question (Q5) that was specific for the hospitality stakeholders to determine whether their hotels were taking any necessary steps regarding the environmental issues in Mykonos and Santorini.

We then asked four more closed questions (Q6, Q7, Q8, and Q9) to analyze the interviewees' perceptions regarding climate change and the impact of climate change on tourism activity in Mykonos and Santorini. Then, we asked another closed question (Q10) that was specific for the policymakers and stakeholders to determine their roles in the fight against the impacts of climate change on tourism activity in Mykonos and Santorini. The following two questions (Q11 and Q12) were open-answer questions and they aim to analyze their perceptions regarding the most important climate change adaptation and mitigation measures to tackle the impacts of climate change. These two open-answer questions were followed by one more open-answer question (Q13) that aim to analyze the perceptions of the stakeholders regarding the measures to decrease the contribution of tourism activity to climate change.

The subsequent closed question (Q14) was used to discern their perceptions regarding tourism's impact on water resource availability. We asked four more questions (Q15, Q16, Q17, and Q18) to establish the interviewees' views on whether tourism activity, short-term water resources management, agriculture activity, and climate change played a role in the water shortages on Mykonos and Santorini. Furthermore, we asked another closed question (Q19) to learn about the frequency of the water shortages in both of the islands. Additionally, we asked another closed question (Q20) because we wanted to hear their satisfaction levels with the water supply (in terms of water availability / quantity) which is being supplied by DEYAM and DEYATH.

Moreover, we asked the interviewees two specific questions related to desalination plants and reclaimed water. We wanted to hear whether they viewed desalination plants as a "solution" to the water shortages in Mykonos and Santorini (Q21), and we also wanted to learn whether they viewed reclaimed water as a "remedy" to the water shortages in both of the islands (Q22). Then we asked a specific question to the hospitality stakeholders in order to determine whether any private desalination plants were installed at the hotels or resorts of the interviewees (Q23). This question was followed by an open-answer question that was also specific to hospitality stakeholders to assess

their own measures to guarantee water availability in their premises (Q24). In addition to this, we asked another open-answer question to all of the stakeholders to analyze their perceptions regarding the measures / actions taken by the public and water authorities to guarantee water supply in Mykonos and Santorini (Q25).

Afterward, we asked a closed question (Q26) to discern their perceptions regarding the satisfaction with the water quality in Mykonos and Santorini. Additionally, we asked a follow-up closed question (Q27) to hear their perceptions regarding the frequency of the water quality issues in both of the islands. We asked four more questions (Q28, Q29, Q30, and Q31) to establish the interviewees' views on whether tourism activity, short-term water resources management, agriculture activity, and climate change played a role in the water quality problems on Mykonos and Santorini. Likewise, we asked another specific question (Q32) to the policy makers and stakeholders to determine their roles to guarantee water supply (both quantity and quality) in Mykonos and Santorini.

The following question (Q33) was specific to hospitality stakeholders in both of the islands whether they had any policy (strategy or plan) to provide better water quality in their premises in the case of poor water problems in Mykonos and Santorini. The final question (Q34) was asked to all of the stakeholders in both of the islands whether the public and water stakeholders had any policy (strategy or plan) to ensure better water quality to their consumers in both of the islands.

As can be seen above, most of the questions are closed questions. Some solicited yes/no answers, while others were designed as a Likert scale or gave a determinate number of options. This allowed us to analyze frequencies and distributions (quantitative approach). Nevertheless, we asked the interviewees to justify the reasons for each of their responses to the closed questions, which gave us a deeper understanding of water scarcity issues, water resources management, and tourism activity. The qualitative information used in this study to build the discussion section was obtained by means of the content analysis of the information given by the stakeholders.

We contacted a comprehensive list of hotels in Mykonos and Santorini, and we gave information about the research and requested an interview with the hotel managers, hotel directors, or hotel owners. We received 24 positive answers from hospitality stakeholders in total in Mykonos (14 stakeholders) and Santorini (10 stakeholders). The hotels were located in the main tourist places on the islands and covered different hotel categories (See Table 7 and Table 8). Eleven hospitality

stakeholders were interviewed in summer 2014 (5 July–10 August), and thirteen were interviewed in summer 2015 (12 July–15 August). All of the interviews were in-person and held in Mykonos and Santorini (where the interviewees worked), and each interview lasted 1–1.5 h.

On the other hand, we contacted a large number of policymakers and stakeholders in Mykonos and Santorini, explaining the research and requesting interviews with academics, bloggers, journalists, local government officials, municipality representatives, municipality water company representatives (DEYATH and DEYAM), NGO officials, and water activists. In total, we received 19 positive responses from policymakers and stakeholders in Mykonos (9 stakeholders) and Santorini (10 stakeholders). Policymakers and stakeholders play important, critical, supportive, and collaborative roles on both islands, and their professional roles were the primary reason we decided to interview them (See Table 9 and Table 10). Eight policy-makers were interviewed in summer 2014 (5 July-10 August), and eleven were interviewed in summer 2015 (12 July-15 August). All of the interviews were in-person and held in Mykonos and Santorini (where the interviewees worked), and each interview last 1-1.5h.

The interviews were conducted in English, German, and Greek, and a translator helped translate the interviews that were conducted in Greek. We gave detailed information on our research to each interviewee and assured them that their answers and the conversations in the interviews would be confidential. We also asked permission to audio-record the conversations, and only the conversations of the interviewees who gave us permission were recorded.

4.4. DETAILS ON THE DISTRIBUTION OF PARTICIPANT IN MYKONOS AND SANTORINI

We chose the hospitality stakeholders in Mykonos and Santorini, particularly according to their hotel classification, and we placed special emphasis on the selection process due to the interviewees' gender and professional backgrounds. We would like to look at the distribution of hospitality stakeholder participants in Mykonos first:

Table 7. Distribution of the hospitality stakeholder participants according to professional background, gender, and hotel classification in Mykonos.

Hotel Classification	N (%)	Gender	N (%)	Profession	N (%)
Five Star / Resort	5 (35.8%)	Female	4 (28.6%)	Hotel Owner	2 (14.3%)
Four Star	3 (21.4%)	Male	10 (71.4%)	Hotel Director	2 (14.3%)
Three Star	3 (21.4%)			Hotel Manager	10 (71.4%)
Two Star	2 (14.3%)				
One Star	1 (7.1%)				

Source: Author's own work.

As shown in Table 7, we interviewed hospitality stakeholders from each hotel category in Mykonos. We interviewed 35.8% of the hospitality stakeholders from Five Star Hotels / Resorts and 21.4% of the hospitality stakeholders from Four Star Hotels. Despite our desire to interview female and male hospitality stakeholders in equal proportions, we were only able to interview 28.6% of female hospitality stakeholders in Mykonos. As a result, the majority of the hospitality stakeholders (71.4%) interviewed for the study were men. Furthermore, the overwhelming majority of Mykonos hospitality stakeholders (71.4%) were hotel managers, with the remaining 14.3% being hotel owners and the remaining 14.3% being hotel directors.

At this point, we would like to look at the distribution of participants in Santorini:

Table 8. Distribution of the hospitality stakeholder participants according to professional background, gender, and hotel classification in Santorini.

Hotel Classification	N (%)	Gender	N (%)	Profession	N (%)
Five Star / Resort	3 (30%)	Female	5 (50%)	Hotel Owner	1 (10%)
Four Star	2 (20%)	Male	5 (50%)	Hotel Director	1 (10%)
Three Star	3 (30%)			Hotel Manager	8 (80%)
Two Star	2 (10%)				
One Star	1 (10%)				

Source: Author's own work.

As shown in Table 7 and Table 8, we were able to conduct interviews with hospitality stakeholders from each hotel category in both Santorini and Mykonos. It should be noted that 30% of the interviewees are from Santorini's Five Star Hotel/Resort category, while 20% are from the Four Star hotel category. Simultaneously, 30% of hospitality stakeholders interviewed are from the 3 Star Hotel category. It should be noted that, unlike Mykonos, we were able to conduct interviews with equal numbers of males and females, and it was possible to have 50% female interviewees and 50% male interviewees in Santorini. Moreover, Table 8 shows that hotel managers account for the vast majority of hospitality stakeholders in Santorini (80%).

We chose policymakers and stakeholders based on their roles in water resource management and tourism management on the Greek islands of Mykonos and Santorini. The interviewees are coming from different professional backgrounds, and they have key, main, supportive, and collaborative roles in water resources management and tourism management. First of all, we would like to look at the distribution of policy-makers and stakeholders in Mykonos:

Table 9. Distribution of the policy-makers and stakeholders participants according to professional background and gender in Mykonos.

Profession	**N (%)**	**Gender**	**N (%)**
Academician	2 (22.2%)	Female	3 (33.4%)
Journalist	3 (33.4%)	Male	6 (66.6%)
NGO Representative and Water Activists	1 (11.1%)		
Local Government and Public Authorities	2 (22.2%)		
Municipality Water Company Representative	1 (11.1%)		

Source: Author's own work.

As can be seen in Table 9, we were able to conduct interviews with policy-makers and stakeholders from different professional backgrounds. It should be noted that, 33.4% of the policy-makers and stakeholders in Mykonos are journalists while the other 22.2% are local government and public authorities, and the other 22.2% are academicians. Despite our desire to interview female and male hospitality stakeholders in equal proportions, we were only able to interview 33.4% of female policy-makers and stakeholders in Mykonos. As a result, the majority of the policy-makers and stakeholders (66.6%) interviewed for the study were men.

At this point, we would like to look at the distribution of policy-makers and stakeholders in Santorini:

Table 10. Distribution of the policy-makers and stakeholders participants according to professional background and gender in Santorini.

Profession	**N (%)**	**Gender**	**N (%)**
Academician	2 (20%)	Female	2 (20%)
Journalist	2 (20%)	Male	8 (80%)
NGO Representative and Water Activists	2 (20%)		
Local Government and Public Authorities	2 (20%)		
Municipality Water Company Representative	2 (20%)		

Source: Author's own work.

As can be seen in Table 10, we were able to conduct interviews with policy-makers and stakeholders from different professional backgrounds in Santorini. It should be highlighted that we were able to conduct interviews in equal proportions from each professional background, and for each professional background, we held interviews with at least two participants. On the other hand, despite our desire to interview female and male hospitality stakeholders in equal proportions, we were only able to interview 20% of female policy-makers and stakeholders in Santorini. Consequently, the vast majority of the policy-makers and stakeholders (80%) interviewed for the study were men in Santorini.

As previously stated, we provided each interviewee with detailed information about our research and assured them that their answers and conversations during the interviews would be kept confidential. In fact, all of the stakeholders' names will be written as "anonymous" in this work, and we have decided to give each stakeholder a pseudonym:

For the hospitality stakeholders in Mykonos: **Hospitality Stakeholder Mykonos #1…..#14.**

For the hospitality stakeholders in Santorini: **Hospitality Stakeholder Santorini #1…..#10.**

As it was mentioned above, we decided to divide policy-makers and stakeholders into two subgroups although they responded the same questionnaires and we gave each stakeholder a pseudonym:

For the public and water authorities in Mykonos: **Public and Water Authority Mykonos #1...#3.**

For the public and water authorities[8] in Santorini: **Public and Water Authority Santorini #1…#4.**

For the other stakeholders[9] in Mykonos: **Other Stakeholder Mykonos #1…#6.**

For the other stakeholders in Santorini: **Other Stakeholder Santorini #1…#6.**

[8] Public and water authorities include local government authorities, and municipality water company representatives.
[9] Other stakeholders include academicians, journalists, NGO representatives, bloggers, etc.

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CHAPTER 5 – AREA OF STUDY

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THE WATER SCARCITY AND SUSTAINABLE TOURISM IN THE GREEK ISLANDS: FOCUS CYCLADES ISLANDS
Itri Atay

5 – AREA OF STUDY

5.1. GREECE

In this part of the work, we are going to have a general view of Greece as a country. Greece is one of the most important tourism destinations in the world since it has a rich history and it has a typical Mediterranean climate. The country is mostly sunny throughout the year and it has often dry summers and mild winters (Buhalis, 2001). One of the unique characteristics of Greece is that the country is consisted of a mainland and 6000 islands and islets which are scattered in the Ionian and Aegean Seas (Buhalis, 2001). The mainland Greece is situated on the southern tip of Balkan Peninsula and it has borders with Albania, Bulgaria, Republic of North Macedonia and Republic of Turkey. Greece consists of nine traditional geographic regions: Macedonia, Central Greece, the Peloponnese, Thessaly, Epirus, Thrace, the Ionian Islands, Crete Island, and the Aegean Islands (including the Dodecanese and Cyclades) (Gavalas, 2018). The total size of all Greece (together with islands and islets) is almost 132.000 km2 and Athens is the capital of Greece (Gavalas, 2018).

Map 1. Administrative Units of Greece

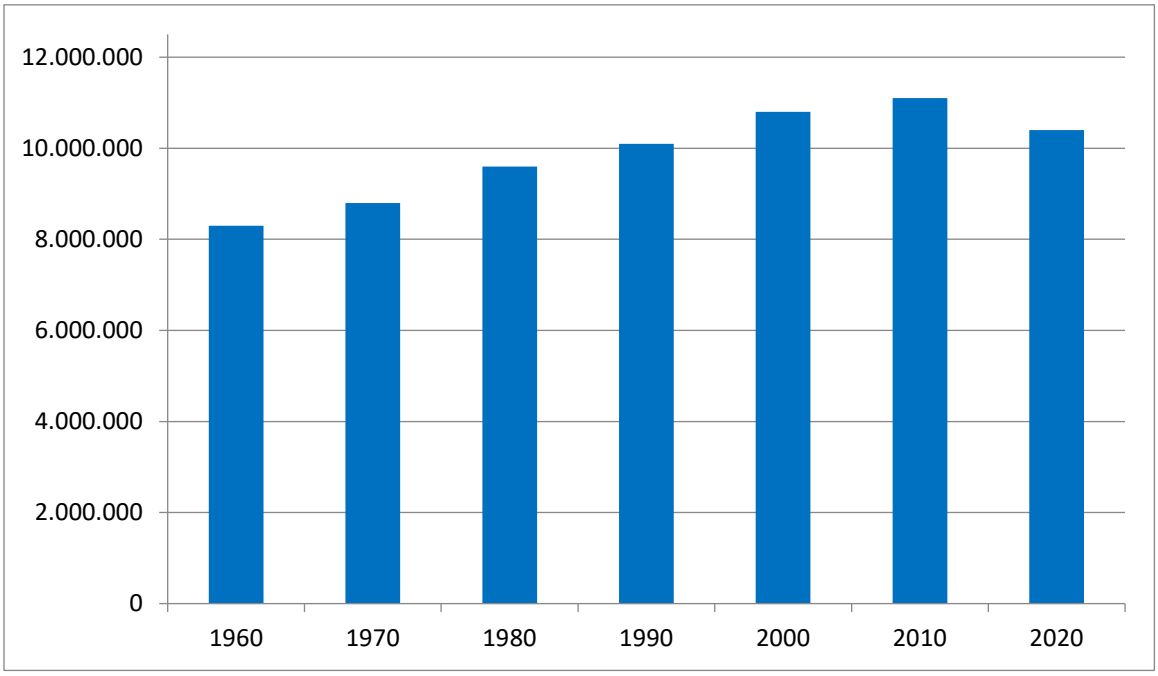
Source: Gavalas, 2018

Greece is one of the members of European Union (E.U.) and it became a member of E.U. largely on political grounds to protect democracy in 1981 (Ioannides and Pissarides, 2015). The accession of Greece to E.U. was a turning point for Greece since the country faced many tragic moments in particularly during the World War II (WWII) period (1939-1945) as well as during the Cold War era. As Ioannides and Pissarides (2015) underlined, Greece faced the invasion of the Axis Forces during WWII, a civil war right after WWII in 1949 and a military dictatorship during the years 1967-1974.

Greece has a population around 10.4 million inhabitants and the population of Greece has been decreasing as it is in the case of other E.U. member states since the last 10 years. As it can be seen in Figure 7, the population of Greece was 8.3 million in 1960 and it continued to increase gradually up to 11.1 million in 2010. Nevertheless, Greek population started to decrease after 2010 due to several factors such as the financial crisis, immigration to other countries (in particularly to other E.U. member states) for better job opportunities and less infertility rates compared to past (Ioannides and Pissarides, 2015). The current population of Greece is around 10.4 million and as it was mentioned above the population is under a decreasing trend.

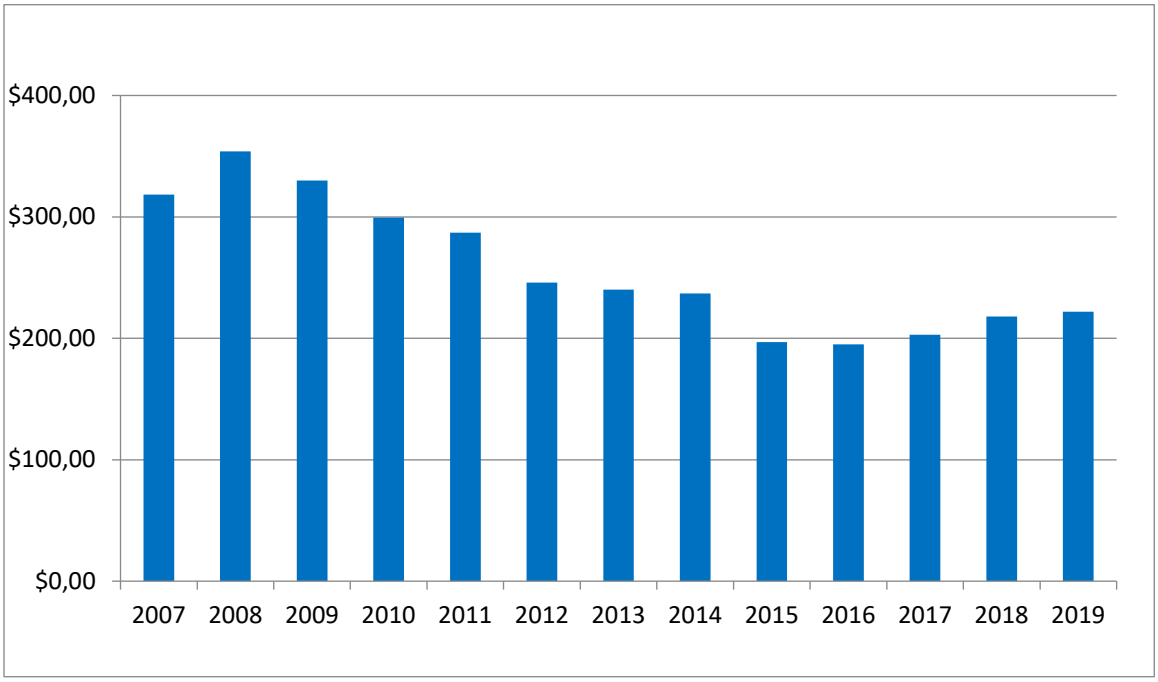
As it was mentioned above, the political, social and economic instability led Greek people to see E.U. as an opportunity and Greece became a full member in 1981. As Ioannides and Pissarides (2015) pointed out, Greeks did not give much attention to the economy and Greek economy was underdeveloped compared to more advanced European nations. The gravity of the situation was understood totally when Greece applied for membership in the Euro Zone in 1999. Greece became a full member of the Euro Zone in 2001 and structural problems started to show themselves quickly (Ioannides and Pissarides, 2015).

Figure 7. Population of Greece from 1960 to 2020.



Source: Statista, 2020a

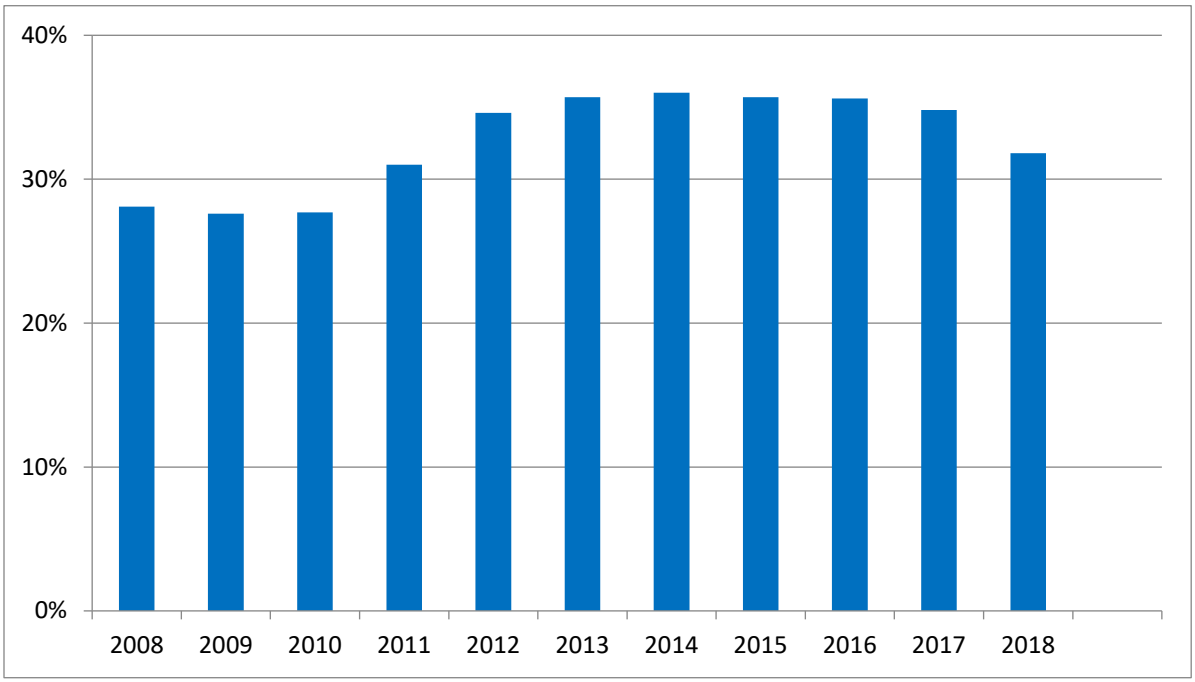
Figure 8. Greece's Gross Domestic Product (GDP) in Billion Dollars from 2007 to 2019.



Source: World Bank, 2019a

Nevertheless, Greek GDP is one of the top economies in the world and the economy of Greece is the 51st largest in the world with a nominal gross domestic product (GDP) of $222 billion per annum in 2019 (World Bank, 2019). As it can be seen in Figure 8, Greece had $354 billion nominal GDP per annum in 2008 but nominal GDP per annum started to decrease due to the financial crisis and it was lowered to $299.360 billion in 2010. The decreasing trend of nominal GDP continued to financial crisis and it decreased to $195 billion in 2016. This clearly shows us that Greece lost almost half of its nominal GDP per annum only in 8 years. Nominal GDP per annum started to increase after the parliament elections, values started to increase gradually per year and nominal GDP per annum reached to $222 billion in 2019. During the financial crisis, unemployment rates and the percentage of people who are at the risk of poverty or social exclusion increased.

Figure 9. Greece's population rate at risk of poverty or social exclusion from 2008 to 2018.

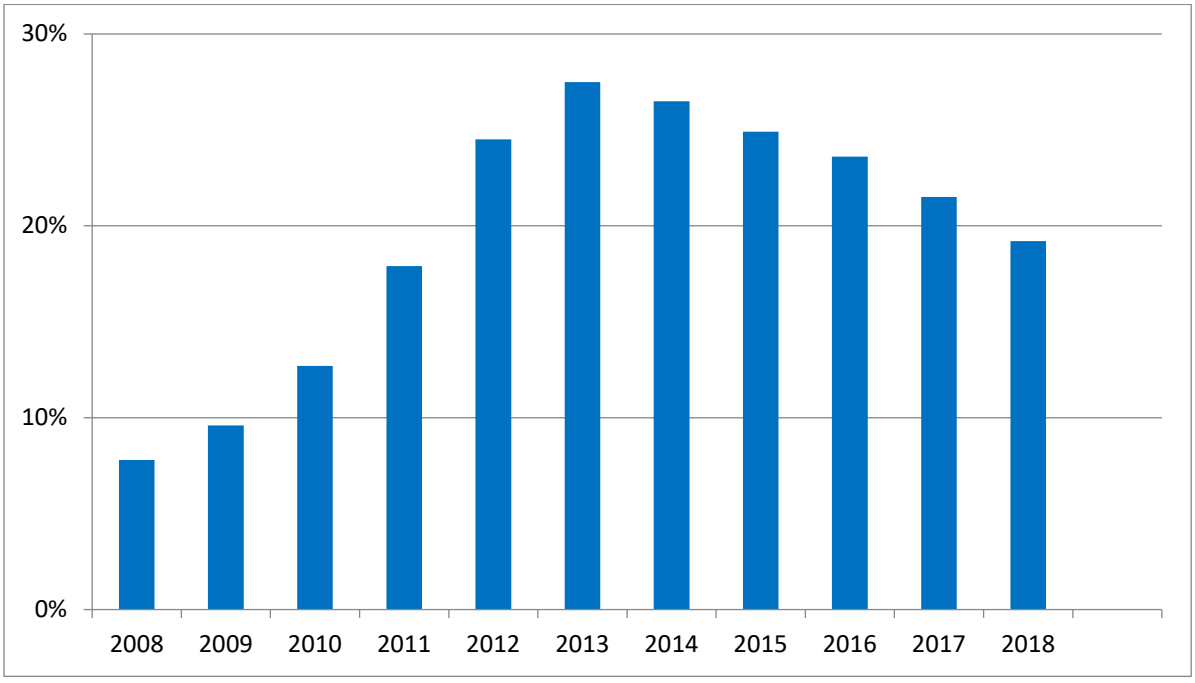


Source: Eurostat, 2019

As it can be seen in Figure 9, the percentage of people at risk of poverty or social exclusion was 28.1% in 2008 and it had a decreasing trend in the next 2 years. However, the impacts of the financial crisis started show itself and it increased to 31% in 2011 and then the trend continued to

increase until 2014 with 36% (Tziovas, 2017). This meant almost 3.6 million of Greek population was living under the risk of poverty or social exclusion. As it will be discussed below, 2016 elections was the turning point for Greece and the percentage of people at risk of poverty or social exclusion started to decrease and reached to 31.8% in 2018.

Figure 10. Greece's total unemployment rate of active population from 2008 to 2018.



Source: World Bank, 2019b

Greece had 7.8% unemployment rate in 2008 but this rate gradually increased up to 27.5% in 2015 as a result of the financial crisis. This meant almost 20% increase in the unemployed people which was a dramatic value for Greece (Tziovas, 2017). As it will be discussed below, structural reforms took place in the economy in particularly by Tsipras government after 2016 parliament elections and unemployment rates started to gradually decrease and percentage value was lowered down to 19.2% in 2018. On the other hand, majority of the unemployed Greek population are from 18-24 age group and their unemployed levels were almost 60% in 2013 (Mavridis, 2018). This indicates that young population suffered worse economically due to financial crisis. At this moment, the main question is to analyze and detect the factors behind Greece's economic instability.

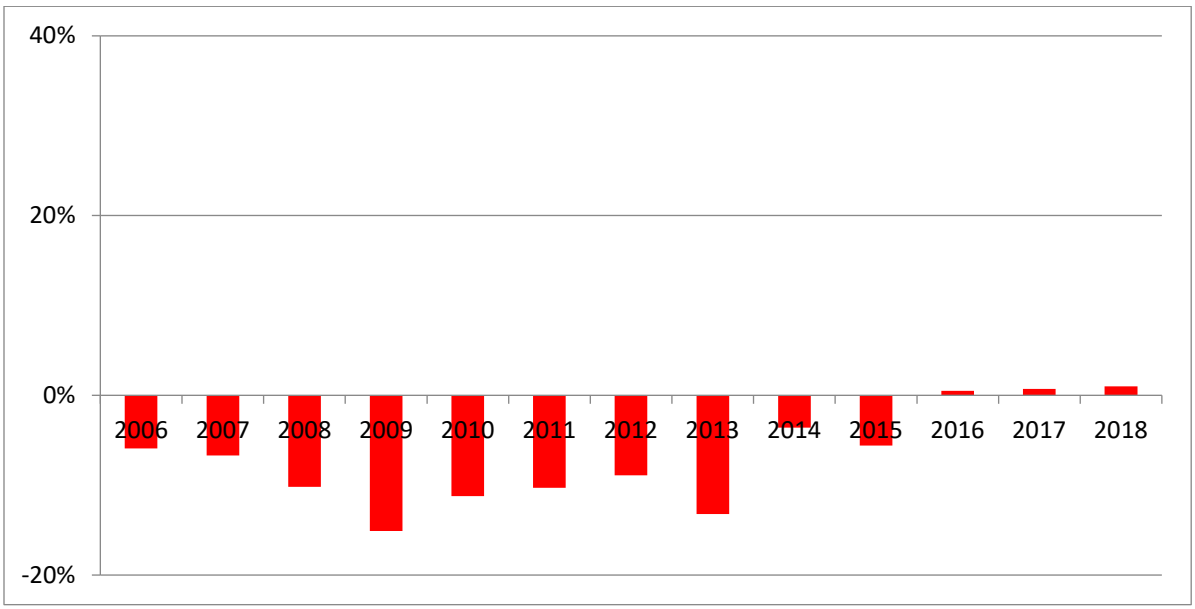
Greece has faced financial instability starting from 2004 when Greece admitted overstating euro entry due to the costs of hosting the summer Olympics (The Economic Times, 2010). At the same time, Greek economy was already weak due to low exports and corruption (Mavridis, 2018). All these factors started the birth of the Greek financial crisis and the situation continued somehow until 2007. In 2007, the world markets have faced the most serious financial crisis since 1929 Economic Depression and the public deficit of Greece reached 7% of GDP (Thomadakis, 2015). Due to the global financial instability, Greek economy started to have much more public deficit. As Mavridis (2018) mentioned, higher public deficit forced the global markets provide loans with higher interest rates to Samaras government. The situation got more chaotic each day due to more public deficit and Samaras government started to take more loans with higher interest rates in order to balance the deficit (Tziovas, 2017).

As it can be seen in Figure 11 below, we can see that Greek government's budget deficit did not reach any positive value until 2016. This indicates that the public deficit continued for almost 9 years and the peak point of the financial crisis was in 2009 with -15.10% of GDP. This was a turning point for Greece because the country found itself in a chaos and many economic sectors started to get affected negatively. Although the deficit started to decrease in 2010 with -11.20% of GDP and then -10.30% of GDP in 2011, the country found itself not only in an economic crisis but also a civil unrest which resulted in heavy clashes between government security units and street protesters. At the same time, Greece started to lose its most important economic source which is tourism revenues.

Greece's public deficit lowered to -8.9% in 2012 but it rose to -13.20% in 2013. This showed EU and Greek government that the full recovery of the economy was going to take much time (Mavridis, 2018; Papadimitriou et al., 2018). As it was stated by International Monetary Fund (IMF), the full recovery of economy required much more effort of the Greek government and EU (IMF, 2013). On the other hand, IMF (2014) underlined that, Greek government could have positive values in budget deficit by making structural reforms in taxation, social security (retirement fees in particularly) and government spending. As Mavridis (2018) pointed out, Greece

lost 22% of its pre-crisis income and real GDP fell by 26% and this made Greek government to be too dependent on its EU partners' help with debts.

Figure 11. Greek government's budget deficit (%GDP) from 2006 to 2018.



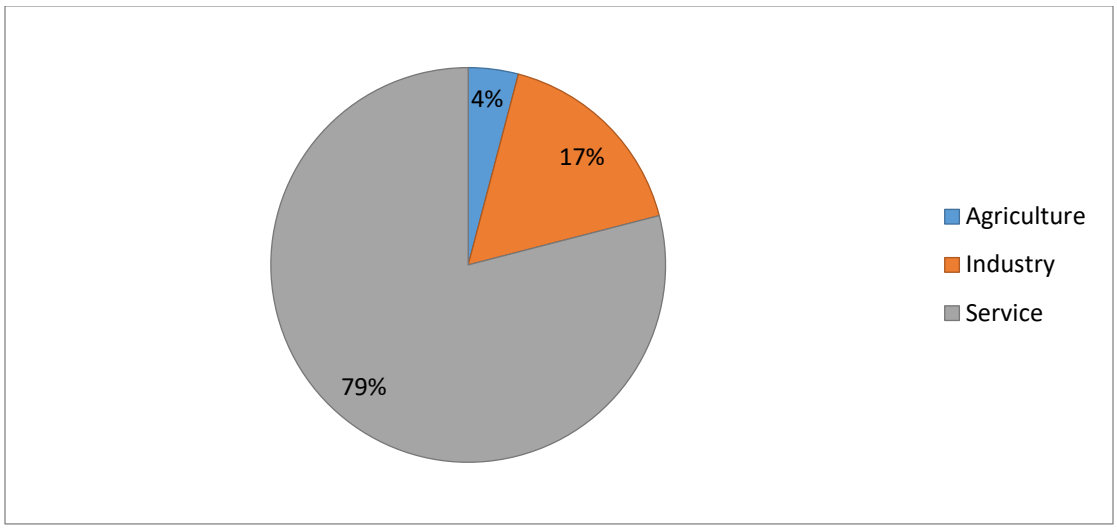
Source: Statista, 2020b

This led Greece to hold multiple elections and after a political struggle, SYRIZA movement (The Coalition of the Radical Left) won the elections in 2015. The leader of the SYRIZA movement Alexis Tsipras became the Prime Minister and Greece started to have more strict policies than the Samaras' government period even though they had promised opposite to their voters (Donnelly and Vicek, 2017). Tsipras government passed austerity measures which targeted almost all social classes in the country by increasing taxes to middle and high level income earners and at the same time by cutting the pensions of retired elder population (Donnelly and Vicek, 2017). These heavy measures worked well for Greece and Greece started to have positive public deficit starting from 2006 with +0.5% of GDP for the first time since 1980s.

Tsipras government took further measures by making across-the-board budget cuts amounting to about 3% of Greece's GDP and by removing value-added tax discounts (Donnelly and Vicek, 2017). This led Greece to have further positive values in 2017 and public deficit became +1% of

GDP in 2018. Furthermore, Tsipras government started to rely on tourism income and saw it as a remedy for the financial crisis. As it can be seen in Figure 12, the contribution of agriculture sector to GDP is 4.1% while the contribution of industry sector to GDP is 16.9%. On the other hand, the contribution of service sector to GDP is 79.1% which is related to dependence on tourism income as it is in the case of other Mediterranean countries such as Italy, Portugal and Spain.

Figure 12. Greece's contribution to GDP by sector in 2018.



Source: Statista, 2020c

Greek economy is heavily dependent on tourism and tourism has a significant share in the GDP (European Commission, 2019). It was not possible to invest in many sectors during the financial crisis and many sectors were not able to adapt themselves to changing global conditions. Nevertheless, tourism recorded double digit growth for three years a row (2017 – 2019) and it has direct and indirect contribution to GDP. According to European Commission (2019), tourism had approximately 27% contribution to GDP with 14.2 billion Euros (only direct contribution taken into account) in 2017.

According to INSETE (Institute of the Greek Tourism Confederation) (2019), tourism had further impact on the economy by 30% contribution to GDP with 57.1 billion Euros (both direct and indirect contribution are taken into account) in 2018. This meant that Greek economy's dependence

on tourism intensified and service sector's contribution to GDP got higher. As a result of these positive economic values, majority of the recent investments aim to develop tourism sector rather than other economic sectors and there are even E.U. funds for building of infrastructure in order to develop tourism sector in Greece (INSETE, 2019).

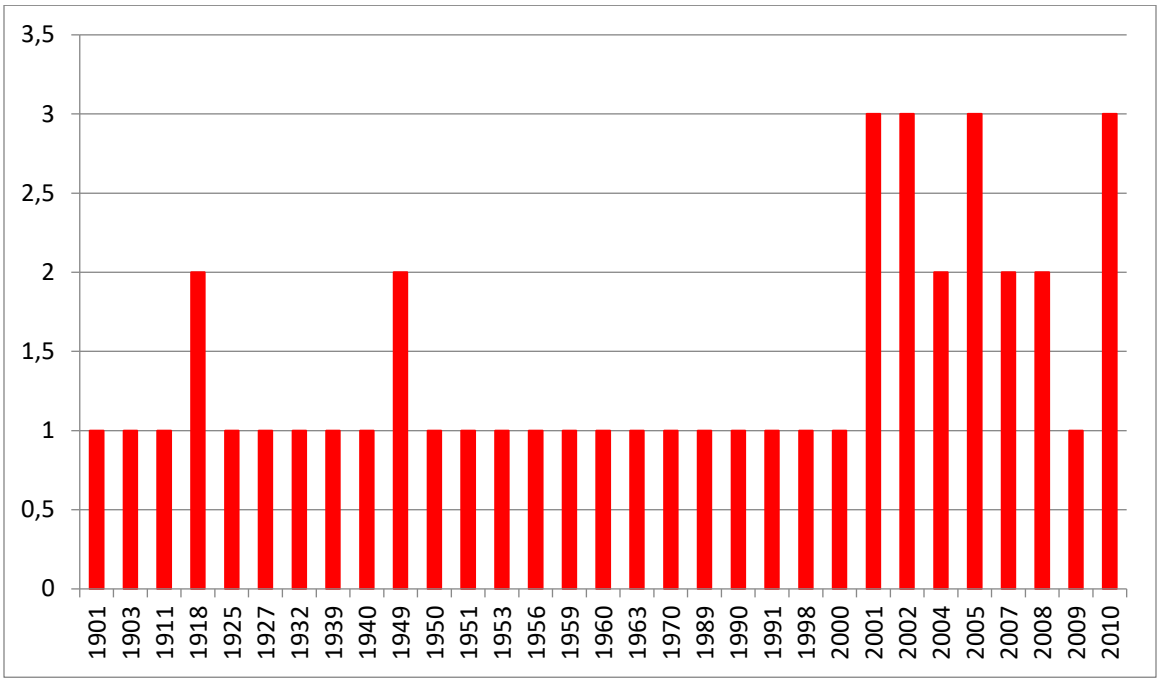
In order to expand tourism sector broader, Greek government privatized 14 domestic airports to transform them into world standard airports (European Commission, 2019). At the same time, Greek government wanted to boost regional development since there has been uneven distribution among the regions in Greece since 1970s. Greece is one of the Mediterranean countries that are heavily dependent on summer tourism even though it has 25.000 registered and protected monuments and archaeological sites as well as numerous museums (Buhalis, 2001). Consequently, climate and natural resources availability play certain role in Greek economic development since tourism is mostly based on summer tourism. As Buhalis (2001) mentioned, tourists will not choose to visit a touristic destination that has not enough natural resources availability and have a climate with extreme hot spells each day.

5.1.1. CLIMATE

If we look more deeply, we can notice that each region has specific characteristics and Greece has different climate and natural resources availability depending on the geographic locations. Northern and Central Greek regions such as Epirus, Macedonia and Thrace are rich in terms of water resources availability since they receive more rainfall during the winter seasons (Hellenic National Meteorological Service, 2019). In addition to this, daily absolute minimum temperatures of -20ºC are common in certain areas in Northern Macedonia and Northern Thrace, as well as at high altitudes in Central Greece (Giannakopoulos et al., 2011). Meanwhile, Southern Regions such as the Peloponnese, Crete Island and Aegean Islands have semi-arid or arid climates with less water availability since they receive less rainfall during the winter seasons (Hellenic National Meteorological Service, 2019).

As Giannakopoulos et al., (2011) mentioned, the daily maximum air temperature ranges between 32ºC and 36ºC, but can climb above 40ºC, as daily absolute maximum temperatures of over 45ºC have been recorded in certain areas of Central and Southern Greece during the summers. In the last decade, climate change has started to extend the seasons and higher temperatures started to occur from March until September in Greece (in particularly for the case of Southern Greece both mainland and islands) (Giannakopoulos et al., 2011). This is a dramatic climatic shift because longer seasons will mean much more usage of water resources. The air temperature used to increase gradually from May and the peaking period has been normally from mid-June to August in Greece (Giannakopoulos et al., 2011). However, the extension of the warmer periods can lead to dramatic conditions such as less water resources availability, water shortages and even droughts in the Southern Greece.

Figure 13. Number of extreme hot spells per year in Greece.



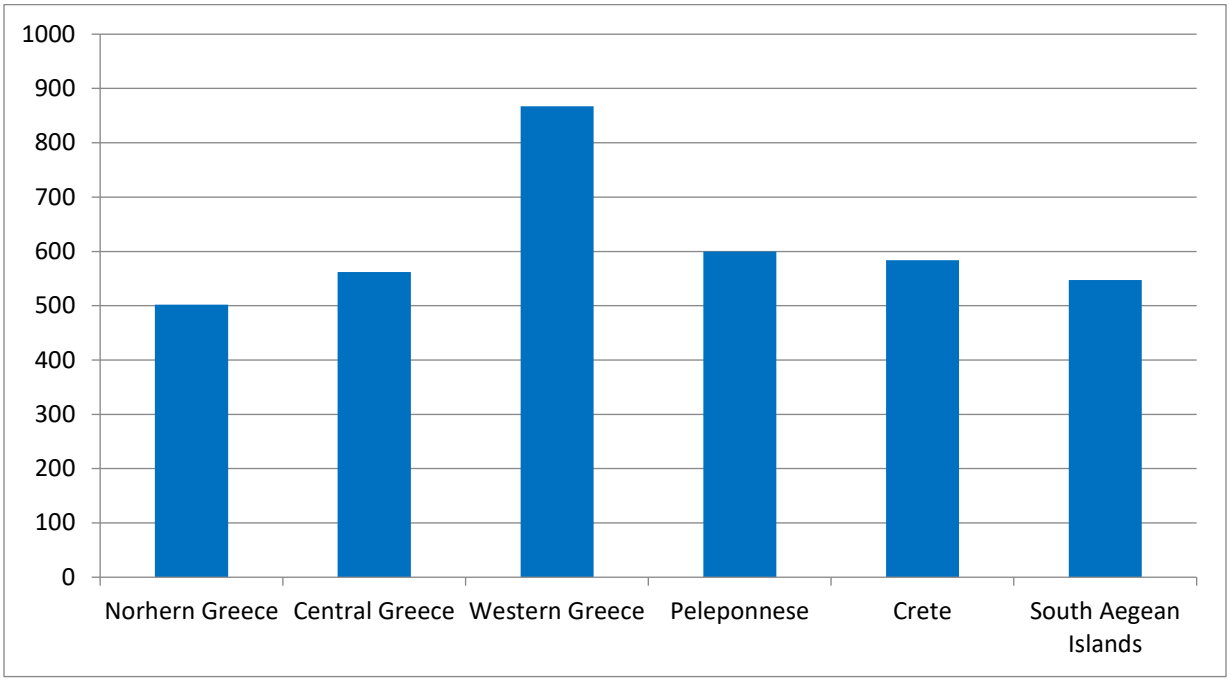
Source: Giannakopoulos et al., (2011).

As it can be seen in Figure 13, the numbers of days with extreme hot spells (which are at least 3 consecutive days with temperature over than 37ºC) have increased dramatically during the

summers from 2000s. It can be observed from Figure 13, Greece was not facing periodically extreme hot spells from 1900 until 2000 and there were many years without extreme hot spells during the summers. Nevertheless, extreme hot spells started to surface periodically from 2000 and the number of days with extreme hot spells even reached to 3 consecutive days in Greece.

Hence, this indicates that the changing climate conditions are affecting not only the extent of the seasons but also the levels of the summer air temperatures in Greece. Meanwhile, these changes in temperatures have an impact on the annual rainfall levels. As Giannakopoulos et al., (2011) mentioned, average annual precipitation levels differ each year due to climate anomalies and there is spatial uneven distribution of annual rainfall among regions due to their geographic locations. For that reason, Greece can witness high amount of rainfall in one region and almost no rainfall in another region at the same time period.

Figure 14. Average Annual Precipitation (mm/year) in Greek Regions.



Source: Hellenic National Meteorological Service, 2023

As it can be noticed from Figure 14, Northern Greece which covers the peripheries of West, Central and East Macedonia and Thrace, has 502 mm/year average annual precipitation. On the other hand,

Central Greece which covers Attica, Epirus, Sterea Hellas and Thessaly peripheries, has 562 mm/year average annual precipitation. Nevertheless, Western Greece which covers Ionian Islands and Western Hellas peripheries is the richest region with 867 mm/year average annual precipitation. Peloponnese region has 600 mm/year average annual precipitation and Crete has 584 mm/year average annual precipitation. The most complex region is South Aegean Islands since average annual precipitation changes from island to island. As an example, Rhodes Island has 86 days of rain with 703 mm/year average annual precipitation but at the same time Milos Island has 46 days of rain with 306 mm/year average annual precipitation (Hellenic National Meteorological Service, 2019). Hence, there is spatial uneven distribution inside regions which makes it difficult to say "Greece is a rich country" in terms of annual rainfall.

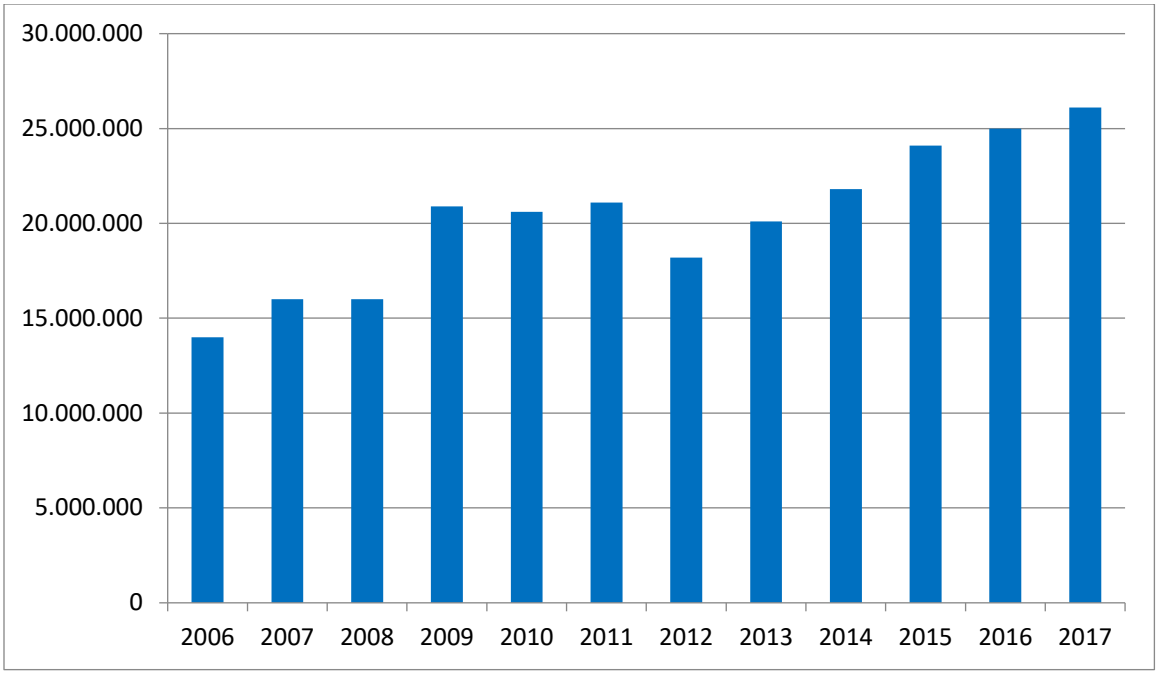
5.1.2. TOURISM ACTIVITY

The changing climate conditions with increasing number of days with extreme hot spells or differences in annual rainfall did not lower down the tourist arrivals to Greece (in particularly to Southern Greece). On the contrary, tourist arrivals continued to increase from May to September and seasonality of tourism has been broadened. As it can be seen in Figure 15, tourist arrivals to Greece were around 14 million in 2006 and they gradually increased until the year of 2012.

This particular reason was related to the Greek Economic Recession because the economic instability started to affect Greek population and this led to unrest in the country (Papatheodorou and Arvanitis, 2015). There were images of violence due to street protests as well as riots while there were even cases of closed airports due to strikes (Papatheodorou and Arvanitis, 2015). As a result of the economic recession and civil unrest, tourist arrivals to Greece decreased to 18.2 million from 21.1 million which meant almost 3 million less tourist arrivals. Nevertheless, tourist arrivals continued to increase by 2013 and arrivals reached to 20.1 million when the Greek government started to take economic as well as security measures and European Union aided the government fiscally (Mavridis, 2018).

The tourist arrivals continuously increased from 2013, onwards and they reached 26.1 million which meant that tourist arrivals increased almost 8 million by 2012. This led tourism to have a significant share than other industries such as agriculture, industry, shipping, etc. in the Greek economy (European Commission, 2019). Hence, infrastructure investments started to transform and many of these infrastructure investments started to be made for the tourism sector. If we look more deeply into the modes of transportation in arrivals, we can see that tourists are using land, air and sea transportation in order to visit Greece.

Figure 15. Number of Tourist Arrivals to Greece.



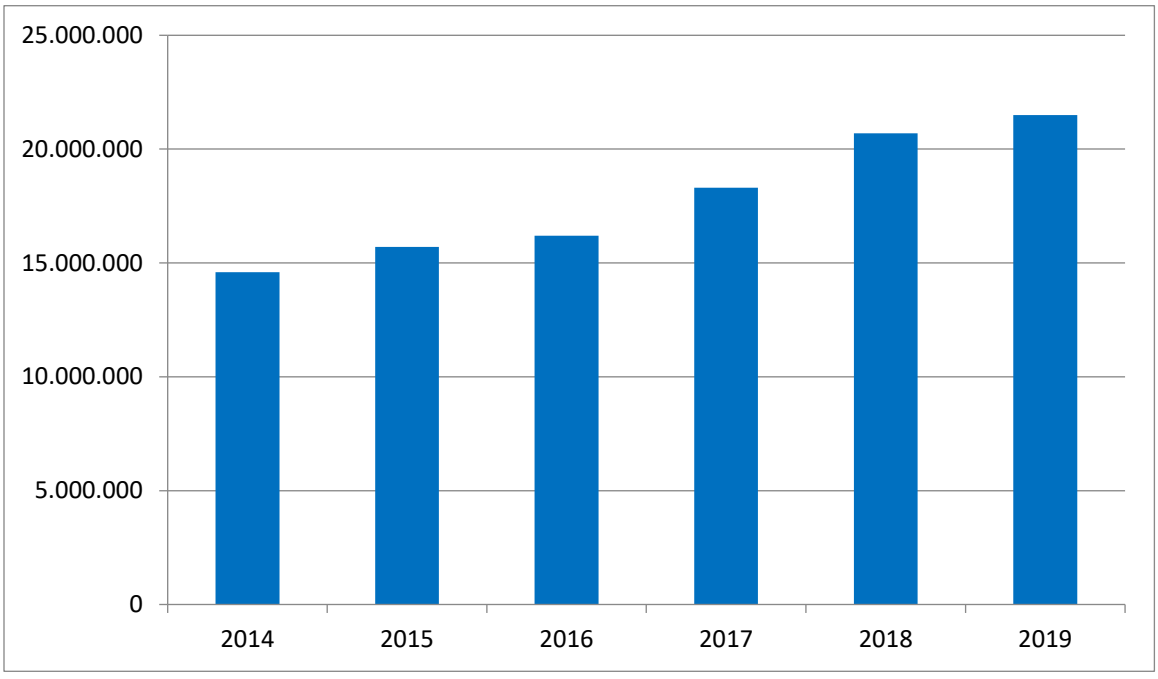
Source: Statista, 2020d

As it can be seen in Figure 15, the highest number of arrivals to Greece is by airlines. There are many tourists from Western, Central and Northern European countries that are using budget and charter airlines to visit Greece (Zenelis and Papatheodorou, 2008). The number of arrivals by air continued to rise gradually and the number of arrivals increased from 14.6 million to 21.5 million in the last 5 years. For that reason, it is possible to indicate that airlines play significant role in the tourist arrivals to Greece. Nevertheless, arrivals by airlines are not the sole mode of transportation

that the tourists are using in order to visit Greece. As it will be analyzed below, there are many international tourists in particularly from Eastern Europe that are using cars or buses to reach Greece.

There are many international tourists in particularly from Albania, Bulgaria, Northern Macedonia and Turkey that are using roadways to visit Greece. According to Hellenic Statistical Authority (2016), 2.5 million tourists visited Greece by using cars or buses as modes of transportation. The number of arrivals by land continued to increase but not significantly as it is in the case of arrivals by air. There were 3.7 million tourists visited Greece by using cars or buses as modes of transportation in 2019 (Hellenic Statistical Authority, 2019). This was equal to almost 1.2 million additional tourists that preferred to use roadways to visit Greece from 2016 until 2019. Hence, it is possible to mention that majority of the tourists prefer to use airlines rather than roadways to visit Greece. Nevertheless, there are many tourists that prefer to use sea transportation (cruise ships) to visit Greece.

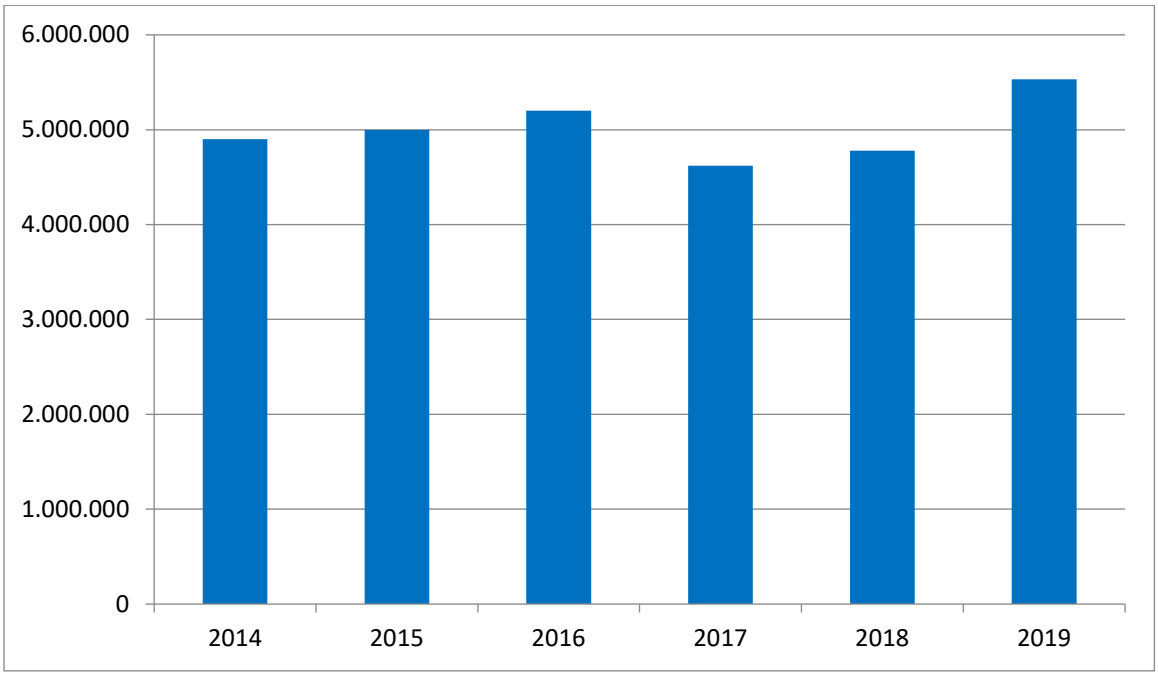
Figure 16. Number of Tourist Arrivals by Air to Greece.



Source: Hellenic Statistical Authority, 2020

Sea lines are the secondary preferred mode of transportation of international tourists to visit Greece. According to Hellenic Ports Association (2019), the number of arrivals by cruise ships was 4.9 million in 2014 and it continued to increase gradually until 2016 with 5.2 million tourist arrivals. Nevertheless, number of arrivals by cruise ships decreased in 2017 with 4.62 million tourists. According to Kasimati et al., 2019 the decrease in the number of arrivals by cruise ships in 2017 was related to substantial increase in the flights (charter flights and budget airlines as well) to Greek Islands. Charter flights, budget airlines and cheaper cruise ships are being preferred by international tourists (in particularly by the retired elder tourists and students) and they have been competing for the market revenues (Gross, 2010). For that reason, similar examples can be seen in other touristic destinations and this particular competition can decrease the shares of the cruise ships from time to time.

Figure 17. Number of Tourist Arrivals by Sea to Greece.



Source: Hellenic Ports Association, 2019

For that reason, cruise ship corporations competed for their market status and the number of arrivals by cruise ships increased in 2018 and reached to 5.53 million tourists in 2019 which was a

significant gain for the Greek economy. Although, Athens - Piraeus is the leading touristic port in Greece, there is evident number of tourists that prefer cruise lines as their mode of transportation to visit Greek Islands and this is determining factor behind the increase in the number of arrivals by cruise ships (Kasimati et al., 2019). As it will be analyzed below, the geolocation and geomorphology of the Greek Islands play significant role in the increasing number of international arrivals. It is not easy to reach each Greek island by airlines, since they are remotely located, some of the small and middle sized islands do not have any access to air traffic. Hence, geomorphology and geolocation of both mainland Greece and Greek Islands became evident indicators for installing the travel accommodation establishments and infrastructure.

Figure 18. Number of travel accommodation establishments in Greece in 2018 (by type).

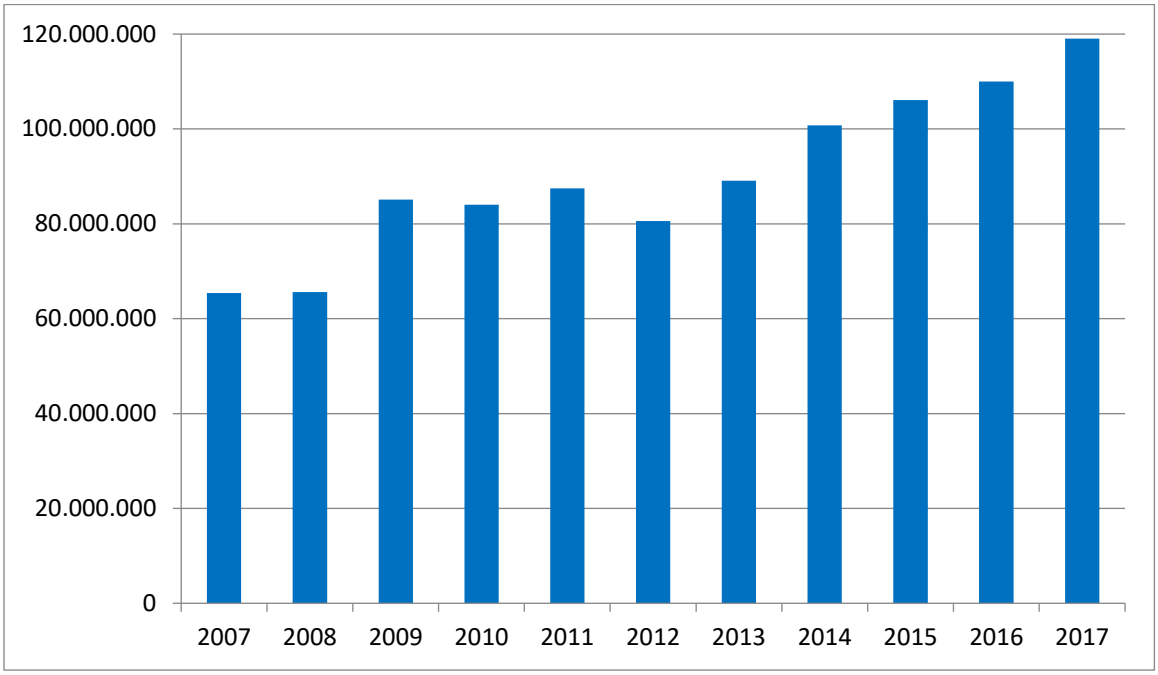
Source: Statista, 2020e

As it can be seen in Figure 18 the number of travel accommodation established in Greece in 2018 reached to a total of 38.180. Holiday and other short-stay accommodation numbers have reached to 27.996 which is a substantial number. On the other hand, there are almost 10.000 hotels and 304 camping grounds, recreational parks and trailer parks. In short, the transformation of the economic investments is visible from Figure 18. This transformation led to another substantial change in the tourism sector. Figure 19 show that the numbers of the overnight stays (in millions) in travel

accommodation in Greece between 2007 and 2018. We can notice that there is a parallel change in the tourist overnight stays.

As it can be seen in Figure 19, the number of tourist overnight stays was decreased to 80.57 million in 2012 due to economic recession and civil unrest in Greece. However, the number of overnight stays continued to increase essentially between 2013 and 2017. Hence, the number of overnight stays reached to 119 million in 2017 which meant almost 30 million more overnight stays than 2012. This is a dramatic change for the Greek tourism and in particularly for the Greek economy. However, we have noticed that the average number of nights spent in commercial accommodation establishments had a slight decrease between 2012 and 2017.

Figure 19. Number of overnight stays in travel accommodation in Greece between 2007 and 2018.

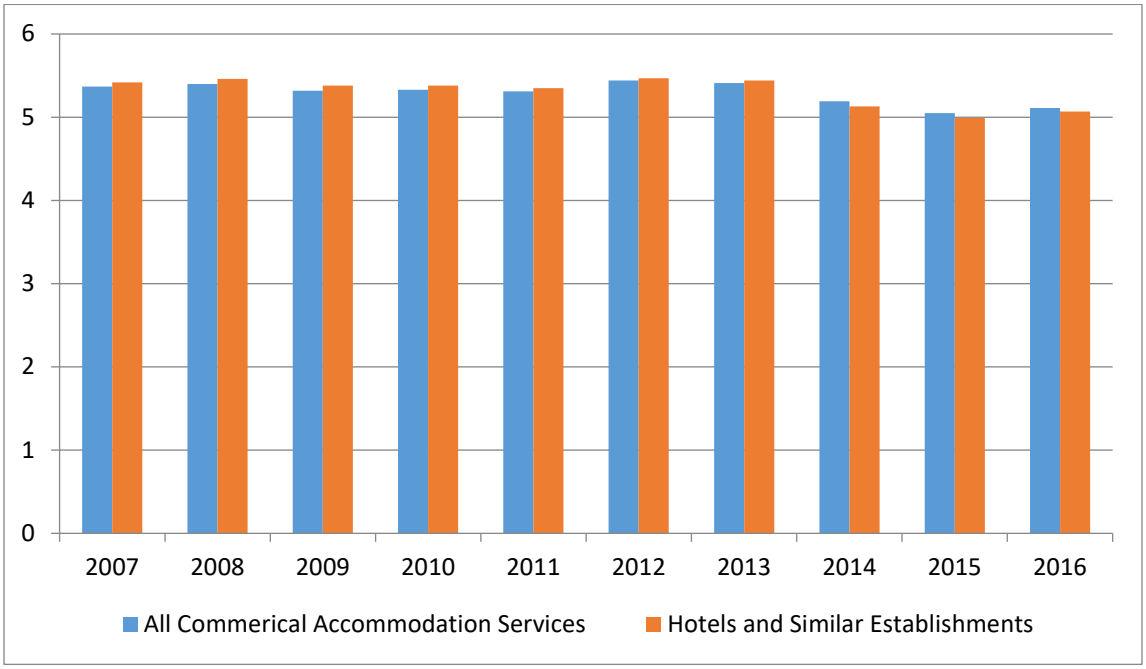


Source: Statista, 2020f

We can notice that the average number of nights spent in all commercial accommodation services by tourists in 2012 was around 5.44. However, these values started to decrease between 2012 and 2016. In 2016, the average number of nights spent in all commercial accommodation services by tourists became 5.11 which meant almost 0.33 decreases in the average number of nights spent.

Consequently, it is a necessity to look more deeply into the tourism revenues by years in order to understand whether the decrease in the average number of nights spent has an impact on tourism's contribution to GDP.

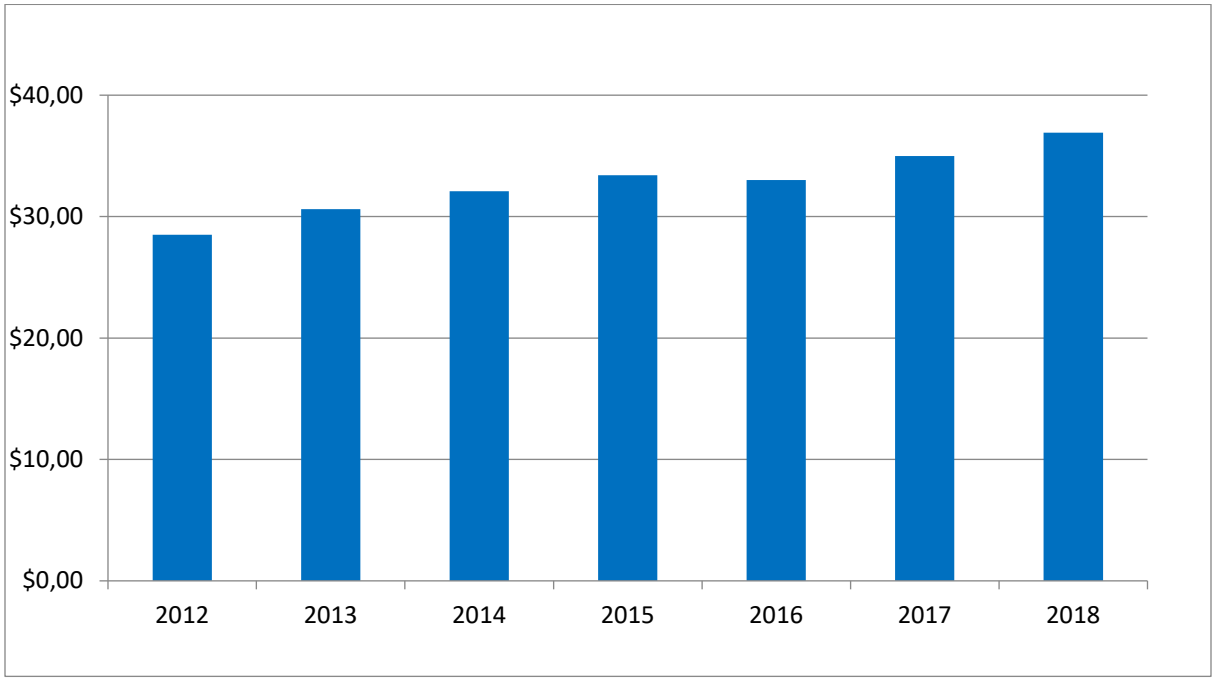
Figure 20. Average number of nights spent in commercial accommodation establishments in Greece from 2007 to 2017.



Source: Statista, 2020g

We can notice from Figure 21 that tourism had a total contribution of 28, 5 billion Euros to GDP during the financial crisis and civil unrest in 2012. It was a dramatic moment for the Greek economy and Greek politicians decided to change their tourism marketing policies including issuance of daily travel visas to Turkish and Russian citizens to Greek Islands in order to receive more revenues for the country's weakened economy (Reuters, 2012). These policies will be analyzed later in this work but the shift of the tourism marketing policies resulted in higher tourism revenues. As it can be noticed in Figure 21, Greece had almost 5 billion Euros raise of total contribution to GDP by the tourism sector only in 3 years and this contribution was up to 33, 4 billion Euros in 2015.

Figure 21. Travel and tourism's total contribution to GDP in Greece in Billion Dollars from 2012 to 2018.



Source: Statista, 2020h

Although, there was a slight decrease in 2016, the total contribution to GDP of tourism sector continued to increase gradually up to 36, 9 billion Euros in 2018. This meant almost 9 billion Euros of increase in the total contribution of tourism to GDP only in 6 years. Hence, the decrease in the average nights spent in Greece did not come up with a decrease in total contribution to GDP. Greek economy received a lot of revenues from the tourism sector and the policy shifts in the tourism marketing led the country to regain its global position in the tourism sector

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5.2. CYCLADES ISLANDS – MYKONOS AND SANTORINI

In this part of this chapter, there will be detailed information regarding the Cyclades Islands in particularly Mykonos and Santorini Islands which are the case study areas of this work. Cyclades Islands are consisted of 220 islands and major ones are: Andros, Ios, Kimolos, Milos, Mykonos, Naxos, Paros, Serifos, Sifnos, Sikinos, Tinos and Thira or Santorini Islands (Prokopiou et al., 2019). Each island has different geographic characteristics and each of them has different levels of natural resources availability (water resources in particularly). The climate is generally dry and mild which led Cyclades Islands to produce certain agricultural products such as wine, fruit, wheat, olive oil and tobacco (Prokopiou et al., 2019).

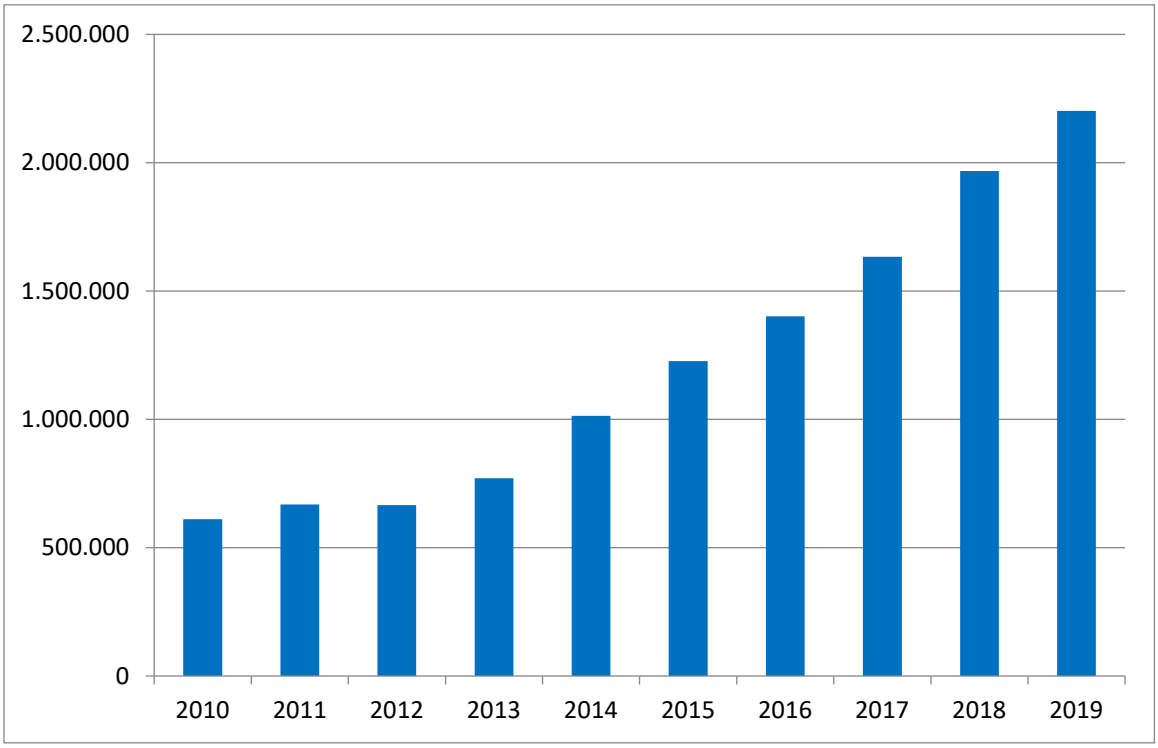
The population of the Cyclades is mainly concentrated in Syros (19,870), Naxos (18,988), Thira (Santorini) (13,960), Paros (12,853), Andros (10,009), Mykonos (10,134), and Tinos (8,574) (Hellenic Statistical Authority, 2019; Prokopoiu et al., 2019). Nevertheless, the remaining islands do not have significant populations which do not exceed more than 4.000 inhabitants with the only exception of Ermoupolis (15,000) which is the capital of Cyclades Islands (Prokopiou et al., 2019). As it can be seen in Map 2, Cyclades Islands differ in terms of their sizes and they are divided into nine regional units since 2011. In 2011, Kallikratis government took the decision to abolish The Cyclades Prefecture and the territory was divided into nine regional units which are responsibly: Andros, Kea-Kythnos, Milos, Mykonos, Naxos, Paros, Thira, Syros and Tiros (Prokopiou et al., 2019).

Map 2. Map of Cyclades Islands.

Source: WorldAtlas.com, 2020

As it was mentioned above, tourism became dominant economic sector for almost whole Greece after the financial crisis. When we look at the case of Cyclades Islands, we can notice that major source of income were agriculture, fishing and shipping until the 1960s in Cyclades Islands. As Prokopiou et al., (2019) underlined, a certain transformation in Cyclades occurred in the late 1960s which led agriculture, fishing and shipping to lose their importance and led tourism to become the dominant sector in 1990s. This shift led many agricultural lands to become rather houses or tourism units such as hotels or resorts. For that reason, Cyclades Islands have been facing major land transformation as well as economic transition from the late 1960s until today. On the other hand, this dramatic shift has come up with a burden which is linked to environmental issues such as deforestation, sand erosion, water scarcity, etc. in Cyclades Islands (Prokopiou, et al., 2019). Consequently, we need to look at the tourism development in Cyclades Islands more deeply by analyzing arrivals by air to the islands.

Figure 22. Number of Tourist Arrivals by Air to Cyclades Islands.

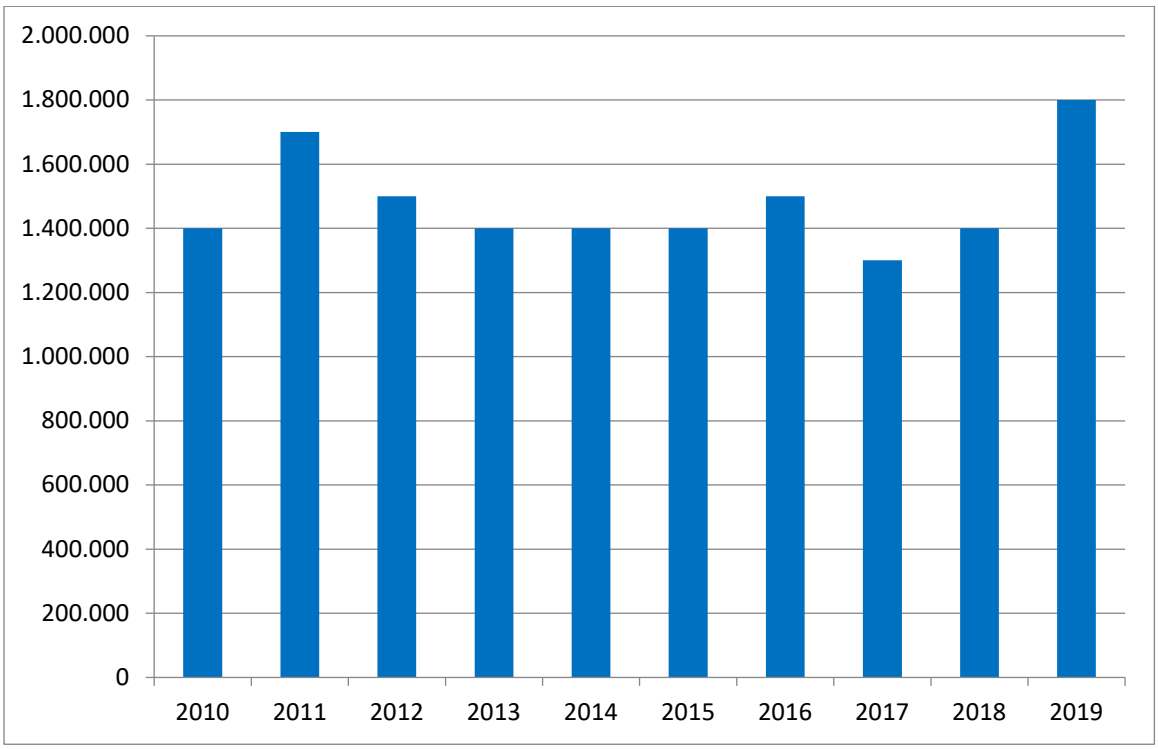


Source: Hellenic Statistical Authority, 2020

Figure 22 shows us the number of domestic and international arrivals by airlines to Cyclades Islands which are Mykonos (Domestic and International), Santorini (Domestic and International), Naxos (Domestic), Syros (Domestic), Paros (Domestic) and Milos (Domestic) from 2010 until 2019. We can see that there were 610.905 total air arrivals in 2010 and only in five years total arrival numbers were doubled. In 2015, there were more than 1.2 million total air arrivals to Cyclades Islands and these numbers gradually increased to more than 1.9 million in 2018. The highest number of total air arrivals was 2.2 million in 2019 which was a record in the history of Greek tourism. As it will be analyzed below, international arrivals have significant importance for Mykonos and Santorini. Nevertheless, there are really high numbers of domestic arrivals to both of the islands. Paros is the third important domestic destination among Cyclades Islands to reach over 100.000 arrivals in 2018. Although, airlines are very important for tourism, Cyclades Islands

are receiving millions of tourists per year through cruise lines so it will be useful to look at the cruise passenger arrivals as well.

Figure 23. Number of Tourist Arrivals by Sea to Cyclades Islands.



Source: Hellenic Statistical Authority, 2020

Cyclades Islands have not been receiving less than 1.3 million cruise passenger arrivals per year since 2010. We can see from Figure 23 that there were 1.4 million arrivals in 2010 and numbers reached to 1.7 million in 2011. Nevertheless, budget airlines and charter flights started to operate in Cyclades Islands and there was a decrease in cruise passengers, starting from 2012. The lowest number of cruise passenger arrivals to Cyclades Islands was seen in 2017 with 1.3 million passengers. However, the number of cruise passenger arrival started to increase in 2018 and they reached the highest number 1.8 million passengers in 2019. When we add 2.2 million total number of air arrivals to 1.8 million total number of cruise passenger arrivals, we can see that 4 million domestic and international tourists visited Cyclades Islands in 2019. This shows us clearly how much popular destinations they have become in the last 10 years.

It is evident from air and cruise arrivals data that Cyclades Islands are not only a domestic destination for Greeks but also worldwide known international tourism destinations and they benefit significantly from tourism incomes. As a matter of this, tourism units have been gradually increasing in Cyclades. According to Prokopiou et al., (2019), there were in total 39,917 hotel beds capacity in Cyclades back in 2005. We can see from Table 11 that, in total, there were 1.634 hotel units with 1.016 rooms and 50,270 guest beds in 2017. This shows us how much tourism has importance for Cyclades Islands and hotels' guest bed capacity have increased 12% in 12 years. The increase in the number of hotels is gradually continuing in Cyclades Islands and only 140 new hotels are built in Santorini and Ios Islands from 2017 to 2019 (Municipality of Thira, 2019).

Table 11. Hotel Capacity in Cyclades Islands in 2017.

	5*	4*	3*	2*	1*	TOTAL
Units	146	289	346	628	225	1,634
Rooms	92	193	223	371	137	1,016
Guest Beds	8,048	11,879	11,349	15,001	3,993	50,270

Source: SETE, 2017

Similar increase can be also founded in the number of rooms for rent. As it can be seen in Table 12, there were 73,845 rooms for rent in total in 2017. This shows us there are so many apartments that are being rented by tourists during summer season in Cyclades Islands. As Prokopiou et al., (2019) underlined, introduction of AirBNB to Cyclades Islands played a major role in the high number of rooms for rent since they provide much cheaper vacation choices for both domestic and international tourists that are planning to visit the islands.

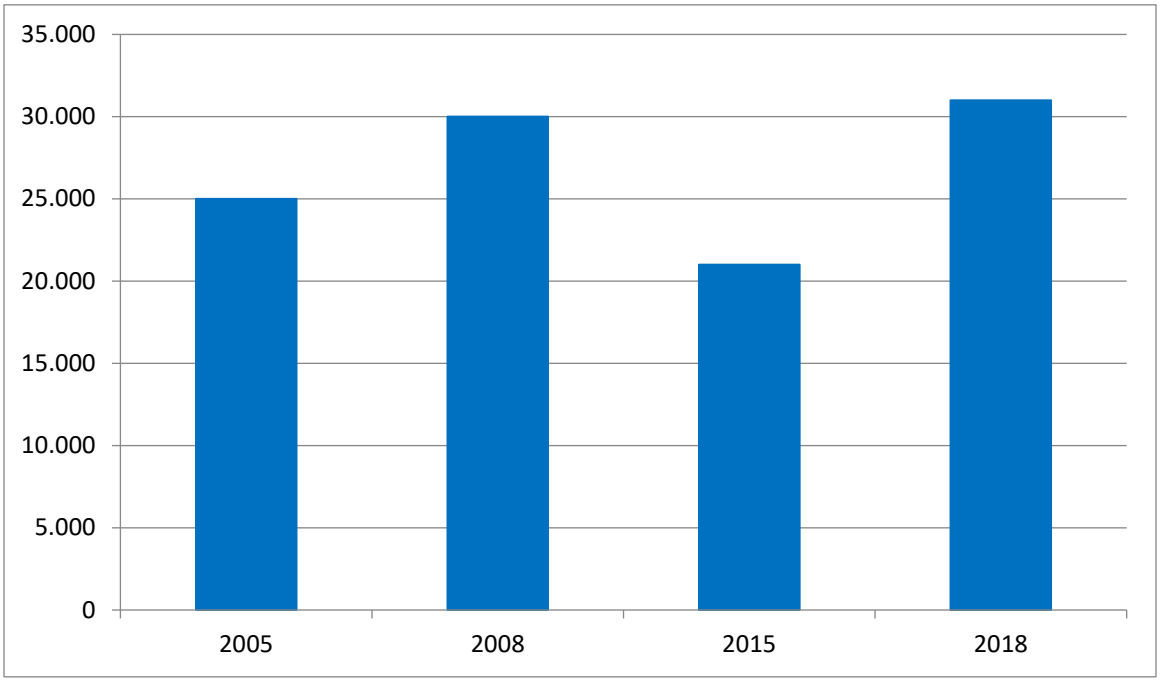
Table 12. Rooms for Rent in Cyclades Islands in 2017.

	4K	3K	2K	1K	TOTAL
Units	485	2,241	3,275	883	6,884
Rooms	903	4,312	6,378	1,731	13,324
Guest Beds	7,959	27,271	31,622	6,993	73,845

Source: SETE, 2017

These increasing numbers of air arrivals, cruise passenger arrivals, hotel units and rooms for rent show us clearly that tourism has significant importance for economic development in Cyclades Islands. We can observe that, GDP of Cyclades Islands was 25.000 euros per capita in 2005 and it reached up to 30.000 euros per capita in 2008. However, Greek financial crisis and instability in the country affected Cyclades Islands and GDP per capita decreased to 21.000 euros per capita in 2015. This was lowest GDP per capita recorded in Cyclades Islands ever since the end of 1990s. Nevertheless, new elections and change in government's economy and tourism policies affected Cyclades Islands positively and GDP per capita reached 31.000 euros in 2018 which is the highest GDP per capita recorded in the last 13 years. Meanwhile, these positive values can be seen in unemployment rates. According to OECD (2018), South Aegean Islands in particularly Cyclades Islands have the lowest unemployment rates among all other regions of Greece and it has also the lowest young employment rates as well. For that reason, tourism has become a remedy for Cyclades Islands' economic revival and become an ultimate source of employment.

Figure 24. GDP (Gross Domestic Product) per Capita Cyclades Islands (Euros).



Sources: Hellenic Statistical Authority, 2019; OECD, 2018

As it was mentioned above, economic success through tourism came together with a burden on environment and this work aims to analyze tourism's effect on water resources availability so we will look more into climate and water resources in Cyclades Islands. As it can be seen at Table 13, Cyclades Islands have typical Mediterranean climate with mild and moderately rainy winters with minimum 9 °C. The wind is essential for Cyclades and usually islands are exposed to cold wind from the mainland Greece (Hellenic National Meteorological Service, 2019).

On the other hand, summers are warm but there is *Meltemi* wind which reduces the feeling of warm weather while cooling the sea temperature and making the sea a bit rough (Hellenic National Meteorological Service, 2019). The average temperature is around 25 °C during the summers and daytime temperatures normally remain below 30°C. The highest temperatures can be seen during the extreme heat waves and Cyclades have maximum 35 °C during these periods when mainland Greece and other Greek Islands such as Dodecanese Islands have around 40 °C (Hellenic National

Meteorological Service, 2019). Consequently, one can notice that Cyclades Islands have relatively better climate than other touristic destinations in Mediterranean.

Table 13. Cyclades Islands Average Temperatures.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min (°C)	9	9	10	12	15	19	22	22	19	16	13	11
Max (°C)	14	14	16	19	22	27	28	27	26	22	19	16

Source: Hellenic National Meteorological Service, 2019.

Though, annual rainfall is not generous since Cyclades receives generally below 500 mm per year and climate change started to decrease the annual rainfall amount to 350 – 400 mm (Hellenic National Meteorological Service, 2019). Annual rainfall is robust during autumn and winter with 6 to 9 days average; there can be showers along with thunderstorms. Summers are very dry and there is almost no rainfall from June to August. For that reason, the landscape is semi-arid and it is not possible to harvest agricultural goods that require a lot of water (Hellenic National Meteorological Service, 2019).

Table 14. Cyclades Islands Average Precipitation.

Month	Ja	Fe	Mar	Ap	May	Jun	Jul	Au	Se	Oc	No	De	Year
Prec. (mm)	75	50	45	20	16	2	0	1	6	45	60	90	411
Prec. (in)	3	2	1.8	0.8	0.6	0.1	0	0	0.3	1.8	2.4	3.5	16.2
Days	9	7	6	3	1	0	0	0	1	4	6	9	46

Source: Hellenic National Meteorological Service, 2019

Cyclades Islands have no less than 15 °C average sea temperature during the whole year. As it can be seen in Table 15, the warmest months in Cyclades are June, July and August when the average sea temperature is 21-23 °C. Cyclades Islands have similar average sea temperatures during September and October so tourists continue to visit the islands during these months (Hellenic National Meteorological Service, 2019).

Table 15. Cyclades Islands Average Sea Temperature.

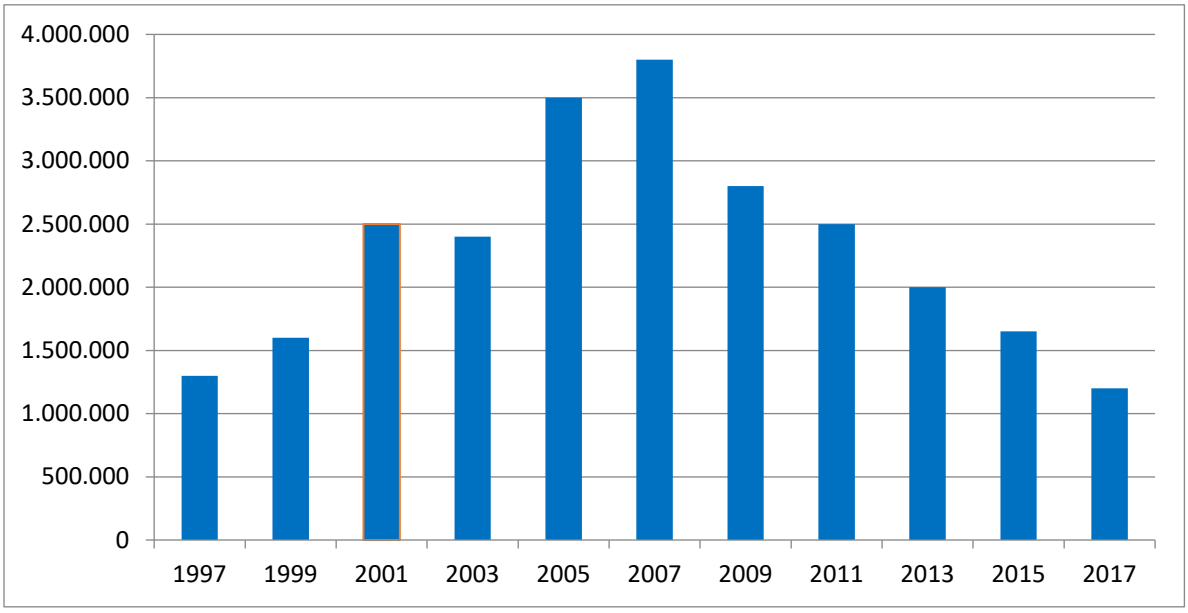
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min (°C)	16	15	15	16	18	21	23	23	23	21	18	17

Source: Hellenic National Meteorological Service, 2019.

As we can understand above, water has been always a problem for Cyclades Islands[10] since they have limited water resources with semi-arid or arid climate that receive lower amount of annual rainfall compared to mainland Greece (Kaldellis et al., 2004; Panagiotis, 2017). Nevertheless, main water scarcity issue showed itself dramatically during 1990s when South Aegean Islands became popular tourism destinations. In the beginning, local water authorities in Cyclades and Dodecanese Islands tried to find solutions to water scarcity problem through transporting water with ships from mainland Greece / Athens (in the case of Cyclades Islands) or Rhodes Island (in the case of Dodecanese Islands) (Kaldellis et al., 2004; Panagiotis, 2017). However, high costs of water transportation and increasing water demand in the islands during summers forced local water authorities to look into alternative solutions rather than water transportation.

[10] Dodecanese Islands have similar problems with water availability. For that reason, it is a general problem among South Aegean Islands and solutions with non-conventional water resources such as desalination plants have been a common topic.

Figure 25. Transported Water Quantity ($m^{3/}$year) to Southern Aegean Islands from 1997 to 2017[11]



Sources: Kaldellis et al., 2004; Kaldellis and Kondili, 2007, Panagiotis, 2017, DEYAM, 2019

As we can see from Figure 25, we can see that there was an increasing trend in the amount of transported water (m^3/year) starting from 1997 with 1.3 million m^3/year transported from rather mainland Greece (Athens) or Rhodes Island to Cyclades and Dodecanese Islands. South Aegean Islands differ from each other in terms of size as well as natural resources availability.

As Kaldellis et al., (2004) underlined, there are 11 very dry islands among Cyclades which are Amorgos, Koyfonisi, Kimolos, Heraklia, Shinousa, Folegandros, Tinos, Sikinos, Therasia, Donousa and Milos Islands that have limited water resources availability and not enough for summer tourism season. On the other hand, there are 9 very dry islands among Dodecanese which are Agathonisi, Lipsi, Megisti, Nisiros, Patmos, Simi, Chalki, North Kalimnos and Pserimos Islands that have very scarce water resources availability (Kaldellis et al., (2004); Kaldellis and Kondili, 2007). As a matter of fact, these nine Dodecanese Islands receive 65% of the total transported water with ships.

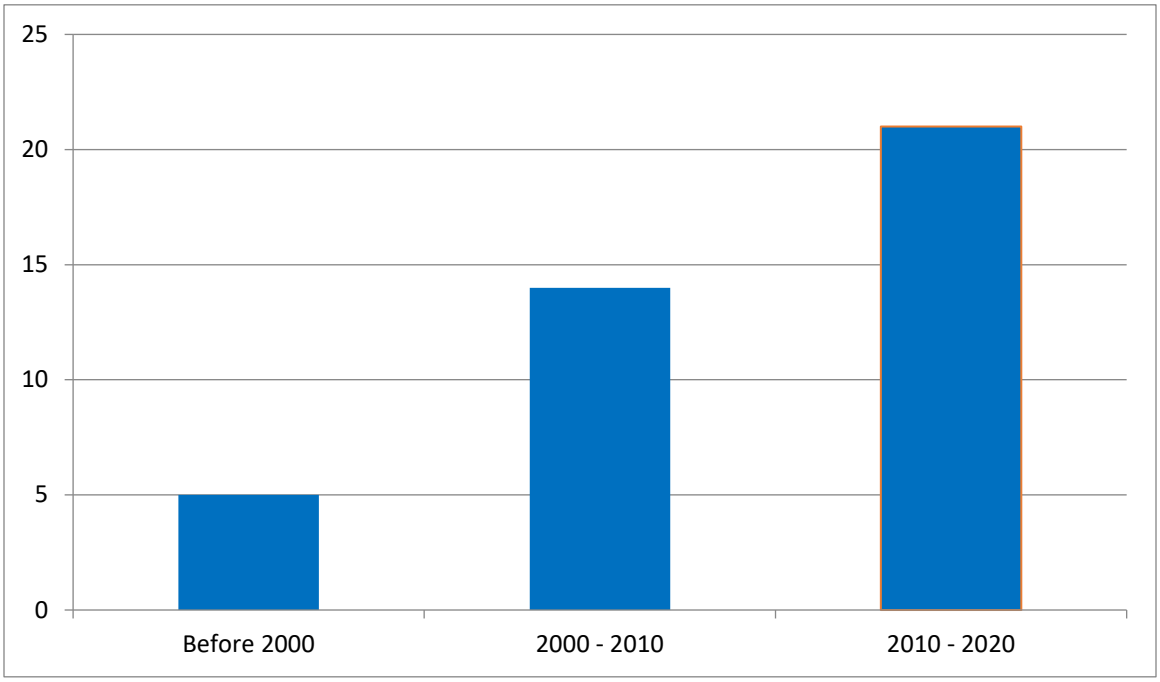
[11] These values are calculated as average and there can be +/- 10%.

The amount of transported water (m^3/year) continued to increase from 1997 and it reached its peak value with 3.8 million (m^3/year) in 2007. This was a crucial moment for South Aegean Islands since it was almost three times more transported water compared to 1997. At the same time, higher amount of transported water coasted 73.5 millions of euros to local municipalities and in particularly to Greek government which led both parties to take decisions to rely on non-conventional water resources such as desalinated water from desalination plants (Panagiotis, 2017).

We can notice from Figure 25 that, amount of water that was transported, gradually decreased after 2007 and they were lowered to 2.8 million (m^3/year) in 2009. There were two factors behind this strong decrease in two years. First of all, Greek financial crisis and civil unrest led Greece to receive less tourist arrivals in this period as it was discussed above. Secondly, Greek officials and local water authorities started to invest in non-conventional water resources in particularly Reserve Osmosis (RO) and Sea Water Reserve Osmosis (SWRO) type of desalination plants (Panagiotis, 2017). As a matter of fact, the investments started to be effective and led to fewer amounts of transported water from mainland Greece as well as Rhodes Island.

The decreasing trend of transported water with ships continued and they decreased down to 1.2 million (m^3/year) in 2017 which was less than the values of 20 years ago. However, desalination plants take the role instead of transported water with ships in the last 20 years. As Arampatzis et al., (2017) pointed out, the rate of installing desalination plants was quite low during the early 2000s but they started to increase significantly prior to the Olympics in Greece in 2004. As we can see at Figure 26, there are 40 desalination plants which are already constructed or being constructed in the Southern Aegean Islands. We can notice that majority of these desalination plants were installed in the last 20 years. For that reason, desalination plants have been seen as the major alternative to transported water with ships by the local water authorities as well as central government.

Figure 26. Number of Desalination Plants at South Aegean Islands.

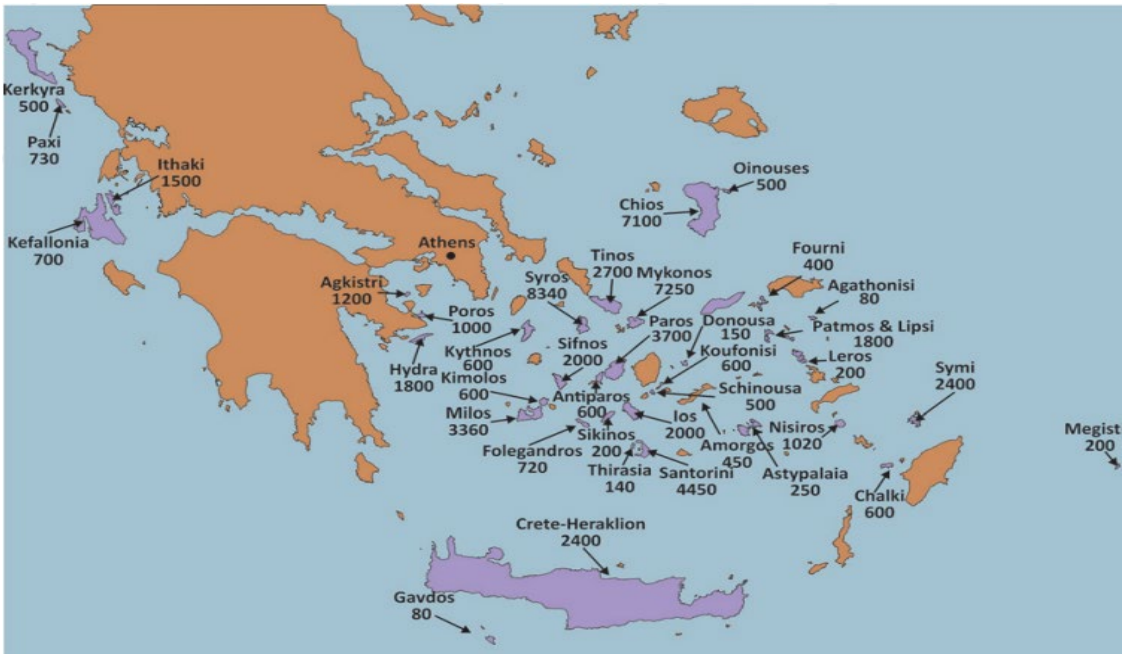


Sources: Aegean and Island Policy Ministry, 2019; DEYAM, 2019; DEYATH, 2019; Panagiotis, 2017; Zotalis et al., 2014

As Arampatzis et al., (2017) underlined, the total capacity of desalination units was 60,000 m^3/ day in 2017 and the capacity has been gradually increasing in the last three years.[12] Desalination units are being used in 39 Greek Islands[13] among Crete, Ioanian Islands, North Aegean Islands and South Aegean Islands with 9000 m^3/day of brackish water feed and 51,000 m^3/day of seawater feed capacity (Arampatzis et al., 2017). It is an interesting factor that majority of the desalination units that were installed from 2010 to 2020 are using renewable energy resources. This is highly related to huge amount of operation costs of fossil fuel based desalination plants and renewable energy resources based desalination plants are relatively more environment friendly than fossil fuel ones (Panagiotis, 2017).

[12] There are new desalination plants projects for the cases of Mykonos and Santorini Islands. It will be discussed later in this work.
[13] Five more islands are planning to install desalination plants (Arampatzis et al., (2017).

Map 3. Map of Desalination Plants located at Greek Islands.



Source: Arampatzis et al., (2017).

The long and the short of it is that, water demand in Greek Islands is constant and it is even increasing more each year due to changing climate conditions, less rainfall during winters and more tourist water demand during summers. For that reason, the only thing that has changed in Greek Islands is the means to supply water resources; transported water with ships left its increasing share to fossil fuel based desalination plants and fossil fuel based desalination plants left their increasing shares to renewable energy resources based desalination plants. Nevertheless, tourist arrivals both domestic and international remain constant and water demand during summers is increasing gradually in particularly for popular tourism destinations such as Mykonos and Santorini Islands among Cyclades.

UNIVERSITAT ROVIRA I VIRGILI
THE WATER SCARCITY AND SUSTAINABLE TOURISM IN THE GREEK ISLANDS: FOCUS CYCLADES ISLANDS
Itri Atay

5.2.1. MYKONOS ISLAND

Mykonos is one of the most touristic Greek Islands and it has an area of 85.5 square kilometers with an elevation of 341 meters above sea level (Xenarios et al., 2013). Mykonos has two municipal districts which are respectively Mykonos Town (Central) and Ano Mera (Mykonos Municipality, personal communication, 18 August 2015). Mykonos population was 10.134 inhabitants according to the last population census in 2011 but permanent population has risen in the last 8 years and it is estimated to be 12.150 inhabitants in 2019 (Mykonos Municipality, personal communication, 18 August 2015). Furthermore, it has one of the highest summer populations in whole Greece due to seasonality of tourism in the last 15 years (Xenarios et al., 2013). For that reason, tourism has clear importance for the island and it is the ultimate source of the economic activity in the island. As Xenarios et al., (2013) underlined, tourism in Mykonos is almost equal to 10% of whole Greek tourism which shows how much Mykonos Island is important for the Greek economy.

Map 4. Map of Mykonos Island.

Source: Lonely Planet, 2020a

Mykonos is an island that has four seasons and as it can be seen in Table 16, Mykonos has mild winters from December to mid-March and the weather is generally windy and quite rainy. The wind is sometimes violent which makes the air feel colder than it is and the lowest temperature is around 8 °C (Hellenic National Meteorological Service, 2019). During the spring season which is from mid-March to May, the weather is quite sunny but it is also windy. At the end of the spring season which is by mid-May, a typical Aegean wind called as *Meltemi* starts to blow which is a persistent wind, cool and dry (Hellenic National Meteorological Service, 2019). The lowest temperature during spring is 11-12 °C and the highest temperature can reach by mid-May 27-28 °C.

Summer season starts from June and it ends on mid-September and this is the most touristic season of Mykonos. *Meltemi* blows in July and August and the wind gusts can exceed 70 kph and as a result of this the maximum temperature is usually below 30 °C when it can reach up to 40 °C in other Greek Islands (Hellenic National Meteorological Service, 2019). Autumn season starts from mid-September and ends on November. The weather is sunny and warm but usually starts to get much cooler and rainier due to strong *Meltemi* wind blows on November (Hellenic National Meteorological Service, 2019). Hence, Mykonos is one of the windiest places in Europe and wind potential of Mykonos has been seen as a remedy to solve the water scarcity problem in the island.

Table 16. Mykonos Average Temperatures.

Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Min (°C)	8	8	9	12	15	19	21	21	19	16	12	10
Max (°C)	13	14	15	18	22	26	27	27	25	21	18	15

Source: Hellenic National Meteorological Service, 2019.

Although, the temperatures cannot reach up to 40 °C and there is wind potential of the island; the island has limited water resources due to changing climate conditions and seasonality of over tourism. As a result of these factors, Mykonos Island started to suffer from poor natural water

resources and it started to receive less annual rainfall in the last decade (DEYAM, personal communication, 20 August 2015). As it can be seen in Table 17, Mykonos has a total precipitation of 498 mm and it has 57 days with rainfall per year. Most of the rainfall occurs from December to January (approximately 20 days) which is winter season. Nevertheless, there are only 6 days with rainfall from May until September which is a critical rainfall level since most of the tourism activities take place during this period.

Table 17. Mykonos Average Precipitation.

Month	**Ja**	**Fe**	**Mar**	**Ap**	**May**	**Jun**	**Jul**	**Au**	**Se**	**Oc**	**No**	**De**	**Year**
Prec. (mm)	100	70	60	25	15	4	2	2	10	45	65	100	498
Prec. (in)	3.9	2.8	2.4	1	0.6	0.2	0.1	0.1	0.4	1.8	2.6	3.9	19.6
Days	10	8	7	5	3	1	0	0	2	5	6	10	57

Source: Hellenic National Meteorological Service, 2019.

For that reason, over tourism seasonality started to become a problem for Mykonos since the island population gets sometimes ten even twenty times more than its regular population (Andriotis, 2004). On the other hand, current climate change started to affect *Meltemi* winds and temperature levels started to differ than the ordinary levels. This change in temperature led more touristic arrivals because sea temperatures started to get much warmer. As it can be seen in Table 18, sea temperature levels start to get warmer from May and they get colder at the end of October which means broader tourist seasonality.

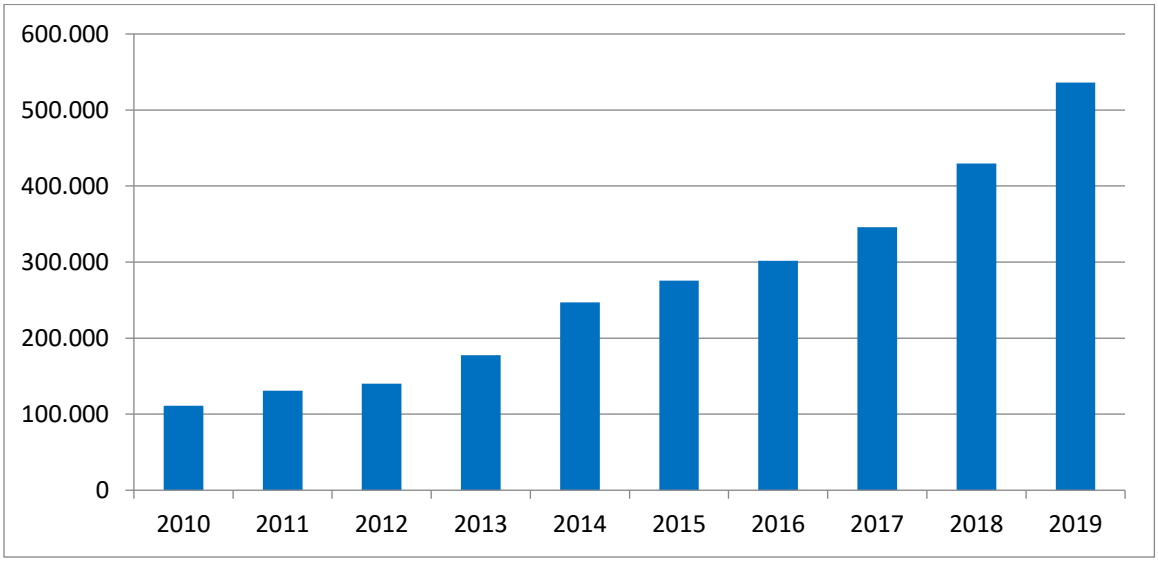
Table 18. Mykonos Average Sea Temperature.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min (°C)	16	15	15	16	18	21	23	23	23	21	18	17

Source: Hellenic National Meteorological Service, 2019.

Airlines and cruise ships are the primary modes of transportation that tourists (International as well as domestic tourists) are using to visit Mykonos. As it can be seen in Figure 27, number of international air arrivals to Mykonos was only 111.000 in 2011. Nevertheless, number of international air arrivals increased gradually and reached up to 275.800 in 2015 which meant more than doubled numbers of international air arrivals to the island only in 5 years. As it was mentioned above, 2016 was a turning point for whole Greece since SYRIZA movement was elected as the government. The structural reforms led Mykonos to have 346.100 international air arrivals in 2017, 429.500 international air arrivals in 2018 and finally 536.100 international air arrivals in 2019. This continuous increasing trend clearly shows that the structural reforms and tourism investments were fruitful for Mykonos as well as for Greece.

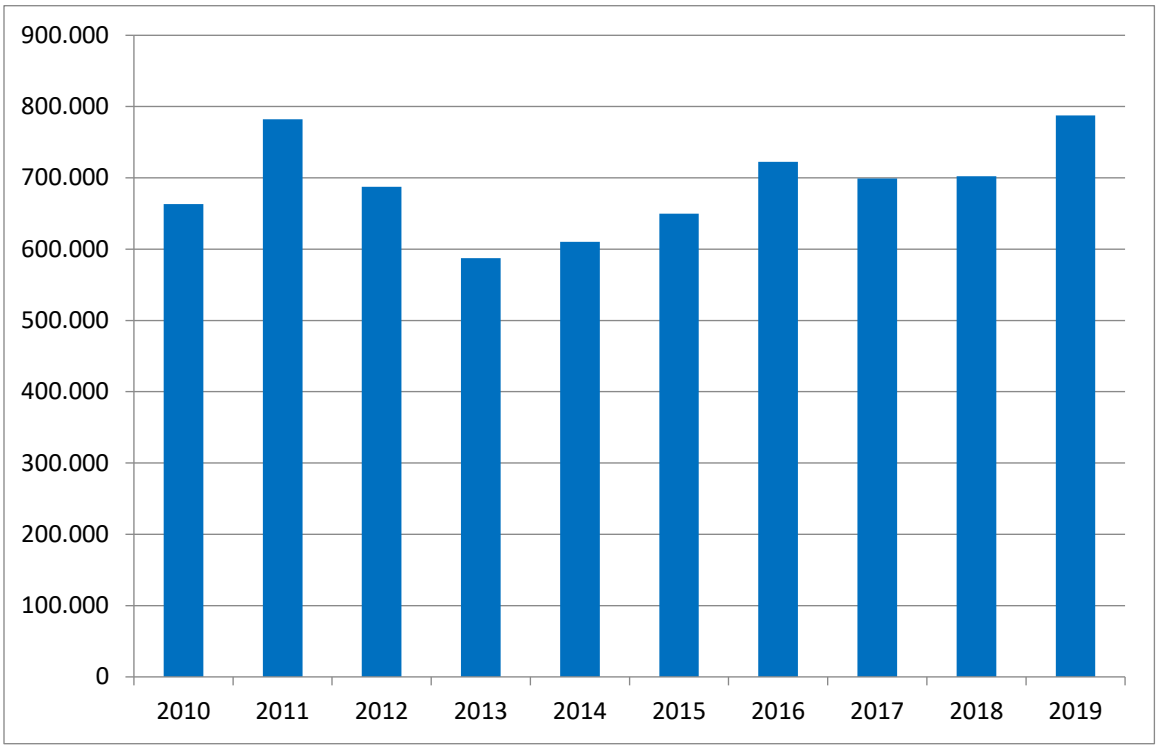
Figure 27. Number of International Air Arrivals to Mykonos from 2010 to 2019.



Source: Hellenic Statistical Authority, 2019

However, airlines have not been the primary modes of transportation to visit Mykonos. As it can be seen in Figure 28, cruise passenger arrivals to Mykonos was 663.300 in 2010 and even reached to 782.300 passengers in 2011. Domestic passengers have significant percentage among the cruise passengers that prefer to visit not only Mykonos but also majority of Greek Islands (Kamenidou et al., 2009). However, there is no common trend in the number of cruise passenger arrivals to Mykonos and the arrivals differ from year to year. As it can be seen in Figure 28, number of cruise passenger arrivals decreased to 587.500 in 2013 but increased to 722.500 in 2016. Nevertheless, the highest number of cruise passenger arrivals to Mykonos took place in 2019 with 787.400 passengers. Hence, we can see that cruise ships did not leave their market shares to airlines although the numbers shift year to year.

Figure 28. Number of Cruise Passenger Arrivals to Mykonos from 2010 to 2019.



Source: Hellenic Statistical Authority, 2019

For that reason, one can notice that Mykonos is one of the busiest touristic locations in Greece (even in the world) in particularly during summers. This situation creates certain stress on water

resources availability and over tourism has become not only an economic remedy but also a threat for the sustainable future of Mykonos. DEYAM (The Municipal Water and Sewage Enterprise of Mykonos) is the responsible authority for the water supply in Mykonos and DEYAM has been working on alternative solutions to supply water in order to match the demands of the residents as well as tourists.

Mykonos Island has two dams that were built by DEYAM authorities to collect rainwater which are *Marathi* and *Ano Meras*; there are also around 1000 wells which are being used to collect brackish water (DEYAM, personal communication, 20 August 2015). Nevertheless, the amount of rainfall and the ground water became not enough to supply the needs of the island in particularly during the tourist season from mid-May to mid-September. For that reason, desalination units had been installed to support the water supply system and there are already five desalination units which are being used by water authorities (DEYAM, personal communication, 20 August 2015). There is an existing 45 km network pipe system to distribute water to livelihoods, hotels, resorts as well as remaining small farms in the island (DEYAM, personal communication, 20 August 2015).

Table 19. Mykonos Municipality Annual Water Needs (m^3/Year).

MUNICIPAL DISTRICT	ANNUAL WATER NEEDS (M^3/YEAR)[14]
MYKONOS CENTER	1.657.399 m^3
ANO MERA	235.429 m^3
TOTAL	1.892.828 m^3

Source: DEYAM, personal communication, 11 August 2019

Table 19 shows the amount of annual water needs per municipal districts together with the calculation of 20% water losses in 2019. As we can see, Mykonos municipal district requires 1.657.399 m^3 of annual water supply per year. On the other hand, Ano Mera municipal district requires 235.429 m^3 of annual water supply per year which makes the total amount 1.892.828 m^3 of annual water supply per year for Mykonos Municipality. The total amount of water (together

[14] According to DEYAM (2019), average water daily need per person in Mykonos Island is 137 liters per day.

with the calculation of 20% water losses) was approximately 1500000 m^3 for Mykonos Municipality in 2015 (DEYAM, personal communication, 20 August 2015).

Hence, this shows us that there has been almost 21% additional demand in the total amount in 3 years for Mykonos Municipality. In order to analyze this shift, there is a need to look more deeply into the water needs per months. Table 20 below will give an insight of the water needs (m^3) per day and per month including the demands of permanent residents, second house owners and tourists that are having overnight stays. However, water demands of tourists that are visiting Mykonos without overnight stays (Mostly cruise ship passengers) and stays at rented rooms which are not AirBnBs are not included in Table 20. As a result of this, these numbers are estimates and actual water demand is most likely higher than it is calculated below at Table 20.

As we can see from Table 20, seasonality plays an important role for the water demand in Mykonos Island. According to SETE (2019), Mykonos have more than 80.000 tourists population from mid-June to the beginning of September when daily cruise passengers and tourists that are renting houses or AirBNB type of accommodation (instead of hotels or resorts) are included into this scheme. As we can see at Table 20, water demand is 1.665 m^3 per day and 49.950 m^3 per month from January until March. Meanwhile, water demand is 5.905 m^3 per day and 177.150 m^3 per month on June.[15] Consequently, permanent residents' three months demand is basically consumed in one month during the tourism season.

However, June is not the peak month of the tourism season in Mykonos. As we can see from Table 21, on July water demand in Mykonos are 6.843 m^3 per day and 205.920 m^3 per month while on August water demand in Mykonos are 7.604 m^3 per day and 228.120 m^3 per month. It has to be also noted that, peak season in the island is actually during warmest weather conditions without rainfall so this indicates that there can be higher demands according to changes in the air

[15] In fact much more than this amount with the start of cruise ships arrivals as well as tourists those are using rented rooms (non AirBNBs) as accommodation.

temperature. Hence, we can clearly notice that water demand is almost three times higher than normal demand on July and four times higher than normal demand on August.

Table 20. Mykonos Municipality Daily Water Needs (m^3).

MONTHS	**POPULATION**		**WATER DAILY NEEDS (m^3)[16]**
	PERMANENT RESIDENTS AND SECOND HOUSE OWNERS	TOURISTS [17]	
January	12.150	0 [18]	1.665 m^3
February	12.150	0	1.665 m^3
March	12.150	0	1.665 m^3
April	12.150	2.000	1.939 m^3
May	13.650	11.650	3.466 m^3
June	14.350	28.750	5.905 m^3
July	15.500	34.450	6.843 m^3
August	15.500	40.000	7.604 m^3
September	13.650	16.000	4.062 m^3
October	12.329	2.000	1.939 m^3
November	12.329	0	1.665 m^3
December	12.329	0	1.665 m^3

Sources: DEYAM, 2019; Hellenic Statistical Authority 2019; SETE 2019

As a matter of fact, seasonality of tourism and in particularly over tourism have been problems for the local water authorities in Mykonos although it has been seen as a remedy by the central government of Greece. Seasonality of tourism and over tourism phenomenon has been a problem not only in Mykonos or Cyclades Islands but also many different locations in the Mediterranean such as Mallorca, Malta, etc., as it was discussed above in Chapter 2. We could expect demand

[16] According to DEYAM (2019), average water daily need per person in Mykonos Island is 137 liters per day.
[17] The tourists' population is calculated as average according to 1 consecutive overnight stay at hotels, resorts and Air BNBs. Daily cruise passengers' visits and stays at rented houses (Non AirBnBs) are not calculated in this average population.
[18] Since, January, February, March, November and December are not in the tourist season, the populations are calculated as "0" because the data is insufficient to make a calculation.

based decisions by the local authorities to decrease water demand during tourist season by actions such as decreasing the number of cruise ships arrivals or decreasing the number of international air arrivals. Nevertheless, water authorities took supply based decisions to increase their water supply capabilities and desalination plants have been installed in the island.

Table 21. Mykonos Island Desalination Plants List 1989-2008.

INDEX	TYPE	YEAR	DAILY WATER SUPPLY (m^3)
1.	Seawater Reserve Osmosis (SWRO) – Fossil Fuel	1989	1.200 m^3 /day
2.	Reserve Osmosis (RO) – Fossil Fuel	2001	1.800 m^3 /day
3.	Reserve Osmosis (RO) – Fossil Fuel	2008	4.500 m^3 /day

Source: DEYAM, personal communication, 20 August 2015

As Xenarios et al., (2013) underlined, continued growth of tourism, excessive residential development along with the extremely high cost of transporting water from the mainland led local water authorities to take the decision to build desalination plants in Mykonos. Three desalination plants with using fossil fuels were built by DEYAM from 1989 until 2008. As it can be seen in Table 21, three desalination plants have capacity of almost 2.700.000 m^3 /year if they are fully functioning, which means that they have enough supply capacity for residents and tourists' water demands. Nevertheless, two of the desalination plants (1989 SWRO and 2001 RO) stopped functioning due to technical problems (DEYAM, personal communication, 20 August 2015).

Meanwhile, Mykonos faced serious drought during the winter of 2014 and partial drought during the winter of 2016 which led water shortages in Mykonos during tourist peak seasons (DEYAM, personal communication, 11 August 2019). Consequently, DEYAM decided to restore two non-functioning desalination plants in 2014 and took another decision to build new desalination plants

in Mykonos in order to increase water supply capacity to match the summer peak season tourist water demand in 2018.

Table 22. Mykonos Island Desalination Plants List 2018-2020.

INDEX	TYPE	YEAR	DAILY WATER SUPPLY (m^3/day)
4.	Portable Seawater Reserve Osmosis (SWRO) – Renewable Energy Resources (RES)	2018	2.500 m^3 /day
5.	Portable Seawater Reserve Osmosis (SWRO) – Renewable Energy Resources (RES)	2019	1.000 m^3 /day
6.	Portable Seawater Reserve Osmosis (SWRO) -Renewable Energy Resources (RES)	2020 (Planned)	1.000 m^3 /day

Source: DEYAM, personal communication, 11 August 2019.

DEYAM decided to increase the capacity to the level 11.000 m^3/per day and decided to build three new desalination plants working with renewable energy resources in 2018 (DEYAM, personal communication, 11 August 2019). The main difference from the previous desalination plants is that new ones are portable and they can work with either solar power or wind power. Nevertheless, problems with the water supply did not end up after two of these three planned desalination plants started to function. In 2018, there was a small fire at the new desalination plant which led to long power outrage in above areas and shortage of water (DEYAM, personal communication, 11 August 2019). In fact, power outrage and water shortage became the biggest ever in Mykonos history and led many tourists to face difficulties during their holidays.

The biggest problem has been related to less annual rainfalls since water levels in Marathi or Ano Mera dams are much lower than ever in island's history (DEYAM, personal communication, 11 August 2019). For that reason, the power outrage led easily to a long water shortage in 2018. The water production stops directly with a power outrage and it takes very long time to fill the network since dams are almost empty (DEYAM, personal communication, 11 August 2019). As a matter of fact, local authorities and DEYAM authorities are suggesting permanent residents as well as second house owners to install water tanks in homes in case of the same scenario not to happen again. Meanwhile, these water shortages take place quite often due to over tourism. As it will be discussed later in this work, there are often water shortages in Mykonos which are almost daily from 2 to 4 hours at a time which affects the lives of permanents residents, second house owners or tourists that are renting houses or AirBNB type accommodation.

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5.2.2. SANTORINI / THIRA ISLAND

Santorini (officially Thira) is one of the iconic tourism destinations of Greece and it is among the most visited locations in the world. One of the unique characteristics of Santorini is related to its natural formation. As Dominey-Howes and Minos-Minopoulos (2004) underlined, Santorini is a part of Hellenic Volcanic Arc which is the surface expression of the subduction of the African plate beneath the Eurasian plate and it is approximately 500 km long and 20-40 km wide extending from the eastern coast of mainland Greece until the western coast of Turkey. Santorini faced one of the largest volcanic eruptions recorded in the history during the period of Minoan civilization and yet it is still the most active volcanic site in the Hellenic Volcanic Arc (Dominey-Howes and Minos-Minopoulos, 2004).

Map 5. Map of Santorini Island.

Source: Lonely Planet, 2020b

According to 2011 population census, Santorini had 15.550 inhabitants but today the permanent population is estimated to be around 25.650 inhabitants (Hellenic Statistical Authority, 2019). The

island population is increasing up to six-seven times higher during tourism peak season. The climate of the island and the rich history that is originated from the Minoan civilization, are making Santorini a popular destination. As it can be seen in Table 23, Santorini has a semi-arid climate with mild winters and sunny summers. Summer season starts from mid-May and ends at the first week of September which is the high season for tourism in the island. On the other hand, winter season starts on mid-November and ends at the end of February.

Table 23. Santorini Average Temperatures.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min (°C)	9	9	10	12	15	19	22	22	19	16	13	11
Max (°C)	14	14	16	19	22	27	28	27	26	22	19	16

Source: Hellenic National Meteorological Service, 2019

Santorini receives most of its rainfall during winter season as it is in the case of most of Cyclades Islands. As it can be seen in Table 24, Santorini has an average of 30 days with rainfall during the winter season and it has relatively better winter season rainfall than Mykonos. The average precipitation is around 557 mm per year and the island receives almost no rainfall during the summer season. Hence, there have been cases of droughts and water shortages during summer seasons. Nevertheless, the water scarcity has been intensified and permanent population started to suffer from water availability due to changing climate conditions as well as over tourism phenomenon which has been increasing the water stress in the last 20 years (Enriquez, et al., 2017).

Table 24. Santorini Average Precipitation.

Month	Ja	Fe	Mar	Ap	May	Jun	Jul	Au	Se	Oc	No	De	Year
Prec. (mm)	115	80	65	30	15	5	1	1	15	60	70	100	557
Prec. (in)	4.5	3.1	2.6	1.2	0.6	0.2	0	0	0.6	2.4	2.8	3.9	21.9
Days	9	7	6	3	2	1	0	0	1	3	5	9	46

Source: Hellenic National Meteorological Service, 2019.

Tourism season is getting extended until the beginning of October which is autumn season in particularly in the last 10 years. As it can be seen in Table 25, Santorini has an average sea temperature of 21 °C on June, 23 °C on July and 24 °C on August during the summer season. Nevertheless, average sea temperature stays still warm on autumn season and average sea temperature is 23 °C on September and 21 °C on October which are almost like June or July average sea temperatures. This leads Santorini to have much more international air arrivals as well as cruise ships arrivals.

Table 25. Santorini Average Sea Temperature.

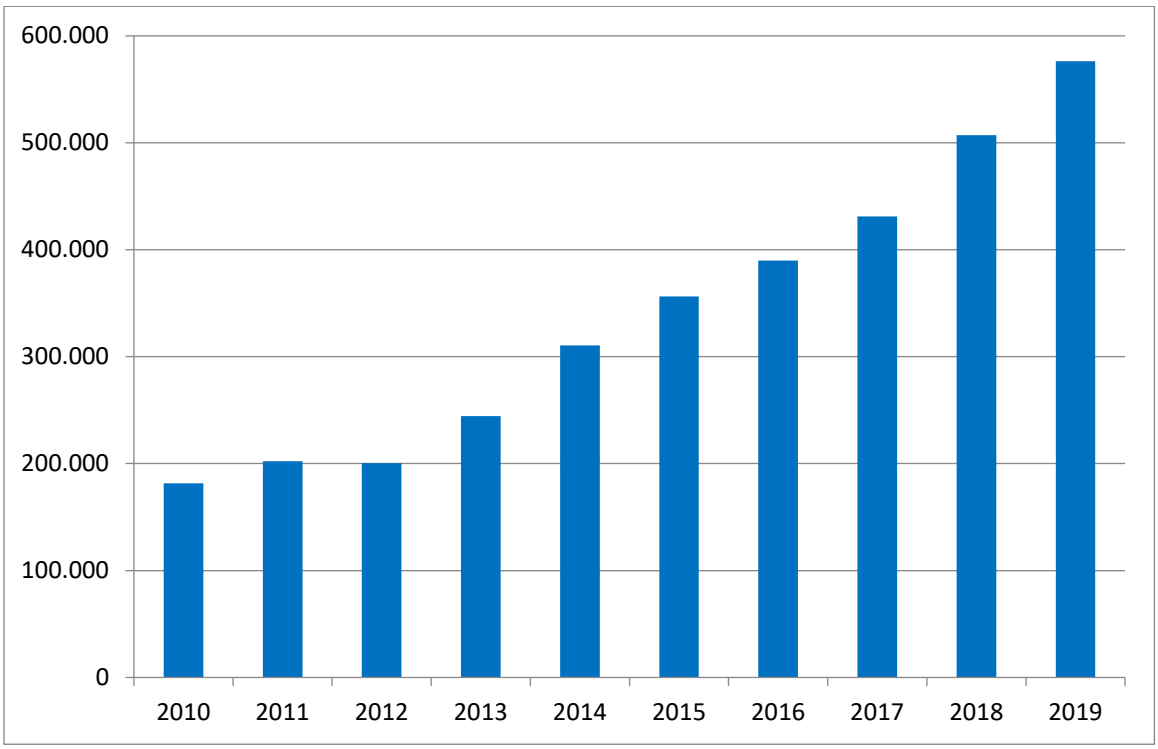
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min (°C)	16	15	15	16	18	21	23	24	23	21	19	17

Source: Hellenic National Meteorological Service, 2019.

Santorini has been receiving one of the highest numbers of international air arrivals in Greece within the last 10 years. As it can be seen in Figure 29, Santorini received 181.700 international air arrivals in 2010 and then received 356.400 international air arrivals in 2015 which meant international air arrivals was doubled only in 5 years of time. Moreover, international air arrivals to Santorini continued to increase gradually and international air arrivals increased to 431.200 in

2017 and finally reached up to 576.400 international air arrivals which made Santorini as one of the most visited destinations in Greece.

Figure 29. Number of International Air Arrivals to Santorini from 2010 to 2019.

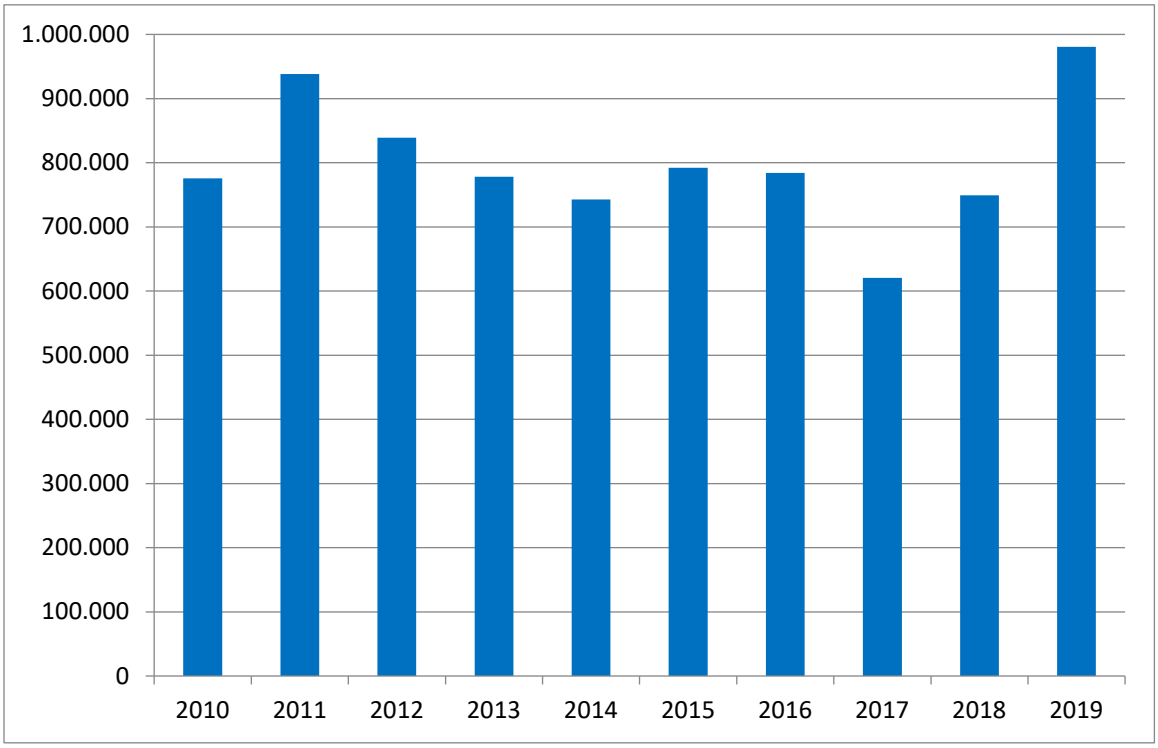


Source: Hellenic Statistical Authority, 2019

Airlines are not the only modes of transportation to visit Santorini, as it is in the case of other Greek Islands. Santorini has a very busy port and it has been receiving one of the highest numbers of cruise passenger arrivals (both domestic and international). As we can see in Figure 30, Santorini received 775.500 cruise passengers in 2010 and only in one year it received 938.200 cruise passengers in 2011. Nevertheless, budget airlines and charter flights started to fly to Santorini Airport which led a slow decrease in the number of cruise passengers to Santorini since 2005 (Zenelis and Papatheodorou, 2008). As we can see in Figure 30, cruise passenger arrivals decreased to its lowest number in 2017 with 620.600 passengers. However, cruise passenger arrivals started to increase again in 2017 with 749.200 passengers and finally reached a record number of 980.800 cruise passengers in 2019. This was a turning point for Santorini because it made local authorities

to take decisions to decrease cruise passengers arrivals as well as water authorities (DEYATH) to take further steps to supply enough water to permanent population as well as tourists in the island (DEYATH, personal communication, 22 August 2019).

Figure 30. Number of Cruise Passenger Arrivals to Santorini from 2010 to 2019.



Source: Hellenic Statistical Authority, 2019

Thira Regional Unit is consisted of five municipalities which are Anafi, Folegandros, Ios, Santorini (Thira) and Sikinos. DEYATH (The Municipal Water and Sewage Enterprise of Thira) is the responsible authority for the water supply in Santorini and DEYATH has been working on alternative solutions to match the high seasonal water demand. Water is supplied through combined usage of conventional and non-conventional water resources in Santorini. *Zoodochos Pigi* (Life-giving spring in English) is the main freshwater source and there are 100 wells (mostly with brackish water) which provide 50% of water supply and there are 5 desalination plants which provide 50% of public water supply (DEYATH, personal communication, 22 August 2019). Nevertheless, water supply started to be not enough during summers since water demand has

increased dramatically due to over tourism in Santorini. This dramatic increase in water demand led DEYATH officials to take the decision to build a mega desalination plant that has capacity of 5.000 m^3 per day (DEYATH, personal communication, 22 August 2019). As it can be seen below, Santorini/Thira municipality has approximately 2.300.000 m^3/year annual water need and this annual demand has been increasing due to international and domestic tourist arrivals during the summers.

Table 26. Santorini / Thira Municipality Annual Water Needs (m^3/Year).

MUNICIPAL DISTRICT	ANNUAL WATER NEEDS (m^3/YEAR)[19]
SANTORINI/THIRA	2.300.000 m^3
TOTAL	2.300.000 m^3

Source: DEYATH, personal communication, 28 August 2015.

Table 27 below will give an insight of the water needs (m^3) per day and per month including the demands of permanent residents, second house owners and tourists that are having overnight stays. However, water demand of tourists that are visiting Santorini without overnight stays (mostly cruise ship passengers) and stays at rented rooms which are not AirBnBs are not included in Table 17. As a result of this, these numbers are estimates and actual water demand is most likely higher than it is calculated at Table 27.

We can see that Santorini has 3.593 m^3 per day water demand from January until the end of March when permanent population is mainly living in the island. In addition to this, from November until the end of December, water demand is 3.593 m^3 per day again since permanent population's water demand is taken into account. It has to be noted, Santorini is visited by tourists each season but we do not count "off season" months' tourist water demand since it is not viable. Summer months have

[19] According to DEYATH (2019), average water daily need per person in Santorini Island is 142 liters per day.

higher water demand and June has 8.190 m^3 per day since the island has a population of more than 80.000 people with tourists' arrivals (DEYATH, personal communication, 28 August 2015).

Table 27. Santorini Municipality Daily Water Needs (m^3).

MONTHS	**POPULATION**		**WATER DAILY NEEDS (m^3)[20]**
	PERMANENT RESIDENTS AND SECOND HOUSE OWNERS	TOURISTS [21]	
January	25.650	0 [22]	3.591 m^3
February	25.650	0	3.591 m^3
March	25.650	0	3.591 m^3
April	25.650	4.000	4.151 m^3
May	25.650	20.000	6.391 m^3
June	28.500	30.000	8.190 m^3
July	28.500	40.000	9.590 m^3
August	30.000	45.000	10.500 m^3
September	28.500	20.000	6.790 m^3
October	25.650	4.000	4.151 m^3
November	25.650	0	3.591 m^3
December	25.650	0	3.591 m^3

Sources: DEYATH, 2019; Hellenic Statistical Authority 2019; SETE 2019

We can notice from Table 27 that from July until the end of August, Santorini's water demand is approximately 10.000 m^3 per day. This is really high amount of water for a small island like Santorini. This high demand of water is directly connected to island's population which is approximately 100.000 people during this period (DEYATH, personal communication, 22 August 2019). On the other hand, island population gets even higher than 100.000 when there are more cruise passengers' arrivals who are visiting daily without overnight stays. As Enriquez et al., (2017)

[20] According to DEYATH (2019), average water daily need per person in Santorini Island is 140 liters per day.
[21] The tourists' population is calculated as average according to 1 consecutive overnight stay at hotels, resorts or AirBNBs. Daily cruise passengers' visits and stays at rented houses (non AirBNBs) are not calculated in this average population.
[22] Since, January, February, March, November and December are not in the tourist season, the populations are calculated as "0" because the data is insufficient to make a calculation.

mentioned, DEYATH officials were not able to supply 37% of water demand in 2015 and this led to overcharge ground water from 52 wells located in the island. For that reason, Santorini's groundwater levels have been decreasing dramatically and this has been causing water stress in the island.

DEYATH officials have been working on the water scarcity issue and they have been focusing on non-conventional water resources such as desalinated sea water as it is in the case of Mykonos. As a matter of fact, DEYATH officials have been using similar policies as DEYAM in Mykonos and they built three desalination plants from 2000 until 2009 which provided extra water supply with 2.160 m^3 per day. However, desalination plants were not able to solve the water scarcity problem in the island. There were two reasons behind this: decreased annual rainfall since 2007 and increased tourist water demand during summers since 2009 (DEYATH, personal communication, 28 August 2015).

Table 28. Santorini Island Desalination Plants List 2000-2009.

INDEX	TYPE	YEAR	DAILY WATER SUPPLY (m^3)
1.	Reserve Osmosis (RO) – Fossil Fuel	2000	320 m^3 /day
2.	Reserve Osmosis (RO) – Fossil Fuel	2002	640 m^3 /day
3.	Reserve Osmosis (RO) – Fossil Fuel	2009	1.200 m^3 /day

Source: DEYATH, 2019

As a matter of fact, DEYATH officials decided to increase their water supply capacity instead of decreasing water demand during summers as it is in the case of Mykonos. They have decided to invest on additional capacity through installing two portable seawater reserve osmosis (SWRO) desalination plants and one reserve osmosis (RO) desalination plant which added additional 890 m^3 of desalinated water per day. Nevertheless, new desalination plants' capacity was not effective

since water authorities were able supply only 63% of total water demand during summers since water demand continued to increase during summer seasons (Enriquez et al., 2017).

Table 29. Santorini Island Desalination Plants List 2010-2020.

INDEX	TYPE	YEAR	DAILY WATER SUPPLY (m^3/day)
4.	Portable Seawater Reserve Osmosis (SWRO) – Fossil Fuel * 2 Units	2010 and 2012	390 m^3 /day
5.	Reserve Osmosis (RO) – Fossil Fuel	2012	500 m^3 /day
6.	Seawater Reserve Osmosis (SWRO) – Fossil Fuel	2020 (Planned)	5.000 m^3 /day (+ 2.500 m^3 Future Additional Capacity)

Source: DEYATH, 2019

As it can be seen at Table 29, DEYATH officials came up with the plan of installing a mega desalination plant which is going to supply additional 5000 m^3 per day in the beginning and later on with additional capacity 7.500 m^3 per day. The decision was a difficult one to take due to high operational coasts and local environmental concerns but Santorini had real difficulties with water supply issues due to soar island population during the summers of 2016, 2017 and 2018 (DEYATH, personal communication, 22 August 2019). The long and the short of it is that, Santorini is in a similar situation with Mykonos and it has become a difficult choice for local authorities whether increasing water supply capacity or decreasing summer population in the island by setting limits to tourists' arrivals.

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CHAPTER 6 – THE EU WATER FRAMEWORK DIRECTIVE 2000/60/EC AND IMPLEMENTATION OF THE DIRECTIVE IN GREECE

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6 – THE EU WATER FRAMEWORK DIRECTIVE 2000/60/EC AND IMPLEMENTATION OF THE DIRECTIVE IN GREECE

6.1. INTRODUCTION

Water is vital for human life and it is an essential task for decision makers, to ensure better water quantity and quality. In fact, it is a must to achieve better water quantity and quality because it is a prerequisite for setting basic living standards for people. For that reason, European Union (EU)[23] has been focusing on the sustainable water resources management and the development of water legislation since the mid-1970s. We can see that the first wave of European legislation for water resources goes back to 1975[24] with the enactment of surface water directive and the drinking water directive which focused on surface water protection and water quality standards (Da-Cunha, 1989; Kaika, 2003a; Kallis and Nijkamp, 2000).

The second wave of European legislation for water resources came in 1991 which included Urban Wastewater Management Directive, the new Drinking Water Quality Directive, the Nitrates Directive and the Directive for Integrated Pollution and Prevention Control (Kaika, 2003a). The third wave came in the mid-90s when EU decided to draft a common framework directive. This framework actually combines the two preceding waves and provides a common framework for EU Water Policy which introduces a new approach to water management based on river basins, gives significant importance water quality and groundwater protection (Kaika, 2003a).

As a matter of fact, EU has adopted the Water Framework Directive 2000/60/EC (WFD) and it was introduced to EU Member States (EMS) in December, 2000. WFD's main target is to ensure the long-term sustainable use of water for people, business and nature (Kanakoudis and Tsitsifli, 2015). WFD is one of the most important documents so far which is focusing on providing the opportunity of development of a new and effective legislative framework as well as long term planning on

[23] EU was established with the Maastricht Treaty in 1993 but there were three European Communities (with common institutions) acting as a predecessor to EU.
[24] European Council Directive 75/440/EEC of 16 June 1975

water resources management. The Article 4 of WFD imposes concrete obligations on EMS that should be completed within the specified deadlines in order to prevent the degradation of water quality and EMS are responsible for the coordination of the orders of WFD's Article 4 related to the achievement of environmental objectives (Kalampouka et al., 2011).

WFD gives specific importance to environmental sustainability and improved water resources management through the coordination and cooperation of EMS that have harmonized the directive. It should be noted that WFD considers water not only a commercial product but also an essential heritage of Europe (Kaika, 2003a; Kalampouka et al., 2011). For that reason, WFD aims to protect all waters (inland surface and groundwater), decrease and control pollution, improve water quality through monitoring, increase participation of all actors in the decision making process (Including NGOs and water enterprises) and develop a management plan at the basin scale which recognizes that the water bodies may be beyond national borders (EC, 2000). As Kaika (2003a) underlined, WFD has the tendency to substitute political action in its traditional form (i.e. protests, strikes, etc.) with participation and requires "active public involvement" in river basin management planning.

Consequently, EU has favored tools and institutions that stand by less hierarchical for more participatory and cooperative forms of governance in the environmental field and EU has endorsed a multilevel governance system in which many actors can take roles (Demetropoulou et al., 2010). In other words, many actors can involve in the decision process on national, regional and even local levels and their active cooperation and coordination may play a significant role for better water resources management and sustainable environment. Furthermore, WFD aims to raise public awareness on environmental issues, access to different stakeholders' knowledge and be more transparent on water resources management through increased participation (Demetropoulou et al., 2010). Hence, WFD has variety sets of sustainability goals through active public participation and involvement of many actors in the decision making process.

Nevertheless, there are issues of power struggle when it comes to the implementation of the directive and there are criticisms that it is top-down based tool; since WFD is making the formation of social capital a three-part process between the state, civil society and the private sector (Kaika,

2003a). Although, the directive has varied sets of goals that are related to better water resources management and environmental sustainability, there are issues regarding the roles of different actors that involve in the decision making process. For that reason, there have been cases in which conflict of interests has occurred and this is particularly related to increasing involvement of private sector; since it is adding extra complication when the state is remaining instrumental (Kaika, 2003a).

In short, WFD is one of the most important documents that are being used in the water resources management in Europe. Although, there are criticisms that the directive has a top-down approach, WFD has been an important tool for EMS to rally their water resources quality and quantity. Nevertheless, there are certain differences in the implementation process compared to Northern Europe to Southern Europe countries (Kanakoudis and Tsitsifli, 2015). Greece is among these countries in Southern Europe that has been experiencing difficulties as well as delays in the implementation process of WFD. The rest of this chapter is organized as follows. The second subchapter is dedicated to the general analysis of water resources management (River Basin Management Plans (RBMPs) and River Basin Districts (RBDs)), and public participation in Greece. The third subchapter is devoted to the water pricing in Greece. The fourth subchapter focuses on the water quality status, and the issues of water pollution in Greece, and the fifth subchapter offers the reasons behind the implementation delays of the EU Water Framework Directive 2000 in Greece.

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6.2. WATER RESOURCES MANAGEMENT AND PUBLIC PARTICIPATION IN GREECE

As Kanakoudis and Tsitsifli, (2015) underlined, the main instrument of the WFD is the river basin management plans (RBMPs) which includes river basin districts (RBD) characterization, economic analysis, and delineation of water bodies, status monitoring and assessment as well as list of the competent authorities. On the other hand, cooperation and coordination among EMS and Non EMS that share trans-boundary water resources is another important factor demanded in WFD (EC, 2000). For that reason, RBMPs have particular role for the implementation of the WFD and there is a timetable that EMS have to follow.

It has to be noted that WFD does not aim at the complete-full harmonization of legislation of EMS in the sector of water resources and there can be differences regarding the type of obligations that WFD impose on EMS (Kalampouka et al., 2011). Greece is one of the EMS since its accession to EU in 1981, had transposed various directives to its legislation related to the protection of marine environment such as the Bathing Water Directive 76/160/EEC, Directive for Toxic Substances in Surface Water, Urban Waste Water Treatment Directive and Directive Concerning the Protection of Water Against Pollution Caused by Nitrates from Agricultural Sources (Kaika, 2003a). Nevertheless, Greece is one of the EMS that has been facing certain difficulties in the harmonization and implementation process of WFD from the very beginning.

Greece harmonized WFD by establishing the Law 3199/2003 and Presidential Decree 51/2007 which actually represent revolutionary approach in the field of water resources management (Kalampouka et al., 2011). The Law 3199/2003 restructures fundamentally the competencies in environmental protection and incorporates the polluter pays principle. At the same time, the Law 3199/2003 establishes a new administrative structure that is consisting of National Water Committee, National Water Council, Central Water Agency, Regional Water Directorates and Regional Water Councils (Stournaras, 2008). Furthermore, Law 3199/2003 defined the RBDs which are in the core of the implementation timetable of WFD since the directive initiates a

promotion of decentralization policy. Hence, Greek central government defined 14 RBDs and 5 of these RBDs are shared with neighboring countries:

Table 30. Name, size and neighbor countries for each RBD.

RBD	Name	Size (Km^2)	Countries sharing borders
GR01	Western Peloponnese	7,232	-
GR02	Northern Peloponnese	7,426	-
GR03	Eastern Peloponnese	8,420	-
GR04	Western Sterea Ellada	10,432	-
GR05	Epirus	10,007	AL[25], RONM[26]
GR06	Attica	3,139	-
GR07	Eastern Sterea Ellada	12,268	-
GR08	Thessaly	13,153	-
GR09	Western Macedonia	13,585	AL, RONM
GR10	Central Macedonia	10,147	RONM
GR11	Eastern Macedonia	7,308	BG[27], RONM
GR12	Thrace	11,159	BG,TR[28]
GR13	Crete	8,301	-
GR14	Aegean Islands	9,118	-

Source: Kanakoudis and Tsitsifli, 2015

As it can be seen from Table 30, the 14 RBDs were defined according to their specific characteristics. GR08 and GR09 which are Thessaly and Western Macedonia RBDs are the two biggest and GR06 which is Attica RBD is the smallest in terms of their sizes. GR05, GR09, GR10, GR11 and GR12 which are Epirus, Western Macedonia, Central Macedonia, Eastern Macedonia and Thrace are international RBDs since they include trans-boundary water resources and these water resources are shared with neighboring countries.

As Mylopoulos and Kolokytha (2008) highlighted, these 5 (five) international RBDs have certain importance for Greece because roughly 25% of country's renewable water resources are

[25] Albania
[26] Republic of North Macedonia
[27] Bulgaria
[28] Turkey

"imported". Although, WFD focuses significantly on trans-boundary cooperation and coordination among EMS and other non-member states, there are certain problems related to sharing water resources. As an example, there are major disagreements among Bulgaria, RONM and Greece in particularly at G11 Eastern Macedonia and EU has been trying to solve these issues through hydrodiplomacy (Mylopoulos and Kolokytha, 2008). It has to be noted that, G13 Crete and G14 Aegean Islands RBDs were established later compared to the other RBDs, and they evolved into crucially important focal RBDs. This evolution is closely related to the water scarcity issues that started to develop with the increasing changing climate conditions and the seasonal tourism activity within the last 20 years.

As it was discussed above, decentralization is important for the implementation of WFD. WFD is an instance of governance that can be characterized as the interaction of individuals and public or private institutions in implementing the requirements of the directive and this interaction can be formal or informal attendance of various actors (Demetropoulou et al., 2010; Rauschmayer et al., 2009). For that reason, 7 Decentralized Administrations and 13 self-governed regions are identified as competent authorities after the Local Administration/Governance reformation plan (Law 3852/2010)[29] and responsibilities are shared (Kanakoudis and Tsitsifli, 2015).

It has to be noted that, WFD requires the existence of adequate water management authorities in every RBD and gives importance to the participatory mechanisms and experience in assisting and facilitating participatory processes (Demetropolou et al., 2010; Koutiva et al., 2007). For that reason, public participation and stakeholder engagements are essential requirements of the directive and it is not an easy aim for a country in which public participation is limited. As a result, one can notice that directive can be implemented much easier with a decentralized government since there are more actors involved in the decision process and there is active civil society (Demetropolou et al., 2010; Koutiva et al., 2007). We can notice that each EU Member State has different experiences

[29] This Law is also known as "Kallikratis" Law.

in the implementation process of the EU Water Framework Directive and decentralization may play a significant role.

As an example, De Stefano et al., (2013) underlined that Regional Water Agencies in Spain worked with certain independence and developed their own methodological approaches in parallel to central government's specific guidelines for the elaboration of RBMPs in the RBDs under its jurisdictions. This has enriched the characterization process of RBDs and made it easier for the implementation of the directive. Nevertheless, Spain is facing tensions between regional authorities and the central government on the water-related issues from time to time since central government (hydrographic confederations) has still significant role in the planning and funding process of the implementation of the directive (De Stefano et al., 2013).

In Greece, the Presidential Decree 51/2007 aims to integrate participation requirements of WFD to legislation and at the same time, intents to achieve active public involvement and representation of interested parties at the National and Regional Water Councils (Stournaras, 2008). Nevertheless, Greece has been traditionally identified as a country that has a hierarchical and centralized state with a weaker civil society compared to other EMS[30] (Demetropoulou et al., 2010). The construction of Evinos reservoir for providing water to Athens is a good example to understand how much central government has the lead in the decision making process in Greece.

There were public hearings and meetings with stakeholders to evaluate the aims and potential outcomes of Evinos Reservoir Project (Demetropoulou et al., 2010). The majority of the stakeholders and locals that attended these meetings and public hearings were lacked of any technical or scientific background regarding the issues that were discussed at the meetings and this led central state to take the ultimate decision (Demetropoulou et al., 2010). We can understand from this example that the central state has a central role behind the decision making process of water resources management matters. At the same time, we can assume that some of the public

[30] Northern European countries such as Denmark and Sweden have stronger civil societies and administrative structure is less hierarchical and centralized compared to Southern European countries such as Greece (Demetropoulou et al., 2010; De Stefano et al., 2013; Torpe, 2003; Wijkström, 2004).

hearings are being hold to demonstrate that the central state is allowing public participation in accordance to the requirements of WFD in Greece.

Nevertheless, there are some cases in which there is active public participation in which stakeholders share their knowledge and take part in the decision process in Greece. *EnviFriendly Project*[31] is among these cases, in which many actors such as local authorities, private consultants, academicians and state representatives joined together in order to take decisions regarding water resources management in different rural areas in Greece (Demetropoulou et al., 2010). Hence, active public participation gave positive results and different stakeholders shared their knowledge and their perspectives on the elaboration of projects planning. As a result, *EnviFriendly Project* can be seen one of the successful examples regarding participation requirements of WFD in Greece (Demetropoulou et al., 2010).

In short, Greece has ongoing problems with the involvement of stakeholders and active public participation which are some of the crucial requirements of WFD. Even though, there are some steps taken regarding active participation such as in the case of *EnviFriendly Project,* the main objectives of the WFD regarding participation are still far from being fully accomplished in Greece.

[31] Environmental Friendly Technologies for Rural Development

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6.3. WATER PRICING IN GREECE

Water pricing is another important aspect of WFD and EMS are required to value their water resources under Article 9 of WFD. Water resources availability, pollution of ground and surface water resources and water scarcity make water pricing as a critical device for taking measures. As Dige et al., 2013 highlighted, water pricing can be a powerful communication tool that can influence the way in which the resource is used since users will have information regarding water abundance or water scarcity. Consequently, water pricing is essential for countries such as Greece that have arid or semi-arid climates in which precipitation levels are limited, with fewer lakes as well as rivers, and there is high demand for water resources, particularly during the summer months.

In Greece, cities with more than 10.000 inhabitants are managed by Municipal Enterprises for Water Supply and Sewerage (DEYA) operating as private companies owned by the municipalities under the Law 1069/80 and in total there are 127 DEYAs all over Greece (Farmaki and Tranoulidis, 2018; Safarikas et al., 2006). DEYAM and DEYATH are among these municipal enterprises that are responsible for supplying water to the residents of Mykonos and Santorini Islands since they have populations more than 10.000 inhabitants. On the other hand, there are municipalities which are directly responsible for water supply and they serve around 12% of the population and two major cities which are Athens and Thessaloniki have partly privatized water enterprises where the state holds 51% of their stocks (Kanakoudis and Tsitsifli, 2015; Safarikas et al., 2006). Hence, Greece has a semi decentralized and privatized water supplying body in which different actors take role depending on the population and geographical location.

Greece has been encountering issues with water pricing since 1980s and it has become a popular political matter during and after 1989-1991 Water Scarcity Crisis (Kaika, 2003b). At this point, we believe that it is a necessity to look into these issues historically in Greece. Water pricing debates started with the 1985 Parliamentary Elections that was won by PASOK which is a socialist party, led by Andreas Papandreou (Pantelis et al., 2010). PASOK passed a groundbreaking environmental law (Law 1739/1987) which nationalized the management of water resources, cancelled all existing

rights over water linked to private property, declared water as a "natural gift" to be used for satisfaction of social needs and ensured the right to water as "the undeniable right of every individual" (Kaika, 2003b). The Law 1739/1987 defined also 14 hydrological departments that are still being used by the central government in Greece.

However, this nationalization process faced serious criticism shortly after a severe drought that lasted for almost three years (1989-1991) in particularly in Athens. The drought converted water as a source of conflict and a threat to daily lives of residents in Athens (Kaika, 2003b). For that reason, socialist government and the Law 1739/1987 received continuous criticisms from public, media, opposition parties, and even from scholars that have knowledge about water resources management. "The Water Scarcity Problem" became "The Water Scarcity Crisis" shortly after the official announcement of the water company in Athens.

The water company stated that Athenians have only 170 days of available water left, and this announcement created public crisis in Athens within a short period of time and people started to accuse each other for "stealing" water (Kaika, 2003b). "The Water Scarcity Crisis" became so effective together with financial difficulties in Greece. As a result, PASOK lost the elections which were hold in 1989 and Constantine Mitsotakis' New Democracy Party which has liberal-conservative views won the majority (Pantelis et al., 2010).

Conservative government decided to make changes on the Law 1739/1987 shortly after the elections. In 1990, Mitsotakis government announced "Emergency Acts" which enabled the creation of a new tariff and pricing system (allowance to increase the water prices up to 300%), prohibition of heavy water-consuming activities (such as car washing or garden watering) and construction of a new dam at Evinos River (Kaika, 2003b). The new water pricing system had a short term impact and decreased water demand up to 20% in Athens. However, the new pricing system did not target high volume consumers and poor citizens of Athens were mostly affected (Kaika, 2003b). This led to major concerns in public regarding social justice and equality because there were already economic difficulties in Greece as it was mentioned above. The severe drought ended and Athenians started to think that water pricing tariffs were going to be much cheaper. Yet,

Mitsotakis government maintained the high water pricing even after dropping other "emergency measures" and focused on privatization of all water enterprises until the Parliamentary Elections 1993 in Greece (Kaika, 2003b).

PASOK won decisively the Parliamentary Elections in 1993 because of the liberal economic policies of Mitsotakis' government, and privatization of water enterprises were kept on hold until 1999 (Kaika, 2003b; Pantelis et al., 2010). In 1999, EU was working on the draft version of WFD and demanded EMS to privatize water utilities and to use water pricing effectively. As a result, PASOK government decided to privatize the water utilities and took over the plans of Mitsotakis' government, as a response to EU demands[32] (Kaika, 2003b). In short, the Law 1739/1987 was abolished after 12 years by the very same socialist political party that granted the right to water as "the undeniable right of every individual", and these political debates over water pricing and privatization of water utilities are still ongoing in Greece.

Water pricing has been an issue for most of the EMS because there is not a perfectly acceptable method of calculating the environmental and resource cost of water which are "external" costs to society (Bithas et al., 2014). In other words, water authorities cannot calculate the exact price of water costs due to unavailable calculation methodology. There are three water cost components identified to calculate the price of water. These water cost components are respectively direct cost, environmental cost and natural resource cost (Bithas et al. 2014; Kanakoudis and Tsitsifli, 2015). When one looks at the calculation methodology of these water cost components, operating and maintenance costs and administrative costs are used for direct cost and majority of the water utilities are using similar methodology to calculate direct cost (Bithas et al., 2014; Kanakoudis and Tsitsifli, 2015).

However, environmental and natural resource costs are calculated differently and in fact their calculations depend on the water utility since different methodologies can be used to calculate both of these two water cost components. As Kanakoudis and Tsitsifli, (2015) underlined,

[32] According to Kaika (2003b), EU pressured EMS to privatize water utilities in particularly in the case of Greece.

environmental cost is estimated based on the preventive behavior by estimating the avoidance, cost establishing a wastewater treatment plant or in other cases the environmental damage. Hence, we can notice that there is not an existing general criterion to estimate the environmental cost of water and there are different indicators to calculate it. On the other hand, natural resource cost component is estimated based on the production cost of desalinated water or cost of the alternative water uses in the cases when the abstraction is more than the natural recharge rate is used (Kanakoudis and Tsitsifli, 2015).

Cost recovery for water services is estimated for each supplier and each water service (urban water supply and irrigation) and it is a function of the water provider's revenues (Kanakoudis and Tsitsifli, 2015). Each EU Member State has different policies with regards to their population, geography and available water resources. In Greece, drinking water pricing policy has been based only on the recovery of the economic cost and domestic water is not priced taking into account its real cost (Safarikas et al., 2006). For that reason, water pricing has been continuously a matter of debate among stakeholders in Greece. One can notice that majority of the municipality enterprises (DEYAs) have already adapted the water pricing requirements of WFD.

Nevertheless, there are still enterprises among them which are including only recovery of operation and economic cost but not environmental cost of water resources (Safarikas et al., 2006; Bithas et al., 2014). As Safarikas et al., (2006) highlighted that water enterprises should balance their incomes and expenses and reduce their water losses for compaction of operation cost. It is an important fact that water enterprises have to make profit for the services that they provide but it is another important fact that their customers have to be properly priced. Hence, it is essential that water enterprises adjust water costs attentively.

As it was mentioned above, WFD was transposed to Greek legislation by the Law 3199/2003 and 5 (five) different groups were created. These five groups were separated from each other by the number of residents and municipality enterprises (DEYAs) were created according to population (Kanakoudis and Tsitsifli, 2009; Safarikas et al., 2006). We can see from Table 31 that Mean Water Price per year (€/m^3) gradually increased from 2003 to 2007 for higher populated locations

compared to lower populated locations after transposition of WFD to Greek legislation. This shows us residents that are living in the larger urban areas such as Athens and Thessaloniki, are paying more compared to the residents that are living in small towns. On the other hand, water enterprises should avoid increasing water prices when the losses of natural resources are decreased or when better water resources management is achieved (Safarikas et al., 2006). This leads us to the discussion whether water resources are priced on their exact value or not in Greece as it is indicated in WFD:

Table 31. Water Pricing Based on Population 2003 – 2018.

Population Groups	Mean Water Price Per Year in **2003 (€/m^3)**	Mean Water Price Per Year in **2005 (€/m^3)**	Mean Water Price Per Year in **2007 (€/m^3)**	Mean Water Price Per Year in **2013 (€/m^3)**	Mean Water Price Per Year in **2018 (€/m^3)**
<10.000 Residents	0.84 (€/m^3)	1.13 (€/m^3)	1.09 (€/m^3)	2.15 to 545.91 (€/m^3)	2.47 to 562.34 (€/m^3)
10.001 to 15.000 Residents	1.17 (€/m^3)	1.05 (€/m^3)	1.08 (€/m^3)	1.26 to 642.55 (€/m^3)	1.39 to 663.29 (€/m^3)
15.001 to 30.000 Residents	N/A	1.29 (€/m^3)	1.41 (€/m^3)	0.92 to 519 (€/m3)	1.11 to 534 (€/m^3)
30.001 to 50.000 Residents	1.39 (€/m^3)	1.46 (€/m^3)	1.60 (€/m^3)	1.58 to 410.82 (€/m^3)	1.82 to 453.21 (€/m^3)
50.001 > Residents	1.49 (€/m^3)	1.52 (€/m^3)	1.59 (€/m^3)	1.18 to 528.89 (€/m^3)	1.43 to 545.52 (€/m^3)

Sources: DEYAM, 2019; DEYATH, 2019; Kanakoudis et al., 2015; Kanakoudis and Tsitsifli, 2009; Safarikas et al., 2006.

At the same time, we wanted to look more deeply into effects of the Greek Financial Crisis on water prices and we have decided to use Mean Net Water Consumption Cost per month (€/m^3) data from 2013 to 2018 as it can be seen in Table 31. One can notice that Mean Net Water Consumption Cost per month (€/m^3) gradually increased from 2013 to 2018 for all the five groups and this meant that Greeks faced the effects of the financial crisis in their water bills. Nevertheless, Farmaki and Tranoulidis (2018) underlined that household consumers were the ones that were the most affected from the financial crisis effects on water pricing. We would like to look at the water pricing in the agricultural sector in Greece based on this.

Water pricing in agriculture sector has been a matter of debate ever since WFD's harmonization to Greek legislation. As Karamanos et al., (2007) underlined, the agricultural water in Greece is undervalued and water is not priced according to its real economic value. For that reason, there are many cases in which consumed water exceeds the needs of the users in particularly for the case of agriculture sector and this leads to externalities such as water availability issues or higher water bills for household consumers and other sectorial uses.

It has to be noted that, the water pricing in agriculture is based on the size of the parcel and it has been particularly problematic in irrigation networks that are under water scarcity pressures in Greece (Karamanos et al., 2007). Meanwhile, the low consumption has not been calculated with the low water pricing in the agriculture sector even though it could have been a reward for the farmers that have been using water resources rationally (Karamanos et al., 2007). In addition to these, there have been many incidents in which farmers choose to dig illegal boreholes in order to evade water scarcity pressures in the distribution networks and piping systems in Greece (Atay, 2012; Zoumides and Zachariadis, 2009).

As a consequence, EU has reformed Common Agricultural Policy (CAP) to tackle economically inefficient, environmentally unsustainable and socially inequitable agricultural water management (irrigation water management) in Southern Europe[33] (Zoumides and Zachariadis, 2009). Thus, one

[33] In Southern Europe agriculture sector has the highest consumption levels since irrigation accounts for a large proportion of total water consumption (83% in Greece, 69% in Cyprus, 68% in Spain, 57% in Italy and 52% in

can notice that the goals of WFD and CAP are quite similar in terms of sustainable water resources management and rational water pricing tariffs in accordance to agriculture sector. In short, there are still substantial needs to make changes in the agriculture policy and water pricing tariffs for the agriculture sector, and agricultural production should be avoided in the areas where there is certain water scarcity pressure in Greece.

Each water enterprise (DEYA) follow different water pricing strategies and water pricing tariffs can be way different from each other depending on the geographical characteristics and population of the areas in Greece (Farmaki and Tranoulidis, 2018). In order to understand these differences, we need to look at the highest and lowest water pricing tariffs in Greece. We can see that Syros Island has the highest (1.35 €/m^3) price of water per unit of consumption in Greece since it has arid climate, limited water resources and high seasonal demand[34] (Farmaki and Tranoulidis, 2018; Kartalidis et al., 2016). On the other hand, Patras City has the lowest (0.09 €/ m^3) price of water per unit of consumption, because it has rich water resources such as Glafkos and Haradros Rivers and at the same time Patras receives significant amount of rainfall during winters (Farmaki and Tranoulidis, 2018; Langousis and Kaleris, 2013).

Public information about water pricing is a crucial task for water enterprises. Water enterprises should consider that there can be political issues and water consumers may have concerns as well as unwillingness to pay higher water bills even though there is a need to increase the water prices because of water scarcity (or less water availability) (Safarikas et al., 2006). As a matter of fact, public information is vital to inform water users regarding the status of water resources and the reasons behind increasing water costs. Meanwhile, public education and outreach is also essential for creating awareness because people will be more ready for water scarcity matters. Furthermore, decisions of water authorities such as increasing water tariffs can be accepted by public easier if emergencies such as droughts occur (Piccoli et al. 2010).

Portugal). However, it is opposite in the case of Northern Europe where it account to less than 10% (Berbel et al., 2007; Zoumides and Zachariadis, 2009).

[34] Syros Island is one of the Cyclades Islands and it has high summer water demand due to tourism (Kartalidis et al., 2016).

These issues bring us the question of social equity and justice in water pricing. As Bithas et al., (2014) underlined, water full costs should maximize social welfare, prevent exploitation of resources and secure access to water to the socially vulnerable members of the society. It is a fact that there can be many citizens that may have difficulties in paying their water bills due to their financial conditions in particularly in countries such as Greece that has faced serious financial crisis within the last decade.

There is no exact estimation individually for uses regarding the primary sector, industry, agriculture and domestic use and cost estimation is distributed with economic analysis among them (Kanakoudis and Tsitsifli, 2015; Safarikas et al., 2006). At the same time, it is not clear which are the socio-economic activities that can affect the ecological status of a water resource in particularly for the cases where the definition of cost is not possible since there may not be a clear "cause and effect" relationship between anthropogenic pressures (pressures of pollution, effects of extract quantities of water from the aquatic system, changes in morphology of the water system, etc.) and externalities on ecosystem (water scarcity, water pollution, saline intrusion, etc.) (Bithas et al., 2014).

Water pricing can be a challenging task not only for water authorities in Greece but also for other EMS and even different countries in the world. Water prices should reflect the total cost recovery with objectives of water use efficiency, resource sustainability and social equity/justice (Bithas et al., 2014). Thus, water pricing can become a complex task for water authorities because they may need to maintain balance between sustainable water resources management and anthropogenic activities. There have been cases which led to deterioration of water resources and led to externalities with much higher water costs because of inefficient water pricing as well as losing the balance between sustainable water resources management and anthropogenic activities (Bithas et al., 2014)

In addition to all this, another complex task for the water authorities is related to water costs and externalities because of tourism sector's activities. As it was mentioned above, majority of the academic research is concentrated on the water consumption of agriculture, industry or domestic

water consumption and there are few academic works that concentrate on the consumption of tourism sector. In fact, Gössling (2012) underlined that tourism sector's exact cost of water services is estimated within the urban water supply and there is no separate estimation of tourism sector's exact cost. As a matter of fact, residents that are living in the Greek Islands (such as Mykonos and Santorini) are paying much higher water bills because of tourism sector's high water demand. We will discuss these later in this work and at this point we would like to look at the water quality requirements of WFD and water quality status in Greece.

6.4. WATER QUALITY STATUS AND POLLUTION IN GREECE

Water quality is essential for the health of people and pollutants have to be removed from water resources and people should have access to clean water resources. For that reason, EU has an ongoing policy of removing all of the pollutants from water resources and providing better water quality to people (Zoumides and Zachariadis, 2009). As a consequence, WFD has a specific focus on water quality and there are certain requirements that each EMS has to follow. However, as Karavoltsos et al., (2008) underlined, EU had set these requirements and parametric values regarding pollutants with the Directive 98/83/EC before WFD was drafted. Hence, we can see Directive 98/83/EC as a complementary directive for achieving of WFD's better water quality and zero pollution goals.

The majority of EMS provide water supply through abstraction from groundwater resources and this is equal to 50% to 75% of public water supply depending on the country's geographic conditions (De Stefano et al., 2013; Karavoltsos et al., 2008). Greece is one of the countries that have water scarcity issues and have intensive water withdrawal from aquifers for agriculture and tourism. At the same time, Greece has some issues with water pollution due to agrochemicals and saline intrusion due to overcharge of aquifers (Kanakoudis et al., 2015; Zoumides and Zachariadis, 2009). As a result, WFD's requirements and Directive 98/83/EC's parametric values regarding water pollutants have been matters of debate in Greece because there have been violations.

In order to understand these debates, we need to look at some of the drinking water quality researches that were conducted in the last 12 years. According to a drinking water quality research conducted in 2008, Cyclades Islands (which is a part of G14 Aegean Islands RBD) had the most violations of the parametric values and at the same time 64% of Cyclades Islands' municipalities had the highest concentrations of ammonium, cadmium, copper, lead, chloride, sodium and potassium (Karavoltsos et al., 2008).

This study also showed that Dodecanese Islands and Crete had similar problems as Cyclades Islands and this gave us a hint that majority of Aegean Islands had been sharing similar issues with water pollutants. Nevertheless, a recent drinking water quality research in 2018 showed that the

parametric values lowered to the threshold level but there were still some small traces of violations of heavy metals and physicochemical parameters in particularly in the case of Mykonos and Santorini Islands which are part of the Cyclades Islands (DEYAM 2019; DEYATH 2019).

There may be three reasons behind these violations in the Aegean Islands. Cyclades Islands are in particularly characterized as "water stressed" islands and some of the islands such as Milos, Tinos and Syros depend on storing water resources (i.e. rainwater harvesting) in small individual domestic reservoirs and metals from paints of these reservoirs might have mixed to water (Bougiatioti and Oikonomou, 2009; Karavoltsos et al., 2008).

Secondly, it is a common problem in Greece that the distribution networks and piping system of drinking water are old and poorly maintained (Karavoltsos et al., 2008). As an example, water enterprise DEYATH in Santorini Island spent substantial amount of financial resources to renew the distribution network because there were rusted pipes in the piping system and removal of these rusted pipes has lowered the pollutants from water resources (DEYATH, 2019).

Third of all, majority of small islands depend on desalinated water or transported water as it was discussed above. It has to be noted that, fossil fuel based old type desalination plants produce water with poorer quality compared to new RES based reserve osmosis desalination plants (Darre and Toor, 2018). On the other hand, transported water may have poorer quality because water is transferred through tanks which may have metal corrosion (Kanakoudis et al., 2015). Hence, we can notice that water availability issues do play significant roles behind poor water quality in Aegean Islands. WFD's requirements of water quality may not be in the top agenda of water authorities because there is high risk of water scarcity since water demand exceeds water supply in particularly during summers and water authorities are using any kind of conventional or non-conventional water resources.

It has to be noted that, majority of RBDs in Greece have problems with poor water quality and there are many cases of pollution in particularly in the Northern Greece. This is usually related to agricultural activities and there are high levels of nitrate concentrations which originate from

fertilizers of potassium nitrate or ammonium nitrate (Karavoltsos et al., 2008). Nitrates are one of the well-known pollutants but there can be more pollutants which have not detected yet in Greece. As Steinebach (2019) underlined, majority of EMS have water quality data[35] besides Greece and Portugal and there can be more pollutants which have not been taken into account since there is lack of data.

As it was discussed above, WFD has regulations that set out new standards for water quality and there are separate standards for each element in the water resources (Steinebach, 2019). There have been debates regarding some of these standards because some of these standards do not totally comply with scientific data. As an example, EU boron regulation does not comply totally with scientific data because countries such as Cyprus, Greece and Italy have high levels of boron concentration in their water resources but there is scientific uncertainty whether boron is dangerous for human health or not and at the same time, there are no clear parameters for threshold level.

Thus, EU boron regulation forced Cypriot, Greek and Italian governments to spend high amount of financial resources to lower down boron concentrations from water resources. According to Weinthal et al., (2005), this was not a feasible requirement because there was another scientific uncertainty whether high boron concentrations were related with natural sources or anthropogenic sources (Weinthal et al., 2005). These scientific uncertainties regarding the boron concentrations led to further academic research. As a result, two of these scientific researches conducted in Southern Europe proved that boron concentrations were related with natural sources and geothermal activity and there was no clear anthropogenic pollution in the cases of Cyprus and Greece (Dotsika et al., 2006; Georghiou and Pashalidis, 2007). Hence, we can understand from this example that some of the water quality and pollutants regulations of EU may not fit all of EMS and there can be certain differences in water concentrations due to specific geological and geographical characteristics.

[35] 17 EMS have detailed data regarding pollutants in the water resources according to Steinebach (2019).

In short, there are violations in Greece regarding WFD's water quality requirements and Directive 98/83/EC's parametric values. Although, there are debates regarding scientific uncertainty of some of the regulations, there are many basic regulations (such as nitrates concentrations and metals) that are not totally followed in Greece yet. Consequently, at this point we would like to look the reasons behind the implementation delays and violations in Greece.

6.5. THE REASONS BEHIND THE IMPLEMENTATION DELAYS IN GREECE

There is variety of reasons behind delays in the implementation timetable of WFD in Greece. First of all, geological structure and geomorphology play significant roles for implementing the requirements of WFD. Greece has a complicated geological structure and unequally distributed water resources and water demand is generally supplied through groundwater abstracted from aquifers via numerous wells and boreholes[36] in most of the RBDs (Antonakos et al., 2014; EASAC, 2010). At the same time, Greece has unequally distributed population and high seasonal demand due to agriculture and tourism sectors' activities which led to overexploitation of water resources that resulted in water quality deterioration (salinization and nitrate pollution) (Antonakos et al., 2014; EASAC, 2010).

Water availability and water quantity matters are still important issues for Greece (as it is in the case of other Southern EMS) because of climate change and water quality problems are not in the top agenda (as it is in the case of Northern. EMS) (Garrote et al., 2015; Kanakoudis et al., 2015). Greece has RBDs such as GR09 Western Macedonia that is rich in terms of water resources availability and have excessive access to freshwater due to high precipitation levels (EASAC, 2010). Nevertheless, Greece has RBDs such as G14 Aegean Islands that have very limited access to water resources since they have less precipitation levels because of changing climate conditions.

At the same time, overexploitation of groundwater resources, higher seasonal water demand and higher water losses because of evaporation (and leakages) play important role and annual water losses can reach up to %32 such as in the case of Mykonos Island which is a part of G14 Aegean Islands RBD (DEYAM, personal communication, 11 August 2019). Consequently, we can notice that RBDs have different characteristics and some of them face serious water scarcity problems

[36] The numbers were around 300.000 back in 2010 according to EASAC, (2010).

and from time to time this can become a barrier for RBD authorities to concentrate on the integrated water management policies[37] of WFD (Kanakoudis et al., 2015).

Greece has still a centralized and hierarchical state mechanism as it was discussed above. For that reason, state takes majority of the decisions related to the requirements of WFD. Nevertheless, Kanakoudis et al., (2015) highlighted that Greek state was not ready to adopt such an integrated policy for water resources and this caused so many changes in the legislation and each change in the legislation meant different management planning for RBD authorities. At the same time, Greek central government delayed transporting the provisions of Article 9 "Recovery of costs for water services" of WFD for almost 7 years until the adoption of new legal framework Joint Ministerial Decision 135275/2017 (Farmaki and Tranoulidis, 2018). As a result, it has not been an easy aim for water authorities in Greece, to implement the main requirements of WFD.

In addition to these reasons, financial problems play significant role since lack of financial resources or unwillingness to divert the financial resources available for integrated water management policies have been leading to setbacks in the implementation timetable (Tatsis, 2008). As Kalampouka et al., (2011) underlined, some of the EMS may aim to achieve less binding environmental objectives than those required under Article 4 of WFD since these may cost much less compared to the main requirements under Article 4.

It is visible that Greece faced a serious financial crisis and this affected WFD's requirements' implementation and led to delays in the timetable of WFD (Demetropoulou et al., 2010). WFD requires detailed monitoring of water resources and removing all pollutants to sustain better water quality and this indicates that there is certain dependence on financial resources (Kanakoudis and Tsitsifli, 2015). As a matter of the fact, the costs of WFD's requirements have been a bottleneck for some of EMS such as Greece.

[37] Integrated water management policies such as active public participation and increased number of monitoring sites for data collection for better water quality, etc.

There are other reasons which are more technical and structural. As it was discussed above, monitoring is one of the essential elements of WFD for managing water resources sustainably and having better water quality. Nevertheless, there is only limited focus in monitoring in the Greek RBDs and in general Greece has insufficient involvement of the scientific community, insufficient qualitative and economic data and less technical infrastructure (such as monitoring stations) compared to other EMS (Demetropoulou et al., 2010).

Furthermore, there is limited information from existing monitoring stations on ecological and chemical parameters and Greece has much less sampling sites compared to other EMS' monitoring stations (Kanakoudis and Tsitsifli, 2015). The sampling sites are critical for pollution detection and preemptive decisions to protect water resources. As Kanakoudis and Tsitsifli, (2015) underlined, there is only small number of sampling sites for the identification of special pollutants and priority substances to ensure better water quality and there is many missing data to correlate the water bodies' situation with the causes of downgrading.

For that reason, lack of data and technical infrastructure has been a critical issue for majority of the RBDs in Greece and there are certain setbacks in the implementation timetable due to missing and limited data on monitoring. In Mykonos and Santorini Islands which are part of G14 Aegean Islands RBD similar issues can be observed and there have been issues of water pollution (DEYAM, 2019; DEYATH, 2019).

It has to be noted that, WFD implementation itself and the measures that need to be taken, can cause many reactions and sometimes these reactions can even evolve into protests because authorities and users may have certain mentality that cannot be changed easily, as it has been happening in Greece (Kanakoudis et al., 2015). For that reason, we can talk about a political cost because users may not vote again to ruling political parties if they experience externalities such as higher water prices or higher taxes due to WFD's requirements. On the other hand, there have been cases of political interests' interference and even corruption scandals during the implementation process of WFD in Greece (Kanakoudis et al., 2015). This led to distrust between users, authorities and stakeholders which led to setbacks in the implementation timetable of WFD.

The long and the short of it is that, there are political, financial, technical and geographical reasons behind the postponement of the implementation timetable of WFD in Greece. Although Greece has 7 Decentralized Administrations and 14 self-governed regions, there is still great influence of central government in the nationwide water resources management planning. RBD authorities cannot take decisions easily without the support of the central government due to administrative and financial reasons. In other words, decentralized RBD authorities have still certain level of dependence on the central government. As it will be analyzed later in this work, similar difficulties in management planning took place among local authorities and central government and led to certain delays in Mykonos and Santorini Islands which are the case study areas of this study.

CHAPTER 7 – RESULTS AND DISCUSSION

UNIVERSITAT ROVIRA I VIRGILI
THE WATER SCARCITY AND SUSTAINABLE TOURISM IN THE GREEK ISLANDS: FOCUS CYCLADES ISLANDS
Itri Atay

7 – RESULTS AND DISCUSSION

This chapter will examine the responses of stakeholders on Mykonos and Santorini. The results of the surveys distributed to stakeholders on Mykonos and Santorini will be evaluated using tables and figures. At the same time, there will be some stakeholder comments that provide extensive information about the main topics of this work, such as water resource management, climate change, and sustainable tourism. Furthermore, figures were developed by converting qualitative input into quantitative data via the assessment of open-ended questions. Tables were generated by analyzing closed-answer questions. Finally, there will be a discussion section in this chapter where the research findings will be examined and contextualized in relation to the overall research objectives.

7.1. MYKONOS RESULTS

Table 32 lists the responses from the hospitality stakeholders, water and public authorities, as well as other stakeholders, on the questions of whether or not Mykonos' tourist and environmental policies are (Q1) and should be (Q2) coordinated. We can see that in 2014 and 2015, the majority (64%) of hospitality stakeholders did not think that Mykonos' tourist and environmental strategies were coordinated. Contrarily, the overwhelming majority of the general public and water authorities (100%) said Mykonos' tourist and environmental policies were integrated. The hospitality stakeholders' perspectives were followed similarly by the other stakeholders, and all other stakeholders (100%) indicated that Mykonos' tourist and environmental policies were not coordinated in 2014 and 2015.

On the other hand, we can see that once more, an overwhelming 85% of hospitality stakeholders responded in favor of coordinating tourism and environmental regulations. These comments show that the vast majority of Mykonos' hospitality stakeholders are well aware of the need to coordinate environmental and tourism policies in order to manage the island's tourism and environment sustainably. Additionally, the large majority of public and water authorities (67%) and the overwhelming majority of the other stakeholders (100%) shared similar perceptions with the hospitality stakeholders and agreed that the tourism and environmental policies should be coordinated.

Table 32. Perception of the Mykonos' Stakeholders – if tourism and environmental policies **are** coordinated **(Q1)** and if they **should** be coordinated **(Q2).**

	Question 1				**Question 2**			
	HS[38]	**PWA[39]**	**OS[40]**	**ALL[41]**	**HS**	**PWA**	**OS**	**ALL**
Yes	5 (36%)	3 (100%)	0	8 (35%)	12 (85%)	2 (67%)	6 (100%)	20 (87%)
No	9 (64%)	0	6 (100%)	15 (65%)	2 (15%)	1 (33%)	0	3 (13%)
Total	14 (100%)	3 (100%)	6 (100%)	23 (100%)	14 (100%)	3 (100%)	6 (100%)	23 (100%)

Source: Author's own work.

Environmental concerns may have a detrimental effect on a tourist destination's lifecycle. In order to address environmental issues that may even result in the end of the tourism lifecycle of a tourist destination, the stakeholders who play specific roles in the management of tourism, public governance, water resources, and the environment should have specific tourism policies and administrative planning. In reality, we've asked all of the Mykonos stakeholders (Table 33) if the island's tourism administration and regulations take environmental concerns, particularly the supply of water, into account.

Table 33 shows that 42% of the hospitality stakeholders have the perception that "maybe" the tourism policies and administration take into account environmental issues in Mykonos. In addition

[38] HS stands for hospitality stakeholders which includes hotel managers, hotel owners, hotel directors, etc.
[39] PWA stands for public and water authorities that have certain roles in water resources management.
[40] OS stands for other stakeholders that include academicians, journalists, NGO representatives, bloggers, etc.
[41] ALL stands for all stakeholder subgroups including HS, PWA, and OS.

to this, 29% of hospitality stakeholders agree that tourism policies and administration take into account environmental issues. Nevertheless, the other 29% of the hospitality stakeholders disagree that tourism policies and administration take into account environmental issues. On the other hand, the overwhelming majority of public and water authorities (100%) agree that the tourism policies and administration take into account environmental issues in Mykonos. On the contrary, the vast majority of the other stakeholders either disagree (33%) or absolutely disagree (67%) that the tourism policies and administration take into account environmental issues. In short, there are different perceptions among Mykonos stakeholders, and each stakeholder group has different opinions on whether the tourism policies and administration take into account environmental issues in Mykonos.

Table 33. Perception of the Mykonos' Stakeholders about if tourism policies and administration take into account environmental issues, especially water availability.

	N (%) / Values			
	HS	**PWA**	**OS**	**ALL**
Absolutely Agree (5)	0	0	0	0
Agree (4)	4 (29%) / 16	3 (100%) / 12	0	7 (30%) / 28
Maybe (3)	6 (42%) / 18	0	0	6 (26%) / 18
Disagree (2)	4 (29%) / 8	0	2 (33%) / 4	6 (26%) / 12
Absolutely Disagree (1)	0	0	4 (67%) / 4	4 (18%) / 4
Total N (%) / Total Values	14 (100%) / 42	3 (100%) / 12	6 (100%) / 8	23 (100%) / 62
Mean Value (SD)	4.3 (1.7)	4 (0)	1.33 (0.47)	2.69 (1.08)

Source: Author's own work.

Tourist activity issues should be included in environmental policies and administration because the tourism lifecycle depends on sustainable tourism management. The management of water resources is particularly vulnerable to the major danger posed by seasonal mass tourism (summer months)

and over tourism. In order to determine whether environmental policies and administration take into account issues related to tourism activity or not, the following question was also posed to the Mykonos stakeholders:

Table 34. Perception of the Mykonos' Stakeholders about if environmental policies and administration take into account tourism activity issues.

	N (%) / Values			
	HS	**PWA**	**OS**	**ALL**
Absolutely Agree (5)	0	0	0	0
Agree (4)	4 (29%) / 16	3 (100%) / 12	0	7 (30%) / 28
Maybe (3)	6 (42%) / 18	0	0	6 (26%) / 18
Disagree (2)	4 (29%) / 8	0	2 (33%) / 4	6 (26%) / 12
Absolutely Disagree (1)	0	0	4 (67%) / 4	4 (18%) / 4
Total N (%) / Total Values	14 (100%) / 42	3 (100%) / 12	6 (100%) / 8	23 (100%) / 62
Mean Value (SD)	4.3 (1.7)	4 (0)	1.33 (0.47)	2.69 (1.08)

Source: Author's own work.

Table 34 shows that 42% of the hospitality stakeholders have the perception that "maybe" the environmental policies and administration take into account tourism activity issues in Mykonos. Additionally, 29% of the hospitality stakeholders "agree" but the remaining 29% of hospitality stakeholders, however, disagree that the environmental policies and administration take into account tourism activity issues. Meanwhile, the vast majority of the public and water authorities (100%) agree that the environmental policies and administration take into account tourism activity issues. Finally, the overwhelming majority of the other stakeholders either disagree (33%) or absolutely disagree (67%) that the environmental policies and administration take into account tourism activity issues. The long and the short of it is that we can notice that Mykonos stakeholders have similar responses to Question 4 as it is in the case of Question 3 and each stakeholder group

has different opinions on whether the environmental policies and administration take into account tourism activity issues.

The hospitality stakeholders that play certain roles in hotels or resorts should have clear plans in place to address environmental issues that could possibly result in the demise of a tourist destination's tourism lifecycle. In fact, we specifically questioned the Mykonos hospitality stakeholders about whether environmental issues were on their agenda (Table 35). The majority of hospitality stakeholders (71%) have indicated that environmental issues are on the agenda in their responses, as can be shown. In addition to this, 14.5% of hospitality stakeholders absolutely agree that environmental issues are on their agenda. In short, 85.5% of hospitality stakeholders either absolutely agree or agree that environmental issues are on their agenda.

Table 35. Perception of the Mykonos' Hospitality Stakeholders about if environmental issues are in their agenda.

	N (%)	Values
Absolutely Agree (5)	2 (14.5%)	10
Agree (4)	10 (71%)	40
Maybe (3)	2 (14.5%)	6
Disagree (2)	0	0
Absolutely Disagree (1)	0	0
Total / Mean value (SD)	14 (100%)	4 (0.53)

Source: Author's own work.

There is little doubt that diverse economic sectors such as the tourism industry may be impacted by shifting climatic conditions if they are already located in regions that have arid or semi-arid climates. The negative impacts can be severe if there is seasonal tourism activity as well as the over-tourism phenomenon. Hence, we wanted to learn the perceptions of the Mykonos stakeholders on whether climate change has an influence on the tourism industry activities in Mykonos or not. As can be seen in Table 36, 50% of the hospitality stakeholders believe that climate change has a very high influence while the other 14% of the hospitality stakeholders think that it has a high

influence. In addition to this, 22% of the hospitality stakeholders have the perception that climate change has some influence on tourism activity in Mykonos.

Meanwhile, the majority of the public and water authorities (66%) have the perception that climate change has a high influence on tourism activity in Mykonos. Finally, the majority of the other stakeholders (67%) have the perception that climate change has a very high influence on tourism activity in Mykonos. It has to be noted that, there was only 1 out of 3 public and water authorities, and 1 out of 6 of the other stakeholders believe that there was little influence of climate change on tourism activity in Mykonos.

Table 36. Perception of the stakeholders about if climate change has influence on tourism activity in Mykonos.

	N (%) / Values			
	HS	**PWA**	**OS**	**ALL**
Very High Influence (5)	7 (50%) / 35	0	4 (67%) / 20	11 (48%) / 55
High Influence (4)	2 (14%) / 8	2 (66%) / 8	0	4 (17%) / 16
Some Influence (3)	3 (22%) / 9	0	1 (16.5%) / 3	4 (17%) / 12
Little Influence (2)	1 (7%) / 2	1 (34%) / 2	1 (16.5%) / 2	3 (13%) / 6
Very Little Influence (1)	1 (7%) / 1	0	0	1 (5%) / 1
Total N (%) / Total Values	14 (100%) / 55	3 (100%) / 10	6 (100%) / 25	23 (100%) / 90
Mean Value (SD)	3.92 (1.27)	3.33 (0.94)	4.16 (1.21)	3.91 (1.24)

Source: Author's own work.

In addition to natural factors, anthropogenic actions can exacerbate the effects of climate change. As was mentioned above, there are many different anthropogenic activities, and the industries of agriculture, industry, and tourism all contribute in some way negatively to climate change.

Therefore, we were interested in finding out whether the Mykonos stakeholders thought that the tourism industry had a detrimental impact on climate change:

Table 37. Perception of the Mykonos Stakeholders about if the tourism activity has a negative contribution to climate change in Mykonos.

	N (%) / Values			
	HS	**PWA**	**OS**	**ALL**
Very High Contribution (5)	2 (14%) / 10	0	2 (33.3%) / 10	4 (17%) / 20
High Contribution (4)	4 (29%) / 16	1 (34%) / 4	1 (16.7%) / 4	6 (26%) / 24
Some Contribution (3)	6 (43%) / 18	2 (66%) / 6	1 (16.7%) / 3	9 (39%) / 27
Little Contribution (2)	1 (7%) / 2	0	1 (16.7%) / 1	2 (9%) / 3
Very Little Contribution (1)	1 (7%) / 1	0	1 (16.7%) / 1	2 (9%) / 2
Total N (%) / Total Values	14 (100%) / 47	3 (100%) / 10	6 (100%) / 19	23 (100%) / 90
Mean Value (SD)	3.35 (1.04)	3.33 (0.47)	3.33 (1.49)	3.34 (1.12)

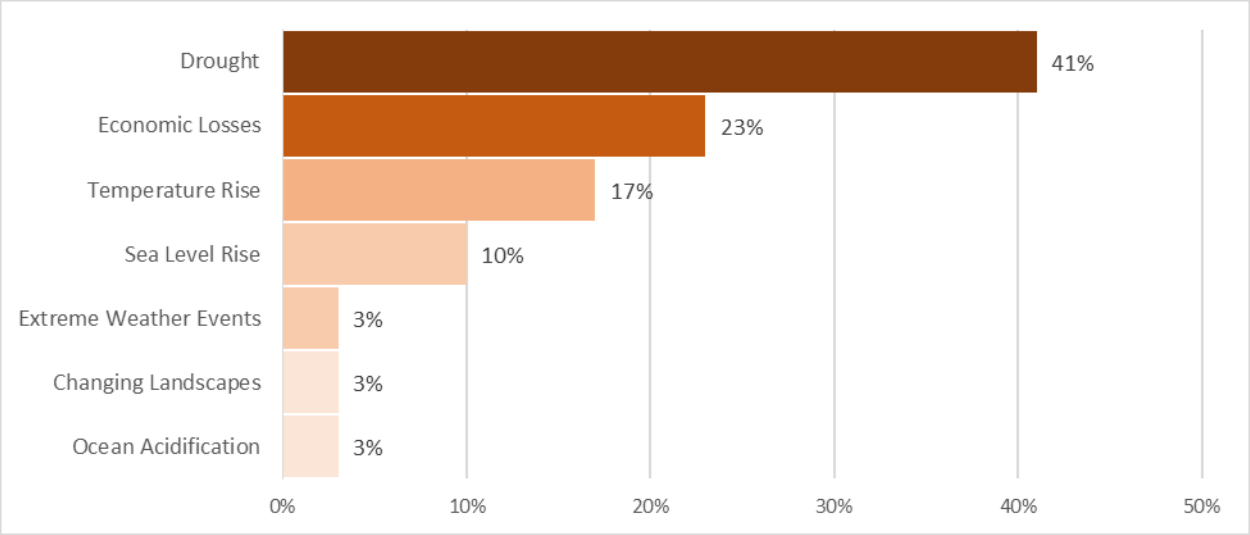
Source: Author's own work.

Table 37 shows that 43% of the hospitality stakeholders have the perception that tourism activity has some negative contribution to climate change. In addition to this, 29% of the hospitality stakeholders believe that tourism activity has a high negative contribution to climate change, and the other 14% have the perception that tourism activity has a very high negative contribution to climate change in Mykonos. On the other hand, 66% of the public and water authorities have the perception that tourism activity has some negative contribution to climate change. Finally, 33.3% of the other stakeholders believe that tourism activity has a very high negative contribution, and the other 16.7% have the perception that tourism activity has a high negative contribution to climate change in Mykonos. In short, it can be observed that the majority of the Mykonos stakeholders

have similar perceptions, and they believe that tourism activity has some certain degree of negative contribution to climate change on the island.

Threats from climate change come in many different forms, and each tourist location may have a unique experience. In fact, we asked Mykonos stakeholders to rank the three greatest concerns posed by climate change to the island's tourism industry. According to Figure 31, the worst two effects of climate change on tourism in Mykonos are "drought" and "economic losses," according to 41% of stakeholders and 23% of stakeholders, respectively. In addition, %17 of the respondents ranked "temperature rise" as the third largest threat posed by climate change to the tourism industry. Sea level rise is the fourth threat posed by climate change to Mykonos tourism, according to 10% of respondents.

Figure 31. Perception of the Mykonos' Stakeholders about the three worst threats of climate change on tourism activity in Mykonos.[42]



Source: Author's own work.

In order to combat the worst effects of climate change, programs for adaptation and mitigation are essential. Therefore, cooperation between decision-makers, managers of water resources, representatives of the hospitality industry, and other stakeholders is crucial for improving resilience

[42] Each one of the 20 stakeholders could choose the 3 worst threats of climate change on tourism activity in Mykonos.

to the dangers posed by climate change. In order to combat the effects of climate change, we consequently asked the Mykonos stakeholders if there should be coordination amongst one another.

As can be seen in Table 38, 43% of the hospitality stakeholders have the perception that there should be coordination among actors to fight against the impacts of climate change on tourism activity. In addition to this, 21% of the hospitality stakeholders believe that there is already existing coordination among the actors. Meanwhile, 66% of the public and water authorities have the perception that there is existing coordination among actors to fight against the threats of climate change on tourism activity in Mykonos. Furthermore, the overwhelming majority of the other stakeholders (83%) have the perception that there should be coordination among the actors to fight against the impacts and threats of climate change on the island.

It should be highlighted that there were 4 out of 23 Mykonos stakeholders who said that there should be future coordination but not now. At last, there were 3 out of 23 Mykonos stakeholders said that there should be never coordination among actors. Hence, we can notice that there are a variety of different perceptions but still, the majority of the stakeholders agree that there should be coordination among actors in order to fight against the impacts of climate change on tourism activity on the island.

Table 38. Perception of the Mykonos' Stakeholders about if there should be a fight against the impacts of climate change.

	HS	**PWA**	**OS**	**ALL**
Yes, they should	6 (43%)	0	5 (83%)	11 (48%)
Yes, and they are acting at present	3 (21%)	2 (66%)	0	5 (22%)
No, they should not now, but they should in the future	3 (21%)	0	1 (17%)	4 (17%)
No, they should never	2 (15%)	1 (34%)	0	3 (13%)
Total	14 (100%)	3 (100%)	6 (100%)	23 (100%)

Source: Author's own work.

Each stakeholder group has a different role to play in the serious planning that is needed to combat the effects of climate change. As a result, we specifically asked a question about the public and water authorities and other stakeholders' roles in the battle against climate change in Mykonos.

Table 39. The role played by your institution/organization in order to fight against climate change.

	Public & Water Authorities	**Other Stakeholders**
The main role, it is the leader	2 (66%)	0
Key role	1 (34%)	0
Collaboration with the main and the key actors	0	3 (50%)
Supporting strategies designed by the main actors	0	3 (50%)
Total	3 (100%)	6 (100%)

Source: Author's own work.

Table 39 shows that 66% of the public and water authorities have the main role, and the other 34% has a key role in the fight against climate change. Meanwhile, the half of the other stakeholders collaborate with the main and the key actors, and the other half of the other stakeholders are supporting strategies designed by the main actors. As a matter of fact, the majority of public and water authorities have, in reality, either the primary or crucial role in the fight against climate change. On the other hand, the other stakeholders are in charge of either collaboration or playing supportive roles in the fight against climate change in Mykonos.

In order to combat the effects of the changing climate conditions, climate change mitigation methods are crucial. Different mitigation tactics may be used to combat the effects of climate change. In order to learn what stakeholders on Mykonos thought were the most crucial mitigation tactics, we posed the following open-ended question to them:

Public and Water Authority #2: We are focusing on creating desalination projects with sustainable solar energy. We believe that increasing the usage of RES is a good mitigation strategy for tackling the impacts of climate change on tourism. In addition to this, I believe that increasing allocation efficiency by making sure domestic water demand is met and using the remaining

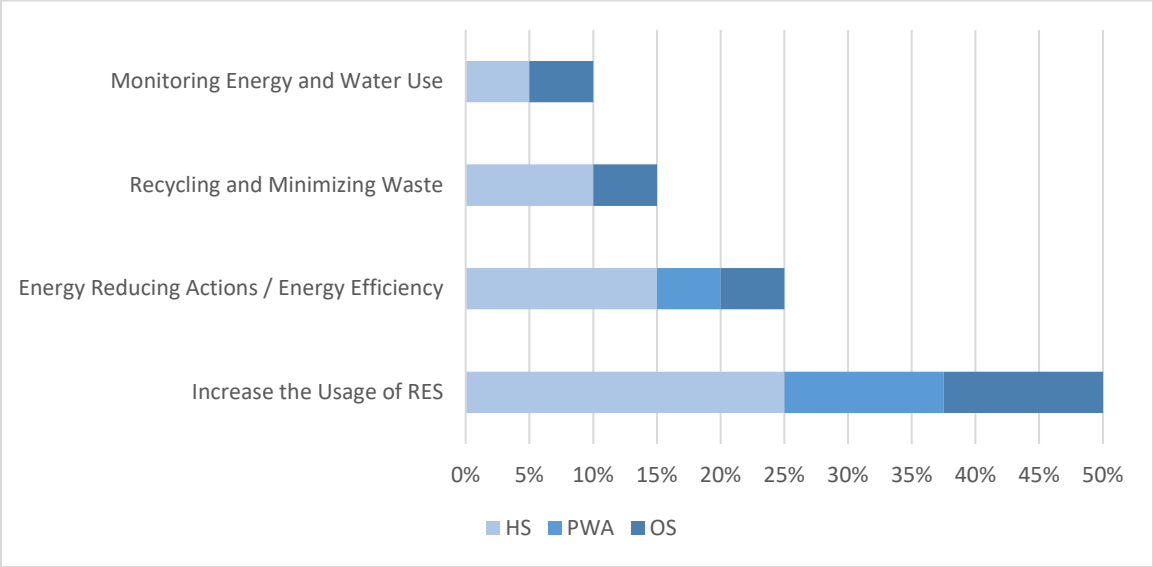
available water below the maximum sustainable level for the success of tourism is another mitigation strategy. We are in the process of achieving these goals together with the tourism resorts.

Other Stakeholder #2: There is a need for national drought policies which will include integrated drought and water scarcity risk management, emergency relief, and rehabilitation planning. Planning and having mitigation strategies are key issues when we talk about water scarcity in Mykonos. Summer 2009 is a good example since there was no kind of mitigation strategy, tourists could not be able to take even showers at 4-star hotels.

Hospitality Stakeholder #3: We have specific mitigation plans and our main focus is to monitor our energy and water use. We aim to decrease our energy and water consumption gradually within the next 2-3 years.

As evidenced by some of the responses, each stakeholder group has different perspectives on the most important climate change mitigation strategies. According to Mykonos stakeholders (including all three sub-groups), the following are the most important mitigation strategies:

Figure 32. Perception of the Mykonos Stakeholders about the most important mitigation strategies to tackle the impacts of climate change.[43]



Source: Author's own work.

[43] 20 of the 23 Mykonos Stakeholders answered Question 8 as a, b or c. For that reason, the results are according to the 20 stakeholders including all three different stakeholder sub-group.

Figure 32 shows that half of the Mykonos stakeholders have the perception that the most important mitigation strategy is to increase the usage of Renewable Energy Resources (RES). In addition to this, 25% of the Mykonos stakeholders believe that energy-reducing actions (energy efficiency) are the second most important mitigation strategy to tackle the impacts of climate change. On the other hand, 15% of the Mykonos stakeholders think that recycling and minimizing waste is the third most important mitigation strategy. Finally, 10% of the Mykonos stakeholders have the perception that monitoring energy and water use is the fourth most important mitigation strategy to tackle the impacts of climate change. In short, the majority of the Mykonos stakeholders believe that increasing the usage of RES is the most important mitigation strategy to intercept the impacts of climate change in Mykonos.

Climate change adaptation strategies are critical for tourist destinations facing the effects of changing climate conditions. Matter of fact, we asked another open-ended question to Mykonos stakeholders to assess their perceptions of the most important climate change adaptation strategies:

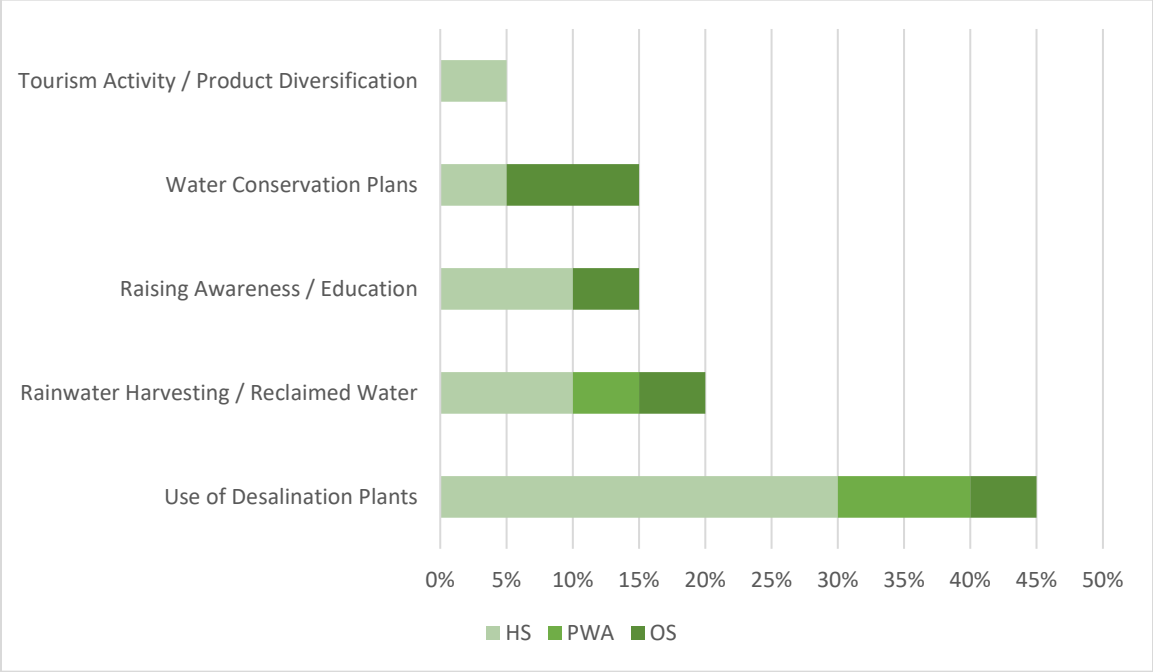
Public and Water Authority #3:.We need to decrease the impacts of climate change and this can be only achieved through building more desalination plants that are functioning with solar or wind power. In Mykonos, we have more than enough solar and wind power. This is our main adaptation plan.

Other Stakeholder #1: The most important adaptation strategy will be infrastructure improvements. Rainwater collectors can be very useful for tourism resorts.

Hospitality Stakeholder #1: Water scarcity has become a problem in the last 10 years. There are already 3 desalination plants in Mykonos but they are not totally functioning. There should be solutions to adapt to the impacts of climate change. The local authorities are not successful at all and we are even thinking of building our own desalination plant to guarantee water supply for our customers during the summer months.

Some of the responses show that Mykonos stakeholders have a variety of different perspectives on the most important climate change adaptation strategies. According to Mykonos stakeholders (including all three sub-groups), the following are the most important adaptation strategies:

Figure 33. Perception of the Mykonos Stakeholders about the most important adaptation strategies to tackle the impacts of climate change.[44]



Source: Author's own work.

Figure 33 shows that the majority of the Mykonos stakeholders (45%) have the perception that the usage of desalination plants is the most important climate change adaptation strategy. In addition to this, 20% of the Mykonos stakeholders believe that rainwater harvesting or using reclaimed water is the second most important climate change adaptation strategy. Furthermore, 15% of the Mykonos stakeholders believe that raising awareness / education, and the other 15% think that water conservation plans are the third most important climate adaptation strategies to tackle the impacts of climate change. In short, the use of desalination plants as a climate change adaptation strategy has widespread acceptance among Mykonos stakeholders.

The tourism industry contributes to climate change in some ways, and many hotels and resorts in tourist areas are taking steps to reduce their carbon footprint. As previously discussed, there are several examples, such as Rhodes and Malta Islands, where there are plans for negative

[44] 20 of the 23 Mykonos Stakeholders answered Question 8 as a, b or c. For that reason, the results are according to the 20 stakeholders including all three different stakeholder sub-group.

contribution-reducing actions such as monitoring energy and water use, and raising awareness for customers and staff. As a result, we wanted to learn about Mykonos stakeholders' perceptions of the most important actions to reduce the tourism sector's negative contribution to climate change:

Public and Water Authority #1: Cooperation is important. When we talk about Mykonos, we talk about 2000 swimming pools during the summer which means 80 cubic meters of water on average and a total consumption of 160.000 cubic meters of water during the summer. As I have mentioned without mutual understanding and cooperation, we cannot handle a future crisis. There is a lot of work to do by the tourism and hospitality stakeholders because it is not an easy goal to decrease energy and water use when millions are visiting the island during the summer months.

Other Stakeholder #5: The first thing that the tourism and hospitality stakeholders should do is to notice that they are not alone on the island by themselves. There are local people who are living in Mykonos and they have to face each year summer water shortages. So first of all, they should start a dialogue with the people. Then they should focus on reducing their water demand. This should be done in cooperation together with the government and the local people.

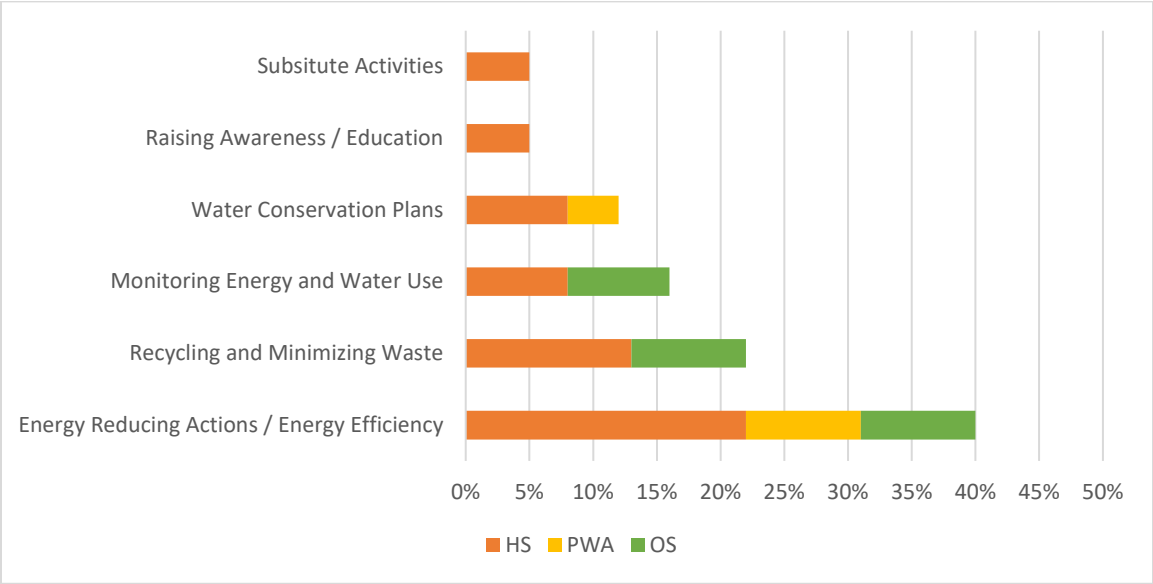
Hospitality Stakeholder #6: There should be impact assessment and monitoring. This is of course not easy for small hotels or even medium-sized hotels. Nevertheless, 4 or 5 stars must have alternative plans and adaptation strategies.

As evidenced by some of the Mykonos Stakeholders' responses, there is a wide range of perceptions among the stakeholders regarding the negative contribution measures. As a result, Figure 34 depicts the most important measures to reduce tourism's negative contribution to climate change.

As can be seen in Figure 34 the majority of the Mykonos stakeholders (40%) have the perception that energy reducing actions (energy efficiency) is the most important measure to decrease the negative input of tourism activity to climate change. On the other hand, 22% of the Mykonos stakeholders believe that recycling and minimizing waste is the second most important measure to lessen the negative input of tourism activity to climate change. Moreover, 16% of the Mykonos stakeholders view monitoring energy and water use as the third most important measure to decrease the negative contribution of tourism activity to climate change. In short, the majority of the Mykonos stakeholders believe that energy reducing actions (energy efficiency) is the most

important measure to lessen the negative externalities of tourism activity to climate change in Mykonos.

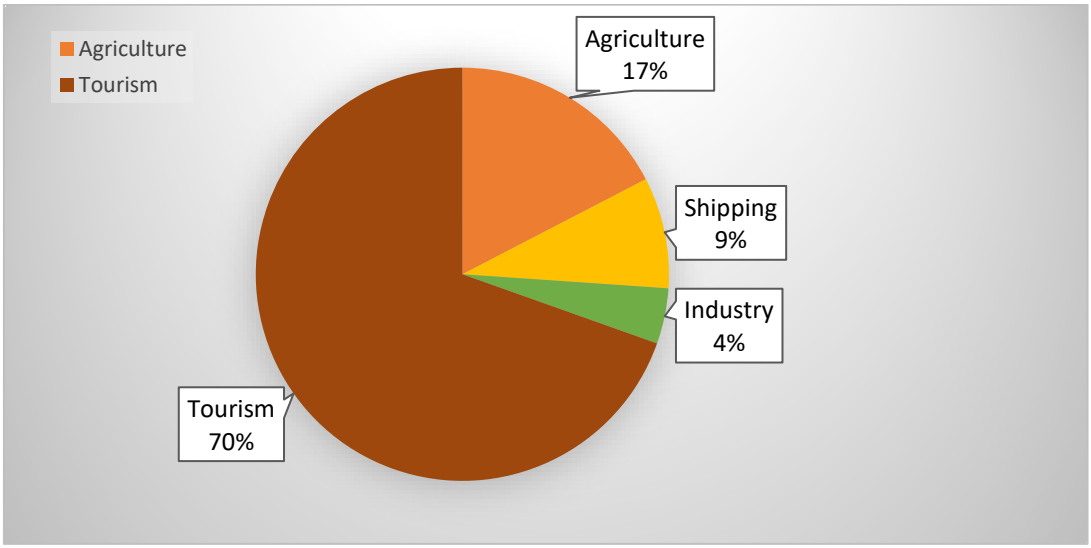
Figure 34. Perception of the Mykonos Stakeholders about the measures to reduce negative tourism contribution to climate change.



Source: Author's own work.

Although Mykonos's most significant industry is tourism, the island's economy also includes agriculture, with a focus on the wine and olive oil industries in particular. In fact, we were interested in finding out what Mykonos stakeholders thought about the island's commercial sector's excessive water use. Figure 35 shows that the majority of Mykonos stakeholders (%70) are aware that the tourism industry uses the most water on the island. Meanwhile, %17 of the stakeholders think that the agricultural industry in Mykonos uses the second most water.

Figure 35. Perception of the Mykonos' Stakeholders about the highest water consuming economic sector.



Source: Author's own work.

For the past ten years, Mykonos has struggled with a water stress, especially in the summer when the island's population soars due to the island's booming tourism industry. The native population of the island has already felt the effects of these water constraints on a daily basis. In addition, the island's reputation as a tourist attraction is being harmed by the water shortages. We were interested in finding out how Mykonos stakeholders felt about this and whether they believed that the island's expanding tourism industry was to blame for the island's summertime water problems.

As seen in the local media, DEYAM's provision of water services to the island has been the subject of complaints from the local inhabitants. Similar objections were heard when some of the stakeholders were interviewed. We therefore wanted to know their perceptions, and if they believed that DEYAM's management of the island's water resources was the primary cause of the island's water issues.

Table 40. Perception of the Mykonos Stakeholders about if water shortages are due to tourism activity in Mykonos **(Q15)** and if short term based water resources management exist in Mykonos or not **(Q16).**

	Question 15				Question 16			
	HS	**PWA**	**OS**	**ALL**	**HS**	**PWA**	**OS**	**ALL**
Absolutely Agree (5)	2 (14%) / 10	3 (100%) / 15	1 (16.7 %) / 5	6 (26.1%) / 30	2 (14%) / 10	0	4 (67%) / 20	6 (26.1%) / 30
Agree (4)	3 (21%) / 12	0	3 (50%) / 12	6 (26.1%) / 24	5 (36%) / 20	0	1 (16.5%) / 4	6 (26.1%) / 24
Maybe (3)	7 (50%) / 21	0	1 (16.6 %) / 3	8 (34.8 %) / 24	4 (28%) / 12	1 (33.3 %) / 3	0	5 (21.7 %) / 15
Disagree (2)	2 (14%) / 8	0	1 (16.6 %) / 2	3 (13%) / 10	2 (14%) / 4	0	0	2 (8.7%) / 4
Absolutely Disagree (1)	0	0	0	0	1 (8%) / 1	2 (66.7 %) / 2	1 (16.5%) / 1	4 (17.3%) / 4
Total N (%) / Total Values	14 (100%) / 51	3 (100%) / 15	6 (100 %) / 18	23 (100%) / 88	14 (100%) / 47	4 (100 %) / 5	6 (100%) / 25	23 (100%) / 77
Mean Value (SD)	3.35 (0.89)	5 (0)	3.33 (1.10)	3.65 (1.00)	3.35 (1.10)	1.66 (0.94)	4.16 (1.46)	3.34 (1.40)

Source: Author's own work.

Table 40 shows that 50% of the hospitality stakeholders have the perception that "maybe" the water shortages are due to tourism activity in Mykonos. At the same time, 21% of the hospitality stakeholders "agree" that the water shortages are due to tourism activity. Meanwhile, the overwhelming majority of the public and water authorities (100%) "absolutely agree" that the water shortages are related to tourism activity on the island. In addition to this, 33.6% of the other stakeholders "agree", and the other 16.6% "absolutely agree" that the water shortages are due to the tourism activity in Mykonos. For that reason, it can be observed that there are a variety of

different perceptions regarding the role of tourism activity behind the water shortages, and there is not a general consensus among each stakeholder group in Mykonos regarding this matter.

Table 40 also shows that 36% of the hospitality stakeholders “agree”, and the other 14% of the hospitality stakeholders “absolutely agree” that short-term-based water resources management exists in Mykonos. On the contrary, 66.7% of the public and water authorities “absolutely disagree” that there is bad water management in Mykonos that causes water shortages during the summer months. At last, it can be observed that 67% of the other stakeholders “absolutely agree” and the other 16.5% of the other stakeholders “agree” that the bad water resources management is the reason behind the summer water shortages on the island. As a result, the majority of the hospitality stakeholders and the other stakeholders think that the public authorities and DEYAM's management of the island's water resources are partially to blame for the water shortages in Mykonos.

As can be observed in mainland Greece during the summer months, the agricultural sector can lead to excessive water use and even water shortages. As was already indicated, %17 of the stakeholders in Mykonos believe that the agricultural industry uses the second most water after the tourism sector. Thus, the question of whether the island's agricultural activity is to account for the water shortages was raised. Additionally, less rainfall and droughts play a big part in the water shortages in many tourist destinations throughout the world. As was analyzed above, Mykonos stakeholders view “droughts” (41%) as the worst threat coming from climate change. As a result, another question was posed to the stakeholders whether water shortages are taking place on the island because of climate change.

Table 41 shows that 36% of the hospitality stakeholders “disagree”, and the other 21% of the hospitality stakeholders “absolutely disagree” that the agriculture activity in Mykonos has a role in the water shortages. However, 29% of the hospitality stakeholders have the perception that “maybe” agriculture activity in Mykonos has a role in the water shortages. Meanwhile, 67% of the public and water authorities “absolutely disagree” that agriculture activity has a role. Furthermore, the overwhelming majority of the other stakeholders either “disagree” (50%) or “absolutely disagree” (33.3%) that agriculture has no role in the water shortages in Mykonos. In short, the majority of the Mykonos stakeholders believe that agriculture activity has no role in water shortages on the island.

Table 41. Perception of the Mykonos Stakeholders about if water shortages are due to agriculture activity in Mykonos **(Q17)** and if water shortages are due to climate change (**Q18).**

	Question 17				Question 18			
	HS	**PWA**	**OS**	**ALL**	**HS**	**PWA**	**OS**	**ALL**
Absolutely Agree (5)	0	0	0	0	2 (14%) / 10	0	1 (16.7 %) / 5	3 (13%) / 15
Agree (4)	2 (14%) / 8	0	1 (16.7 %) / 4	3 (13%) / 12	6 (43%) / 24	2 (67%) / 8	2 (33.3 %) / 8	10 (43.4%) / 40
Maybe (3)	4 (29%) / 12	1 (33%) / 3	0	5 (21.8%) / 15	3 (21%) / 9	1 (33%) / 3	2 (33.3 %) / 6	6 (26%) / 18
Disagree (2)	5 (36%) / 10	0	3 (50%) / 6	8 (34.7%) / 16	2 (14%) / 4	0	1 (16.7 %) / 2	3 (13%) / 6
Absolutely Disagree (1)	3 (21%) / 3	2 (67%) / 2	2 (33.3 %) / 2	7 (30.5%) / 7	1 (8%) / 1	0	0	1 (4.6%) / 1
Total N (%) / Total Values	14 (100%) / 33	3 (100%) / 5	6 (100 %) / 12	23 (100%) / 50	14 (100%) / 48	3 (100%) / 11	6(100 %) / 23	23 (100%) / 82
Mean Value (SD)	2.35 (0.97)	1.66 (0.94)	2 (1)	2.17 (1.00)	3.42 (1.11)	3.66 (0.47)	3.5 (0.95)	3.47 (1.01)

Source: Author's own work.

Moreover, Table 41 also shows that the majority of the hospitality stakeholders either "agree" (43%) or "absolutely agree" (14%) that climate change has a role in water shortages in Mykonos. It has to be noted that, the majority of the public and water authorities share similar perceptions with the hospitality stakeholders regarding the role of climate change in the water shortages on the island because 67% of the public and water authorities "agree" that climate change has a role in water shortages in Mykonos. Furthermore, 33.3% of the other stakeholders "agree", and the other 16.7% of the other stakeholders "absolutely agree" that climate change has a role. However, it has to be noted that 33.3% of the other stakeholders have the perception that "maybe" climate change

has a role in the water shortages on the island. In short, there is a general perception that climate change has some role in water shortages on the island, and this general perception can be observed in each stakeholder subgroup.

Water shortages in Mykonos typically occur during the summer months, as they take place in Santorini and other Cyclades Islands. Nonetheless, the frequency of these water shortages is significant for the daily lives of the local population as well as the continuation and sustainability of tourism activities in Mykonos. As a result, Mykonos stakeholders were asked about the frequency of water shortages:

Table 42. Perception of the stakeholders about the frequency of the water shortages in Mykonos.

	Question 19			
	HS	**PWA**	**OS**	**ALL**
Very Frequent	4 (28.6%)	0	4 (66.6%)	8 (34.8%)
Frequent	3 (21.4%)	0	2 (33.4%)	5 (21.7%)
Sometimes	4 (28.6%)	1 (33.4%)	0	5 (21.7%)
Rare	1 (7.1%)	1 (33.3%)	0	2 (8.7%)
Very Rare	2 (14.3%)	1 (33.3%)	0	3 (13.1%)
Total	14 (100%)	3 (100%)	6 (100%)	23 (100%)

Source: Author's own work.

Table 42 shows that 28.6% of the hospitality stakeholders believe that water shortages are sometimes taking place on the island. On the other hand, 28.6% of the hospitality stakeholders think that water shortages are very frequent, and the other 21.4% of the hospitality stakeholders believe that water shortages are frequent in Mykonos. Moreover, 33.4% of the public and water authorities believe that water shortages are sometimes taking place on the island. In addition to this, 33.3% of the public and water authorities have the perception that water shortages are rarely taking place, and the other 33.3% of the public and water authorities believe that water shortages are very rare on the island. Finally, the majority of the other stakeholders believe that the water

shortages are either very frequent (66.6%) or frequently (33.4%) taking place on the island. In short, we can notice that there is a variety of different perceptions amongst the stakeholder subgroups and there is no general consensus regarding the frequency of the water shortages in Mykonos.

These findings indicate that there are some issues with water resource management in Mykonos, and stakeholder perceptions provide insight into the quality of the water supply (in terms of water availability). Even if water shortages occur "every now and then" on the island, they can cause consumer dissatisfaction. As a result, the satisfaction of water supply is critical in analyzing the details of poor water resource management. As a result, stakeholders were surveyed to see if they were satisfied with the water supply (in terms of availability / quantity) in Mykonos.

Table 43. Perception of the Mykonos Stakeholders about if they have satisfaction of water supply (in terms of water availability / quantity) in Mykonos.

	N (%) / Values			
	HS	**PWA**	**OS**	**ALL**
Very Satisfied (5)	1 (7.3%) / 5	1 (34%) / 5	0	2 (8.7%) / 10
Satisfied (4)	2 (14.3%) / 8	1 (33%) / 4	0	3 (13%) / 12
Neutral (3)	3 (21.4%) / 9	1 (33%) / 3	0	4 (17.4%) / 12
Unsatisfied (2)	4 (28.5%) / 8	0	1 (16.7%) / 2	5 (21.8%) / 10
Very Unsatisfied (1)	4 (28.5%) / 4	0	5 (83.3%) / 5	9 (39.1%) / 9
Total N (%) / Total Values	14 (100%) / 34	3 (100%) / 12	6 (100%) / 7	23 (100%) / 53
Mean Value (SD)	2.42 (1.23)	4 (0.81)	1.14 (0.35)	2.30 (1.33)

Source: Author’s own work.

Table 43 shows that 28.5% of the hospitality stakeholders are “very unsatisfied”, and the other 28.5% of the hospitality stakeholders are “unsatisfied” with the water supply in Mykonos. On the contrary, 34% of the public and water authorities are “very satisfied”, and the other 33% of the

public and water authorities are “satisfied”. However, the perceptions of the other stakeholders are similar with the hospitality stakeholders since the overwhelming majority of the other stakeholders are “very unsatisfied” (83.3%). In short, the hospitality stakeholders and the other stakeholders are either “very unsatisfied” or “unsatisfied” with the water supply in terms of quantity. Nevertheless, public and water authorities are rather “very satisfied” or “satisfied” with the water supply in Mykonos.

Many different tourism destinations around the world (particularly those with arid or semi-arid climates) are using non - conventional water resources such as desalinated water, reclaimed water, or rainwater harvesting to increase water availability. As previously stated, new desalination plants are being built in Mykonos to increase water supplies (water availability) for the same purpose. As a result, Mykonos stakeholders were asked whether desalination plants are the solution to overcoming water shortages and improving water availability on the island. In addition to this question, we asked the stakeholders whether they believe reclaimed water is a viable solution for increasing Mykonos' water availability.

Table 44 shows that the majority of the hospitality stakeholders (57%) have the perception that “maybe” desalination plants are the solution to the water scarcity problem in Mykonos. On the other hand, the overwhelming majority of the public and water authorities (100%) “agree” that desalination plants are the solution to the water scarcity issues on the island. Furthermore, the majority of the other stakeholders (66.6%) “absolutely disagree” that desalination plants are the solution to the water scarcity problem in Mykonos. In short, there is a variety of different perceptions among Mykonos stakeholders, and each subgroup has its own opinions there is no general consensus on whether the desalination plants can be a remedy for the water scarcity problem in Mykonos.

Table 44 also shows that there are mixed perceptions among the hospitality stakeholders on whether reclaimed water is the solution to the water scarcity problem in Mykonos because 42.8% of the hospitality stakeholders “disagree” while the other 35.8% of the hospitality stakeholders believe that “maybe” reclaimed water is the solution to the water scarcity problem. On the other hand, the vast majority of the public and water authorities (100%) “disagree” that reclaimed water is the solution to the water scarcity problem. The mixed perceptions can be followed in the responses of the other stakeholders as well because half of the other stakeholders “agree” that

reclaimed water is the solution while the other half has the perception that "maybe" reclaimed water is the solution to the water scarcity problem in Mykonos. The long and the short of it is that, there are a variety of different perceptions among Mykonos stakeholders and these mixed perceptions can be observed among the hospitality stakeholders and the other stakeholders. Nevertheless, the public and water authorities as a subgroup share similar perceptions (100% disagree) regarding the usage of reclaimed water as a solution to the water scarcity problem in Mykonos.

Table 44. Perception of Mykonos Stakeholders about if desalination plants are the solution to the water scarcity issues in Mykonos **(Q21)** and if reclaimed water is the solution to the water scarcity issues in Mykonos **(Q22)**.

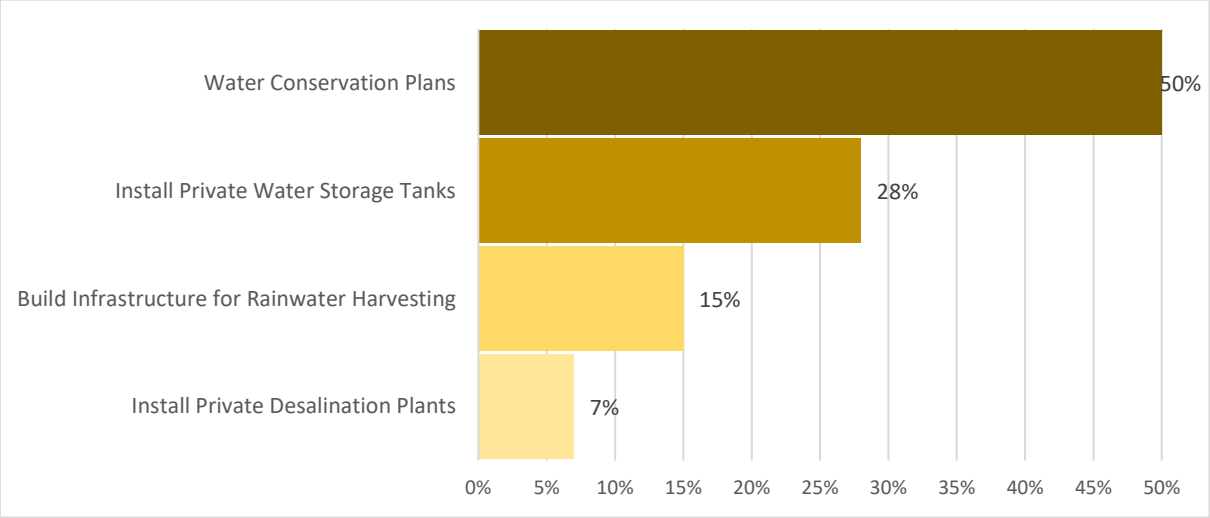
	Question 21				**Question 22**			
	HS	**PWA**	**OS**	**ALL**	**HS**	**PWA**	**OS**	**ALL**
Absolutely Agree (5)	1 (7.2%) / 5	0	1 (16.7 %) / 5	2 (8.7%) / 10	0	0	0	0
Agree (4)	3 (21.4%) / 12	3 (100%) / 12	0	6 (26%) / 24	3 (21.4%) / 12	0	3 (50%) / 12	6 (26%) / 24
Maybe (3)	8 (57%) / 24	0	1 (16.7 %) / 3	9 (39.2 %) / 27	5 (35.8%) / 15	0	3 (50%) / 9	8 (34.8 %) / 24
Disagree (2)	1 (7.2%) / 2	0	0	1 (4.3%) / 2	6 (42.8%) / 12	3 (100%) / 6	0	9 (39.2 %) / 24
Absolutely Disagree (1)	1 (7.2%) / 1	0	4 (66.6 %) / 4	5 (21.8 %) / 5	0	0	0	0
Total N (%) / Total Values	14 (100%) / 44	3 (100%) / 12	6 (100 %) / 12	23 (100%) / 68	14 (100%) / 39	3 (100%) / 6	6(100 %) / 21	23 (100%) / 66
Mean Value (SD)	3.14 (0.91)	4 (0)	2 (1.52)	2.95 (1.23)	2.78 (0.77)	2 (0)	3.5 (0.5)	2.87 (0.80)

Source: Author's own work.

As previously stated, hotels and resorts are constructing private desalination plants in many tourist destinations that face water scarcity issues. As a result, we wanted to know if the hospitality stakeholders in Mykonos use desalination plants. The vast majority of hospitality stakeholders (92.9%) completely disagreed that they had private desalination plants on their premises. It should be noted that only one hospitality stakeholder out of 14 stated in 2015 that their hotel had a private desalination plant.

Water supply is critical for hotels and resorts to continue operating and meeting their customers' needs. Even if there are water shortages in the destination, the majority of hotels must have access to water supply. In fact, different types of accommodations, such as hotels or resorts, must take the necessary steps to ensure water supply to their customers. As a result, we wanted to learn about the perceptions of the hospitality stakeholders, and we asked them a specific question about whether they have any policies, strategies, or plans to ensure water supply to their customers in Mykonos:

Figure 36. Perception of the Mykonos' Hospitality Stakeholders[45] about the policies, strategies or plans to guarantee water supply (Actions by the Hospitality Stakeholders).



Source: Author's own work.

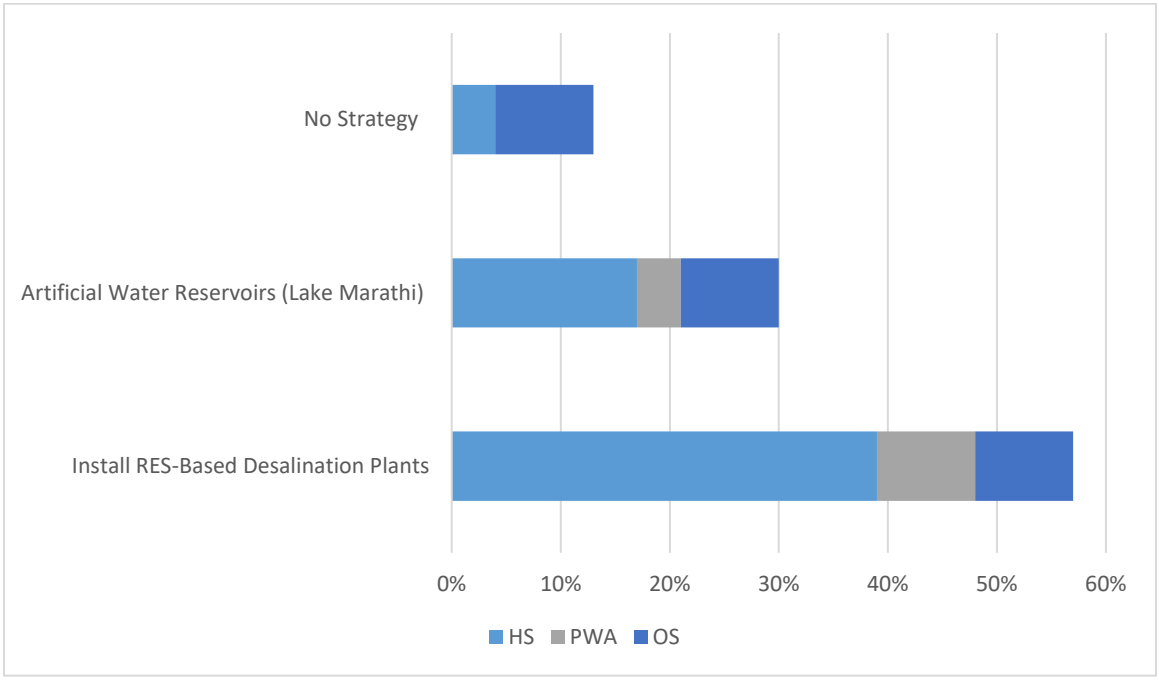
Figure 36 shows that half of the hospitality stakeholders are using water conservation plans (or planning to use), in order to guarantee water availability to their customers in the case of any water

[45] 14 Mykonos Hospitality Stakeholders responded to this question.

shortages during the summer months in Mykonos. Secondly, 28% of the hospitality stakeholders are installing or planning to install private water storage tanks to guarantee water supply to their customers. Third of all, 15% of the hospitality stakeholders are building or planning to build infrastructure for rainwater harvesting in order to guarantee water availability during the water shortages in Mykonos. Finally, there was only 1 hospitality out of 14 who said that they install or planning to install a private desalination plant in order to create water availability for their customers in the case of water shortages during the summer months in Mykonos.

One of the primary responsibilities of public and water authorities is to ensure the supply of water to their customers. As a result, we asked them if they were taking or planning to take any actions to ensure Mykonos' water supply. It should be noted that we asked this question of all Mykonos stakeholders, including hospitality stakeholders, public and water authorities, and other stakeholders.

Figure 37. Perception of the Mykonos' Stakeholders[46] about the policies, strategies or plans to guarantee water supply (Actions by the Public and Water Authorities).



Source: Author's own work.

[46] All of the 23 Mykonos Stakeholders responded to this question.

As can be seen in Figure 37, 57% of the Mykonos stakeholders believe that the public and water authorities are installing or planning to install RES-Based desalination plants to guarantee water availability during the summer months in Mykonos. Secondly, 30% of the Mykonos Stakeholders believe that the public and water authorities have already built Lake Marathi which is an artificial water reservoir to collect water, and guarantee water availability for the summer month on the island. Finally, 13% of the Mykonos stakeholders have the perception that there is no kind of strategy or plan by the public and water authorities to create water availability for the island. In short, Mykonos stakeholders regard the installation of RES-based desalination plants as the most important strategy or plan of the public and water authorities.

Water quality issues can be seen in many tourist destinations where there is a scarcity of water. As previously stated, water quality issues can have a negative impact on tourism sustainability and even end the lifecycle of a tourist destination. As a result, poor water quality and pollution can be important indicators that a tourist destination's image is deteriorating and its lifecycle is coming to an end. As a result, we decided to ask Mykonos stakeholders whether they are satisfied with the water quality.

Table 45 shows that 43% of the hospitality stakeholders are unsatisfied and the other 8% are very unsatisfied with the water quality and 21% are satisfied with the water quality in Mykonos. On the contrary, the overwhelming majority of the public and water authorities (100%) are very satisfied with the water quality on the island. However, the other stakeholders are sharing similar perceptions with the hospitality stakeholders because 66.6% of the other stakeholders are very unsatisfied with the water quality in Mykonos. Consequently, we can notice that the majority of the hospitality stakeholders and the other stakeholders are either unsatisfied or very unsatisfied with the water while the majority of the public and water authorities are very satisfied with the water quality in Mykonos.

Table 45. Perception of the Mykonos Stakeholders about if they have satisfaction of water supply (in terms of water quality) in Mykonos.

	N (%) / Values			
	HS	**PWA**	**OS**	**ALL**
Very Satisfied (5)	0	3 (100%) / 15	0	3 (13%) / 15
Satisfied (4)	3 (21%) / 12	0	0	3 (13%) / 12
Neutral (3)	4 (28%) / 12	0	1 (16.7%) / 3	5 (21.8%) / 15
Unsatisfied (2)	6 (43%) / 12	0	1 (16.7%) / 2	7 (30.4%) / 14
Very unsatisfied (1)	1 (8%) / 1	0	4 (66.6%) / 4	5 (21.8%) / 5
Total N (%) / Total Values	14 (100%) / 37	3 (100%) / 15	6 (100%) / 9	23 (100%) / 61
Mean Value (SD)	2.64 (0.89)	5 (0)	1.5 (0.76)	2.65 (1.30)

Source: Author's own work.

The frequency of water quality issues can be critical for a touristic destination because it can harm the destination's image and even lead to the end of the destination's tourism lifecycle. As a result, water quality or pollution issues can be critical for a tourist destination's long-term viability. As a result, we asked another question about the frequency of these water quality issues in Mykonos:

Table 46. Perception of the stakeholders about the frequency of the water quality problems in Mykonos.

	Question 27			
	HS	**PWA**	**OS**	**ALL**
Very Frequent	1 (8%)	0	4 (66.6%)	5 (21.8%)
Frequent	2 (14%)	0	0	2 (8.7%)
Sometimes	6 (43%)	0	2 (33.4%)	8 (34.7%)
Rare	3 (21%)	0	0	5 (13%)
Very Rare	2 (14%)	3 (100%)	0	5 (21.8%)
Total	14 (100%)	3 (100%)	6 (100%)	23 (100%)

Source: Author's own work.

Table 46 shows that 43% of the hospitality stakeholders have the perception that water quality problems are "sometimes" occurring in Mykonos. In addition to this, 21% of the hospitality stakeholders said that water quality issues are "rarely" taking place on the island. On the contrary, public and water authorities have the perception that water quality problems are very rare in Mykonos. Nevertheless, the majority of the other stakeholders (66.6%) have the perception that water quality problems are "very frequent" in Mykonos. In short, there are different perceptions in each subgroup, and there is no general consensus regarding the frequency of the water quality problems in Mykonos.

Water quality issues in tourist areas can be caused by a variety of factors. These causes could include poor water resource management, agricultural activity, tourism activity, and so on. As a result, we asked Mykonos stakeholders what they thought about the causes of the island's water quality issues.

Table 47. Perception of the Mykonos Stakeholders about if water quality issues are due to tourism activity in Mykonos **(Q28)** and if water quality issues are related to bad water resources management **(Q29)**.

	Question 28				Question 29			
	HS	**PWA**	**OS**	**ALL**	**HS**	**PWA**	**OS**	**ALL**
Absolutely Agree (5)	2 (14.2%) / 10	2 (66.6%) / 10	3 (49.9%) / 15	7 (30.6%) / 25	2 (14.2%) / 10	0	4 (66.6%) / 20	6 (26%) / 30
Agree (4)	3 (21.4%) / 12	1 (33.4%) / 4	0	4 (17.4%) / 16	5 (36%) / 20	0	0	5 (21.8%) / 20
Maybe (3)	5 (36%) / 15	0	1 (16.7%) / 3	6 (26%) / 18	3 (21.4%) / 9	0	2 (33.4%) / 6	5 (21.8%) / 15
Disagree (2)	2 (14.2%) / 4	0	1 (16.7%) / 2	3 (13%) / 6	2 (14.2%) / 4	0	0	2 (8.6%) / 4
Absolutely Disagree (1)	2 (14.2%) / 2	0	1 (16.7%) / 1	3 (13%) / 3	2 (14.2%) / 2	3 (100%) / 3	0	5 (21.8%) / 15
Total N (%) / Total Values	14 (100%) / 43	3 (100%) / 14	6 (100%) / 21	23 (100%) / 64	14 (100%) / 45	3 (100%) / 3	6 (100%) / 26	23 (100%) / 74
Mean Value (SD)	3.07 (1.22)	4.66 (0.47)	3.5 (1.6)	3.39 (1.37)	3.21 (1.26)	1 (0)	4.33 (0.94)	3.21 (1.47)

Source: Author's own work.

As can be seen on Table 47, 36% of the hospitality stakeholders have the perception that "maybe" the tourism activity in Mykonos is the main reason behind the water quality problems. It has to be noted, 21.4% of the hospitality stakeholders "agree", and the other 14.2% of the hospitality stakeholders "absolutely agree" that tourism activity leads to water quality issues in Mykonos. On the other hand, 66.6% of the public and water authorities "absolutely agree", and the other 33.4% of the public and water authorities "agree" that tourism activity on the island causes water quality issues on the island. The majority of the other stakeholders (49.9%) "absolutely agree" that tourism

activity has a role behind the water quality problems, and they share similar perceptions with the public and water authorities in Mykonos. In short, the majority of the public and water authorities as well as the other stakeholders believe that tourism activity has a role behind the water quality problems in Mykonos. Nevertheless, the hospitality stakeholders have the perception that "maybe" tourism activity has a role behind water quality problems on the island. This indicates that there is not a general consensus amongst all the stakeholders' subgroups but still there is some degree of an understanding of tourism activity's role in the low water quality issues in Mykonos.

Table 47 also shows that 36% of the hospitality stakeholders "agree", and the other 14.2% "absolutely agree" that the water quality problems are related to bad water resources management on the island. On the contrary, the overwhelming majority of the public and water authorities (100%) "absolutely disagree" that the water quality problems take place in Mykonos because of bad water resources management. Finally, we can notice that the other stakeholders share similar perceptions with the hospitality stakeholders because 66.6% of the other stakeholders "absolutely agree" that the water quality issues take place on the island because of bad water resources management. Hence, we can understand that the majority of the hospitality stakeholders and the other stakeholders rather "absolutely agree" or "agree" that there are water quality issues in relation to poor water resources management. However, the public and water authorities are totally opposed to this perception.

As previously stated, the agriculture sector is regarded as the second most water-consuming sector in Mykonos, trailing only the tourism sector. As a result, we asked stakeholders whether agricultural activity plays a role in Mykonos' water quality problems. In addition, we wanted to know if climate change is considered to be a contributing factor to the island's water quality issues. As a result, we asked another question about the role of climate change in Mykonos' water quality issues.

Table 48. Perception of the Mykonos Stakeholders about if water quality problems are due to agriculture activity in Mykonos **(Q30)** and if water quality issues are due to climate change (**Q31)**.

	Question 30				**Question 31**			
	HS	**PWA**	**OS**	**ALL**	**HS**	**PWA**	**OS**	**ALL**
Absolutely Agree (5)	0	0	0	0	0	0	0	0
Agree (4)	1 (7.3%) / 4	0	0	1 (4.4%) / 4	1 (7.3%) / 4	0	0	1 (4.4%) / 4
Maybe (3)	3 (21.3%) / 9	2 (66.6%) / 6	2 (33.4%) / 6	7 (30.4%) / 21	3 (21.4%) / 9	2 (66.6%) / 6	1 (16.7%) / 3	6 (26%) / 18
Disagree (2)	5 (35.7%) / 10	1 (33.4%) / 2	0	6 (26.1%) / 12	6 (42.8%) / 12	1 (33.4%) / 2	1 (16.7%) / 2	8 (34.8%) / 16
Absolutely Disagree (1)	5 (35.7%) / 5	0	4 (66.6%) / 4	9 (39.1%) / 9	4 (28.5%) / 4	0	4 (66.6%) / 5	8 (34.8%) / 9
Total N (%) / Total Values	14 (100%) / 28	3 (100%) / 8	6 (100%) / 10	23 (100%) / 46	14 (100%) / 29	3 (100%) / 8	6 (100%) / 10	23 (100%) / 47
Mean Value (SD)	2 (0.92)	2.66 (0.47)	1.66 (0.94)	2 (0.93)	2.07 (0.88)	2.66 (0.47)	1.5 (0.76)	2 (0.88)

Source: Author's own work.

As can be seen in Table 48 the vast majority of the hospitality stakeholder either "absolutely disagree" (35.7%) or "disagree" (35.7%) that agriculture activity has a role in the water quality problems in Mykonos. On the other hand, 66.6% of the public and water authorities have the perception that "maybe" agriculture activity on the island has a role behind the water quality problems. Finally, the majority of the other stakeholders (66.6%) share similar perceptions with the hospitality stakeholders and they "absolutely disagree" that the agriculture activity on Mykonos has a role in the water quality issues. In short, the hospitality stakeholders and the other

stakeholders share similar perceptions that the agriculture activity has no role in the water quality issues on the island.

Table 48 also shows that the majority of the hospitality stakeholders either "disagree" (42.8%) or "absolutely disagree" (28.5%) that climate change has a role in the water quality problems on the island. However, 66.6% of the public and water authorities have the perception that "maybe" climate change has a role. Finally, 66.6% of the other stakeholders "absolutely disagree" that climate change has a role in water quality issues in Mykonos. Consequently, we can notice that the hospitality stakeholders and the other stakeholders share similar perceptions that climate change has no role in water quality problems in Mykonos.

Water quantity and quality issues are critical to the sustainability and continuation of tourism activity. As a result, we asked the public and water authorities, as well as other stakeholders, a specific question about their role in ensuring better water quality and quantity in Mykonos.

Table 49. The role played by your institution/organization in order to guarantee water supply (quantity and quality).

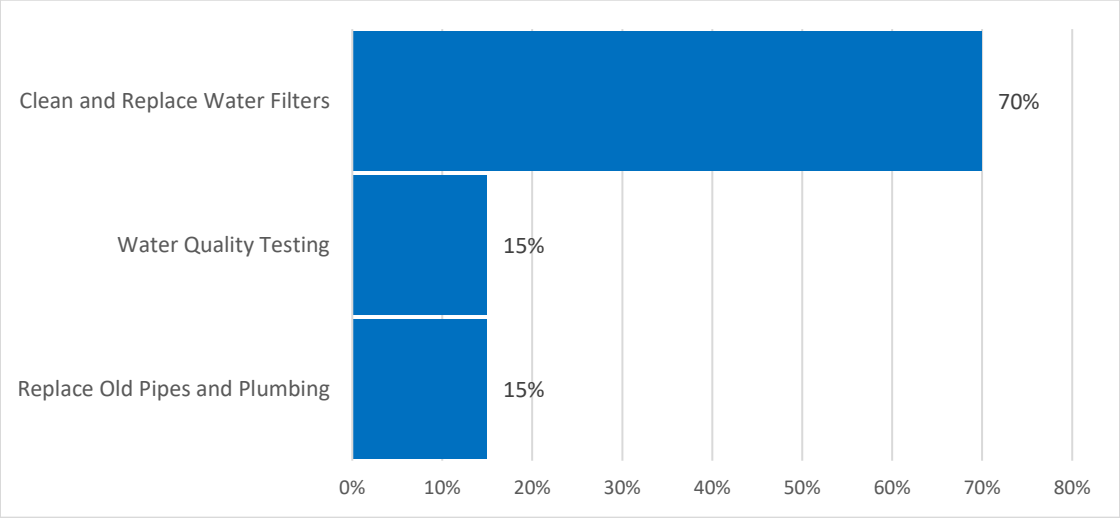
	Public & Water Authorities	**Other Stakeholders**
The main role, it is the leader	2 (66.7%)	0
Key role	1 (33.3%)	0
Collaboration with the main and the key actors	0	3 (50%)
Supporting strategies designed by the main actors	0	3 (50%)
Total	3 (100%)	6 (100%)

Source: Author's own work.

As can be seen in Table 49, the public and water authorities have either the main role (66.7%) or the key role (33.3%) to guarantee water supply (quantity and quality). On the contrary, the other stakeholders have the role of supporting strategies designed by the main actors (50%) as well as they have the role of collaborating with the main and the key actors (50%). As a result, we can see that public and water authorities are aware that they have the primary or primary role of ensuring better water supply (water quantity and quality).

Water quality is critical for hotels because it is directly related to their customers' health and satisfaction. It should be noted that a hotel or resort with poor water quality may lose customers. As a result, we wanted to know if the Mykonos hospitality stakeholders are taking any steps to ensure good water quality in their hotels and resorts, so we asked them a specific question about it:

Figure 38. Perception of the Mykonos' Hospitality Stakeholders[47] about the policies, strategies or plans to guarantee better water quality (Actions by the Hospitality Stakeholders).



Source: Author's own work.

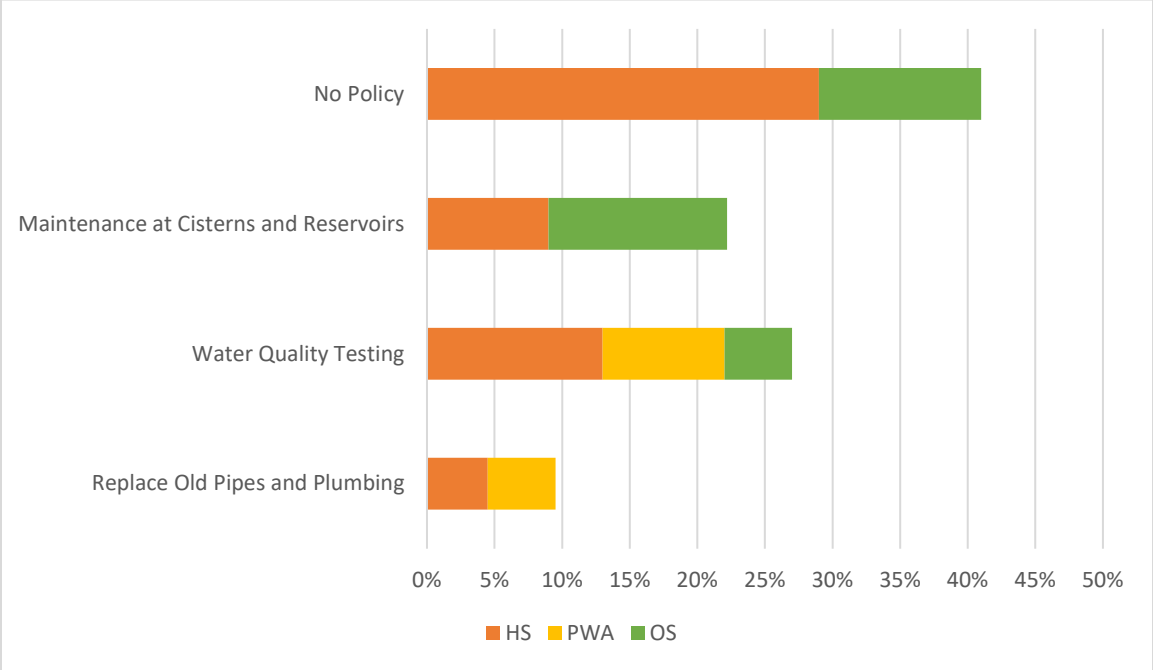
Figure 38 shows that the overwhelming majority of the hospitality stakeholders (70%) are cleaning and replacing their water filters (or planning to clean and replace them) in order to guarantee better water quality to their customers. On the other hand, 15% of the hospitality stakeholders are testing their water quality (or planning to test), and the other 15% are replacing old pipes and plumbing (or planning to replace) to provide better water quality to their customers. In short, the vast majority of the Mykonos hospitality stakeholders are cleaning and replacing their water filters to ensure better water quality for their customers.

It is the responsibility of the public and water authorities to ensure that water quality is improved for the local population as well as hotels and resorts in a tourist destination. Poor water quality can harm a tourist destination's positive image and even lead to the end of the tourist lifecycle. Water pollution, on the other hand, can cause serious health problems not only for the local population

[47] 14 Hospitality Stakeholders responded to this question.

but also for tourists visiting the tourist destination. As a result, we asked all Mykonos stakeholders whether the public and water authorities are taking or plan to take any steps to improve Mykonos' water quality:

Figure 39. Perception of the Mykonos' Stakeholders[48] about the policies, strategies or plans to guarantee better water quality (Actions by the Public and Water Authorities).



Source: Author's own work.

Figure 39 shows that 41% of the Mykonos stakeholders believe that there is no policy of the public and water authorities to provide better water quality. On the other hand, 27% of the stakeholders have the perception that public and water authorities are testing the water quality in Mykonos in order to provide better water quality. In addition to this, 22% of the Mykonos stakeholders believe that the public and water authorities are doing maintenance at cisterns and reservoirs (Lake Marathi in particular) in order to provide better water quality for the island residents and tourists. In short, the majority of the Mykonos stakeholders have negative perceptions regarding the water quality

[48] All of the 23 Mykonos Stakeholders responded to this question.

issues because they do not think that there is an official policy of the public and water authorities for the island residents as well as tourists who are visiting the island.

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7.2. SANTORINI RESULTS

Table 50 shows the answers given by the hospitality stakeholders, public and water authorities and other stakeholders to the questions about if tourism and environmental policies are (Q1) and should be (Q2) coordinated in Santorini. We can notice that the vast majority of the hospitality stakeholders (90%) did not believe that the tourism and environmental policies were coordinated in Santorini back in 2014 and 2015. On the contrary, the vast majority of the public and water authorities (75%) believed that the tourism and environmental policies were coordinated in Santorini. Meanwhile, the other stakeholders shared similar perceptions with the hospitality stakeholders and all of the other stakeholders (100%) indicated that the tourism and environmental were not coordinated in Santorini back in 2014 and 2015.

On the other hand, we can notice that again the vast majority of the hospitality stakeholders (90%) answered that the tourism and environmental policies should be coordinated. We can observe from these responses that vast majority of the hospitality stakeholders in Santorini had clear awareness regarding the coordination of tourism and environmental policies in order to have sustainable environmental and tourism management in Santorini. In addition to this, the vast majority of the public and water authorities (100%) and the other stakeholders (83.3%) shared similar perceptions with the hospitality stakeholders and agreed that the tourism and environmental policies should be coordinated. It has to be noted that, only one of the other stakeholders stressed out that the tourism and environmental policies should not be coordinated.

Environmental issues can have a negative impact on the tourism lifecycle of a tourist destination. For that reason, the stakeholders that have certain roles in tourism management, public governance, water resources management, and environmental management should have specific tourism policies and administrative planning to tackle down environmental problems which can even lead to the end of the tourism lifecycle of a tourist destination. As a matter of fact, we have asked all of the stakeholders in Santorini if tourism policies and administration take into account environmental issues, especially water availability.

Table 50. Perception of the Santorini's Stakeholders – if tourism and environmental policies **are** coordinated **(Q1)** and if they **should** be coordinated **(Q2)**.

	Question 1				**Question 2**			
	HS[49]	**PWA**[50]	**OS**[51]	**ALL**[52]	**HS**	**PWA**	**OS**	**ALL**
Yes	1 (10%)	3 (100%)	0	4 (20%)	9 (90%)	4 (100%)	5 (83%)	18 (90%)
No	9 (90%)	1 (25%)	6 (100%)	16 (80%)	1 (10%)	0	1 (17%)	2 (10%)
Total	10 (100%)	4 (100%)	6 (100%)	20 (100%)	10 (100%)	4 (100%)	6 (100%)	20 (100%)

Source: Author's own work.

The majority of the hospitality stakeholders (60%) agree that the tourism policies and administration take in account environmental issues in Santorini. On the other hand, the vast majority of public and water authorities (100%) absolutely agrees or agrees that the tourism policies and administration take in account environmental issues in Santorini. On the contrary, the majority of the other stakeholders have different perceptions compared to hospitality stakeholders and public authorities because 66.7% of the other stakeholders absolutely disagree or disagree that the tourism policies and administration take in account environmental issues. Hence, one can notice that there are mixed perceptions among the Santorini stakeholders whether the tourism policies and administration take in account environmental issues in Santorini.

[49] HS stands for hospitality stakeholders which includes hotel managers, hotel owners, hotel directors, etc.
[50] PWA stands for public and water authorities that have certain roles in water resources management.
[51] OS stands for other stakeholders that include academicians, journalists, NGO representatives, bloggers, etc.
[52] ALL stands for all stakeholder subgroups including HS, PWA, and OS.

Table 51. Perception of the Santorini's Stakeholders about if tourism policies and administration take into account environmental issues, especially water availability.

	N (%) / Values			
	HS	**PWA**	**OS**	**ALL**
Absolutely Agree (5)	0	2 (50%) / 10	0	2 (10%) / 10
Agree (4)	6 (60%) / 24	2 (50%) / 8	0	8 (40%) / 32
Maybe (3)	2 (20%) / 6	0	2 (33.3%)/ 6	4 (20%) / 12
Disagree (2)	2 (20%) / 4	0	1 (16.7%)/ 2	3 (15%) / 6
Absolutely Disagree (1)	0	0	3 (50%) / 3	3 (15%) / 3
Total N (%) / Total Values	10 (100%) / 34	4 (100%) / 18	6 (100%)/11	20 (100%) / 63
Mean Value (SD)	3.4 (0.8)	4.5 (0.5)	1.83 (0.89)	3.15 (1.23)

Source: Author's own work.

Environmental policies and administration should take into account tourism activity issues because the tourism lifecycle depends on sustainable tourism management. At the same time, seasonal mass tourism (summer months) and over-tourism can seriously threaten environmental policies, particularly water resources management. For that reason, another question was asked to the Santorini stakeholder to assess whether environmental policies and administration take into account tourism activity issues or not:

Table 52 shows that each stakeholder subgroup has different perceptions. If we look at the hospitality stakeholders, we can notice that %30 of the hospitality stakeholders agree that environmental policies and administration take into account tourism activity. At the same time, %40 of the hospitality stakeholders has the perception that "maybe" environmental policies are taken into account. Furthermore, all of the public and water authorities agree that environmental policies take into account tourism activity. On the contrary, %66.6 of the other stakeholders

absolutely disagrees or disagree that the environmental policies and administration take into account activity.

Table 52. Perception of the Santorini's Stakeholders about if environmental policies and administration take into account tourism activity issues.

	N (%) / Values			
	HS	**PWA**	**OS**	**ALL**
Absolutely Agree (5)	1 (10%) / 5	0	0	1 (5%) / 5
Agree (4)	3 (30%) / 12	4 (100%) / 16	1 (16.7%)/ 4	8 (40%) / 32
Maybe (3)	4 (40%) / 12	0	1 (16.7%)/ 3	5 (25%) / 15
Disagree (2)	1 (10%) / 2	0	2 (33.3%)/ 4	3 (15%) / 6
Absolutely Disagree (1)	1 (10%) / 1	0	2 (33.3%)/ 2	3 (15%) / 3
Total N (%) / Total Values	10 (100%) / 32	4 (100%) / 16	6 (100%) / 13	20 (100%) / 61
Mean Value (SD)	3.2 (1.07)	4 (0)	2.2 (1.06)	3.05 (1.16)

Source: Author's own work.

The hospitality stakeholders that have certain roles in hotels or resorts should have specific agendas to tackle environmental problems which can even lead to the end of the tourism lifecycle of a tourist destination. As a matter of fact, we have asked a specific question to the hospitality stakeholders in Santorini (Table 53) if environmental issues are on their agenda. We can see that the vast majority of the hospitality stakeholders (90%) have replied that environmental issues are on the agenda. There was only 1 hospitality stakeholder out of 10 who responded that environmental issues are "maybe" on his/her agenda.

Table 53. Perception of the Santorini's Hospitality Stakeholders about if environmental issues are in their agenda.

	N (%)	Values
Absolutely Agree (5)	0	0
Agree (4)	9 (90%)	36
Maybe (3)	1 (10%)	3
Disagree (2)	0	0
Absolutely Disagree (1)	0	0
Total / Mean value (SD)	10 (100%)	3.9 (0.3)

Source: Author's own work.

It is evident that changing climate conditions can impact different economic sectors. Tourist destinations can be affected negatively by these changing climate conditions if they have arid and semi-arid climates with seasonal tourism activity. For that reason, we decided to ask the stakeholders whether climate change has an influence on the tourism sector in Santorini or not. Table 54 shows that the %60 of the hospitality stakeholders believe that climate change has a very high influence on tourism activity in Santorini. At the same time, %30 of the hospitality stakeholders have the perception that climate change has some influence, and %10 of the hospitality stakeholders have the perception that the tourism activity on the island has a high influence on the tourism activity in Santorini.

The public and water authorities share similar perceptions with the hospitality stakeholders since 50% of the public and water authorities mentioned that climate change has a very high influence and 25% of them said that climate change has a high influence on tourism activity in Santorini. In addition to the hospitality stakeholders and public and water authorities, 50% of the other stakeholders believe that climate change has a very high influence, and the other %50 of the other stakeholders believe that climate change has some influence on tourism activity in Santorini. Consequently, we can notice that all of the Santorini stakeholders have the awareness that climate change has a certain degree of influence on the tourism activity on the island.

Table 54. Perception of the stakeholders about if climate change has influence on tourism activity in Santorini.

	N (%) / Values			
	HS	**PWA**	**OS**	**ALL**
Very High Influence (5)	6 (60%) / 30	2 (50%) / 10	3 (50%) / 15	11 (55%) / 55
High Influence (4)	1 (10%) / 4	1 (25%) / 4	0	2 (10%) / 8
Some Influence (3)	3 (30%) / 9	1 (25%) / 3	3 (50%) / 9	7 (35%) / 21
Little Influence (2)	0	0	0	0
Very Little Influence (1)	0	0	0	0
Total N (%) / Total Values	10 (100%) / 43	4 (100%) / 17	6 (100%) / 24	20 (100%) / 84
Mean Value (SD)	4.3 (0.9)	4.25 (0.83)	4 (1)	4.2 (0.93)

Source: Author's own work.

Climate change impacts can increase due to anthropogenic activities in addition to natural causes. As it was discussed above, anthropogenic activities are varied and agriculture, industry, and tourism sectors have a certain degree of negative contribution to climate change. Hence, we wanted to learn whether the Santorini stakeholders believe that the tourism sector has a negative contribution to climate change:

As can be seen in Table 55, half of the hospitality stakeholders have the perception that tourism activity has some negative contribution to climate change. In addition to this, 75% of the public and water authorities have similar perceptions with the hospitality stakeholders that tourism activity has some negative contribution to climate change. Finally, 33.3% of the other stakeholders have the perception that tourism activity has a high negative contribution to climate change, and the other 33.3% have the perception that tourism activity has some negative contribution to climate change. In short, there is a general consensus among the Santorini stakeholders that tourism activity has some negative contribution to climate change in Santorini.

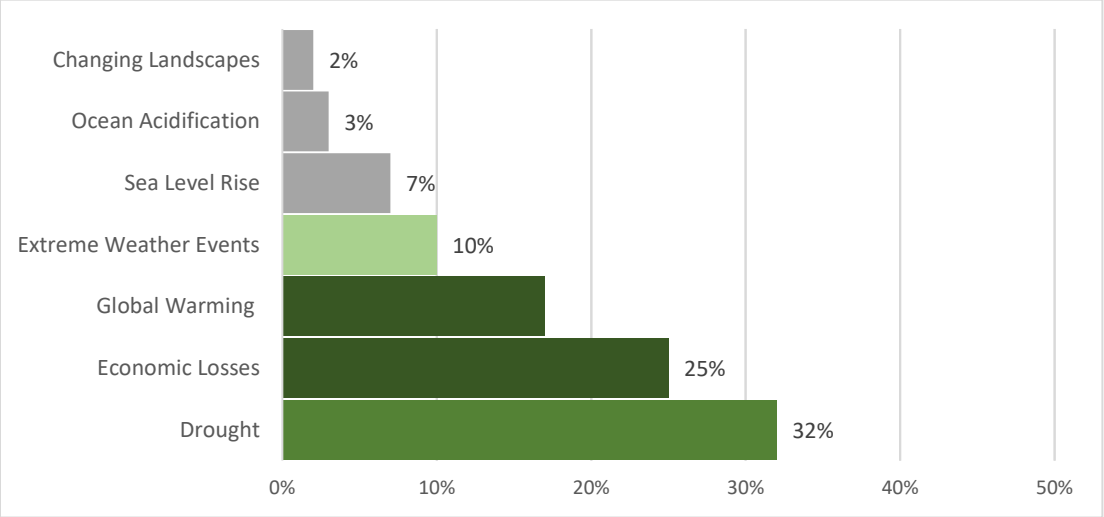
Table 55. Perception of the Santorini Stakeholders about if the tourism activity has a negative contribution to climate change in Santorini.

	N (%) / Values			
	HS	**PWA**	**OS**	**ALL**
Very High Contribution (5)	1 (10%) / 5	1 (25%) / 5	1 (16.7%) / 5	3 (15%) / 15
High Contribution (4)	2 (20%) / 8	0	2 (33.3%) / 8	4 (20%) / 16
Some Contribution (3)	5 (50%) / 15	3 (75%) / 9	2 (33.3%) / 6	10 (50%) / 30
Little Contribution (2)	1 (10%) / 2	0	0	1 (5%) / 2
Very Little Contribution (1)	1 (10%) / 1	0	1 (16.7%) / 1	2 (10%) / 2
Total N (%) / Total Values	10 (100%) / 31	4 (100%) / 14	6 (100%) / 20	20 (100%) / 65
Mean Value (SD)	3.1 (1.04)	3.5 (0.87)	3.3 (1.25)	3.25 (1.08)

Source: Author's own work.

Climate change has a variety of different types of threats and each tourist destination can experience different experiences. As a matter of fact, we asked Santorini Stakeholders to choose the most important three worst threats of climate change on tourism activity in Santorini. As can be seen in Figure 40, %32 of the stakeholders view "drought" and other %25 of the stakeholders see "economic losses" are the worst two threats of climate change on tourism activity in Santorini. Furthermore, %17 of the respondents views that "global warming" as the third worst threat of climate change on tourism activity. Finally, %10 of the respondents view "extreme weather events" as the fourth threat of climate change on tourism activity in Santorini.

Figure 40. Perception of the Santorini's Stakeholders about the three worst threats of climate change on tourism activity in Santorini.[53]



Source: Author's own work.

As it was mentioned above, climate change adaptation and mitigation policies play crucial roles to tackle the worst threats of climate change. For that reason, the coordination among policy makers, water resources authorities, hospitality stakeholders, and other stakeholders is essential to have better resilience against the threats of climate change. Thereby, we asked the stakeholders in Santorini if there should be coordination among each other in order to fight against the impacts of climate change.

Table 56 shows clearly that the vast majority of the hospitality stakeholders (80%) believe that there should be coordination among actors to fight against the impacts and threats of climate change on tourism activity in Santorini. On the other hand, %50 of the public and water authorities and %50 of the other stakeholders share the same belief that there should be coordination among actors.

It has to be noted, there were 4 out of 20 stakeholders who said that there should be future coordination but not now. Finally, there was only 1 stakeholder who said that there should be never coordination among actors. Hence, we can notice that there is a general perception among

[53] Each one of the 20 stakeholders could choose the 3 worst threats of climate change on tourism activity in Santorini.

Santorini's stakeholders about the importance of coordination among actors to fight against the impacts of climate change on tourism activity.

Table 56. Perception of the Santorini's Stakeholders about if there should be a fight against the impacts of climate change.

	HS	**PWA**	**OS**	**ALL**
Yes, they should	8 (80%)	2 (50%)	3 (50%)	13 (65%)
Yes, and they are acting at present	1 (10%)	1 (25%)	0	2 (10%)
No, they should not now, but they should in the future	1 (10%)	1 (25%)	2 (33%)	4 (20%)
No, they should never	0	0	1 (17%)	1 (5%)
Total	10 (100%)	4 (100%)	6 (100%)	20 (100%)

Source: Author's own work.

The fight against the impacts of climate change requires serious planning and each stakeholder group have different responsibilities. Hence, we asked a specific question to the public and water authorities as well as the other stakeholders regarding their role in order to fight against climate change in Santorini.

As can be seen in Table 57, half of the public and water authorities have the main role, and the other half of them have a key role. Meanwhile, the majority of the other stakeholders (67%) collaborate with the main and the key actors, and the other 33% of the other stakeholders are supporting strategies designed by the main actors. For that reason, one can notice that the majority of the public and water authorities have either the main role or a key role in the fight against climate change. On the other hand, the other stakeholders are responsible for collaboration or they have supporting roles in the fight against climate change in Santorini.

Table 57. The role played by your institution/organization in order to fight against climate change.

	Public & Water Authorities	**Other Stakeholders**
The main role, it is the leader	2 (50%)	0
Key role	2 (50%)	0
Collaboration with the main and the key actors	0	4 (67%)
Supporting strategies designed by the main actors	0	2 (33%)
Total	4 (100%)	6 (100%)

Source: Author's own work.

Climate change mitigation strategies are important to tackle the impacts of the changing climate conditions. There can be a variety of different mitigation strategies to fight against the impacts of climate change. Hence, we asked an open-answer question to Santorini stakeholders to determine their perceptions regarding the most important mitigation strategies:

Public and Water Authority #1: There are many negative impacts of climate change on tourism sector. As we have observed in Santorini, climate change has limited our water availability and we had to take further steps to tackle down these negative impacts. Hence, we have introduced RES based desalination plants in Santorini. For that reason, I personally believe that the best strategies to mitigate climate change impacts on tourism sector is to monitor energy use and increase the use of RES.

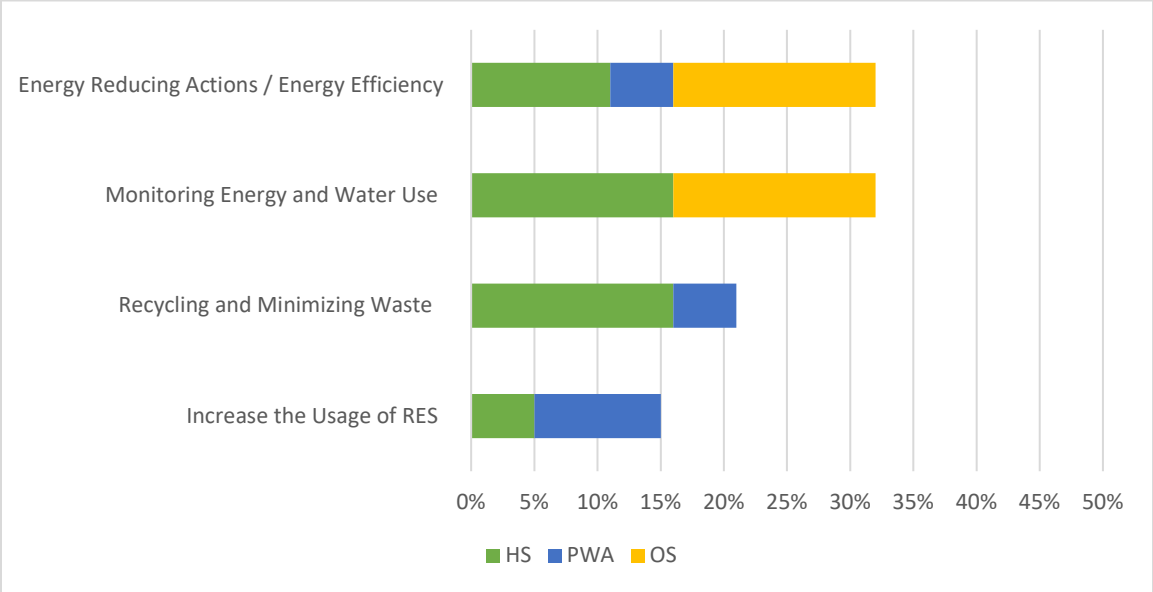
Other Stakeholder #3: We can observe that climate change is directly related to high energy consumption and this is increasing the impact of climate change on tourism sector. Hence, there should be significant steps taken to reduce the high energy consumption and this can be accomplished by monitoring energy usage so that the negative impacts of climate change can be lowered in particular in the tourism sector.

Hospitality Stakeholder #8: The best mitigation strategy is to lower energy consumption, and this can be only done by implementing an energy management system (EMS). The hotels or resorts can

install less energy-consuming equipment on their premises but of course, this requires a certain degree of investment and government support, particularly for small and mid-range hotels.

As can be seen from some of the responses, there are different perceptions among each stakeholder group regarding the most important climate change mitigation strategies. Figure 41 shows the most important mitigation strategies according to Santorini stakeholders (including all three sub-groups):

Figure 41. Perception of the Santorini Stakeholders about the most important mitigation strategies to tackle the impacts of climate change.[54]



Source: Author's own work.

As can be seen in Figure 41, 32% of the Santorini stakeholders have the perception that monitoring energy and water use is one of the most important mitigation strategies to tackle the impacts of climate change. On the other hand, the other 32% of the Santorini stakeholders believe that energy-reducing actions (energy efficiency) are one of the most important climate change mitigation strategies. Furthermore, 21% of the Santorini stakeholders believe that recycling and minimizing waste is the third most important climate change mitigation strategy. Finally, the remaining 15% of the Santorini stakeholders have the perception that increasing the usage of RES is the fourth

[54] 19 of the 20 Santorini Stakeholders answered Question 8 as a, b or c. For that reason, the results are according to the 19 stakeholders including all three different stakeholder sub-group.

most important mitigation strategy to tackle climate change impacts on Santorini. Consequently, one can notice that monitoring energy and water use and energy-reducing actions/energy efficiency are among the most important mitigation strategies according to the Santorini stakeholders.

Climate change adaptation strategies have significant importance for touristic destinations that are facing the impacts of the changing climate conditions. As a matter of fact, we have asked another open-answer question to the Santorini stakeholders to assess their perceptions regarding the most important climate change adaptation strategies:

Public and Water Authority #4: The usage of the desalination plants can be the best option to adapt ourselves to the negative impacts of the climate change because our water resources are decreasing each day and we need to adapt ourselves to the changing climate conditions. I believe that Santorini has a good adaptation policy because of increasing the usage of desalination plants.

Other Stakeholder #2: The most important adaptation strategy is to increase awareness by educating tourists and people that are working in the tourism sector. Unfortunately, climate change awareness do not exist in places such as Santorini.

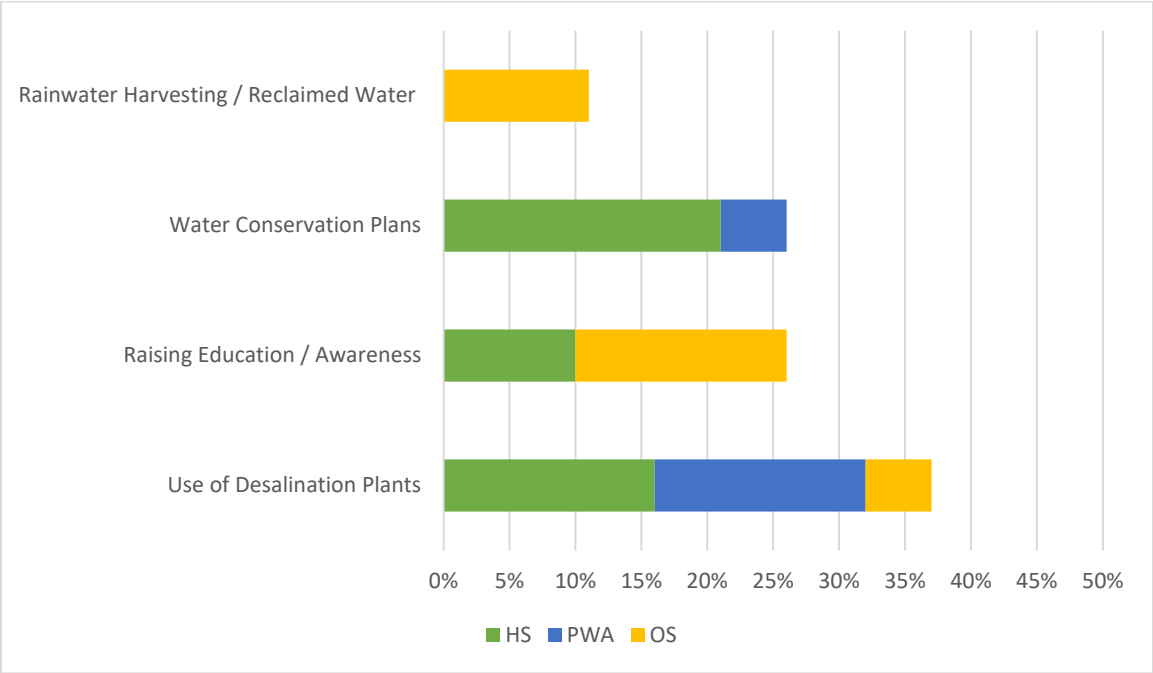
Hospitality Stakeholder #4: There can be water conservation plans so that each person will consume less water and we can be able to adapt ourselves to the impacts of climate change. The biggest threat of climate change is droughts and water scarcity in Santorini.

It can be noticed from some of the responses that the Santorini stakeholders have variety of different perceptions regarding the most important climate change adaptation strategies. Figure 42 shows the most important adaptation strategies according to Santorini stakeholders (including all three sub-groups):

As can be seen in Figure 42, 37% of the Santorini stakeholders have the perception that the usage of desalination plants is the most important climate change adaptation strategy. On the other hand, 26% of the Santorini stakeholders believe that raising education/awareness is the second most important climate change adaptation strategy. Furthermore, the other 26% of the Santorini stakeholders have the perception that water conservation plans are the second most important adaptation strategy to tackle the impacts of climate change. Finally, 11% of the Santorini stakeholders believe that rainwater harvesting / reclaimed water is the third most important

adaptation strategy. In short, one can notice that the usage of desalination plants as a climate change adaptation strategy has significant acceptance among the Santorini stakeholders.

Figure 42. Perception of the Santorini Stakeholders about the most important adaptation strategies to tackle the impacts of climate change.[55]



Source: Author's own work.

The tourism sector has a certain degree of negative contribution to climate change, and many hotels and resorts that are located in tourist destinations are taking initiatives to reduce their contribution to climate change. As it was discussed above, there are various examples such as Mallorca and Cyprus Islands in which there are plans for negative contribution-reducing actions such as raising awareness among the public and water conservation plans. Hence, we wanted to learn the perceptions of the Santorini Stakeholders about the most important actions to reduce the negative contribution of the tourism sector to climate change:

[55] 19 of the 20 Santorini Stakeholders answered Question 8 as a, b or c. For that reason, the results are according to the 19 stakeholders including all three different stakeholder sub-group.

Public and Water Authority #3: I believe that there should be more focus on monitoring water and energy usage. At the same time, the RES-based desalination plants can be a better option for us because we will need to desalinate more water and our energy consumption will be less in Santorini.

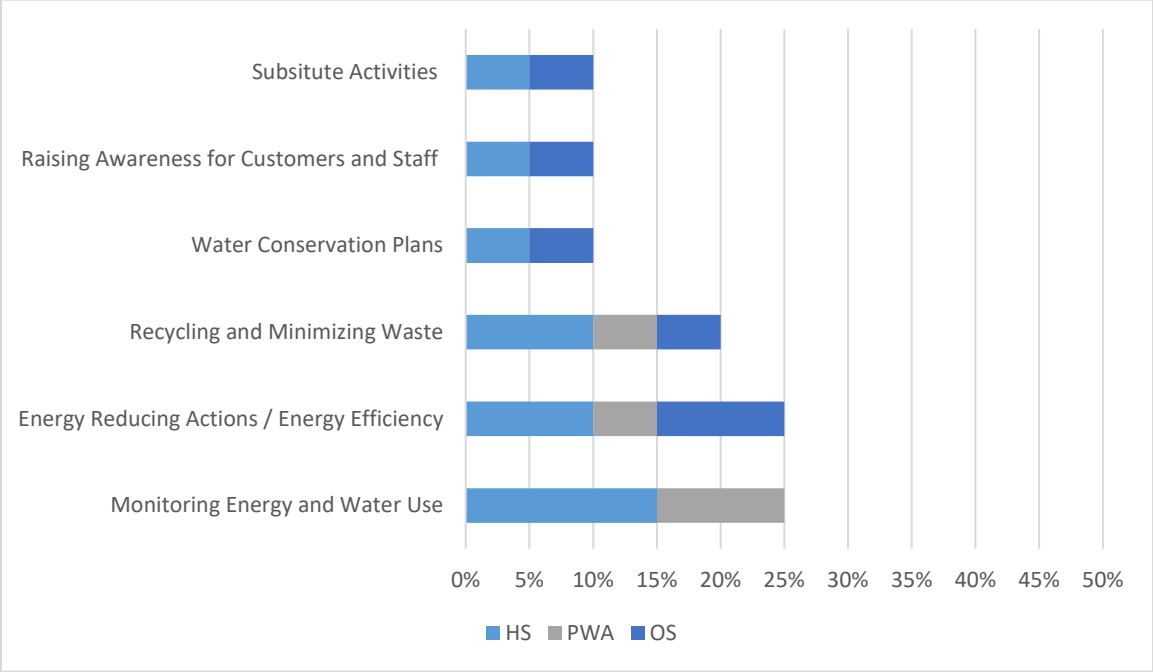
Other Stakeholder #1: There should be changes in the tourism products and this is a must for the case of Santorini. Tourism and hospitality can only reduce the contribution to climate change by changing tourism products. Mass tourism can lead to dramatic consequences.

Hospitality Stakeholder #6: I see water scarcity and drought as the most important threats of climate change. Hence, hotels and resorts should focus more on water conservation plans because we can really save a certain amount of water at the hotels. On the other hand, we can install negative contribution-reducing equipment in the hotels and resorts such as toilet flush that causes less water loss.

As can be seen from some of the responses of the Santorini Stakeholders, there is a variety of different perceptions regarding the negative contribution measures among the stakeholders. Hence, Figure 43 shows the most important measures to reduce the negative contribution of tourism activity to climate change.

Figure 43 shows that 25% of the Santorini Stakeholders have the perception that monitoring energy and water use is the most important measure to lessen the negative input of tourism activity to climate change. At the same time, the other 25% have the perception that energy-reducing actions (energy efficiency) are the most important measure to lower the negative contribution. In addition to this, %20 of the Santorini Stakeholders believe that recycling and minimizing waste is the third most important measure to decrease the negative contribution of tourism activity to climate change. In short, one can notice that half of the stakeholders view monitoring energy and reducing energy consumption as the most important actions to reduce the contribution of tourism activity to climate change in Santorini.

Figure 43. Perception of the Santorini Stakeholders about the measures to reduce contribution to climate change.[56]

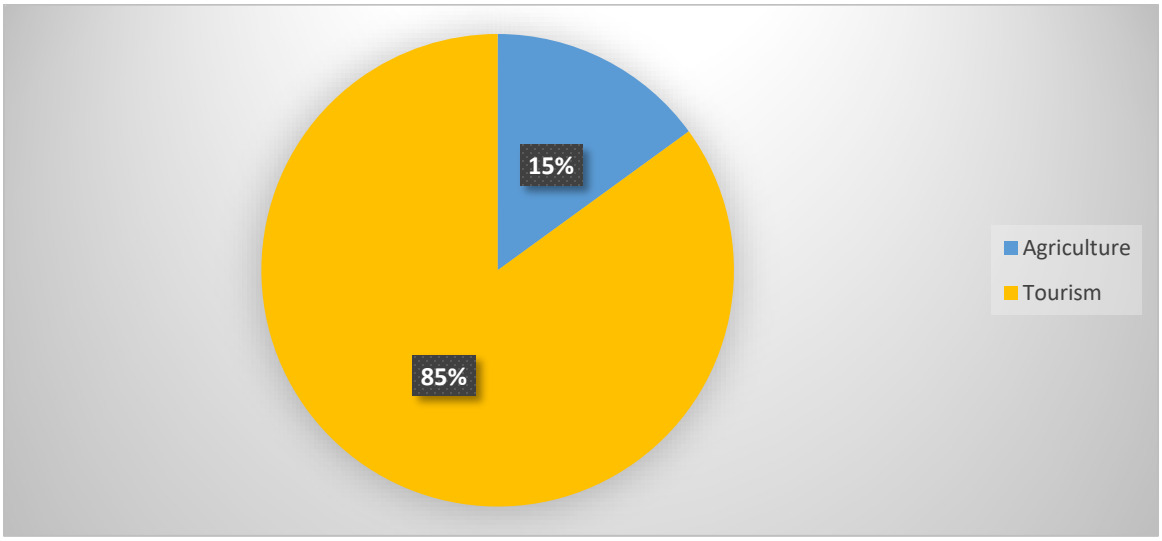


Source: Author's own work.

Tourism is the most important economic sector in Santorini but agriculture forms part of the island's economy, and particularly the wine industry has a specific role. As a matter of fact, we wanted to learn the perceptions of Santorini's stakeholders regarding the highest water consumption by the economic sector in Santorini. As can be seen from Figure 44, the vast majority of the Santorini Stakeholders (%85) are aware that the tourism sector has the highest water consumption on the island. Meanwhile, %15 of the stakeholders believe that the agriculture sector has the highest water consumption in Santorini.

[56] All of the 20 Santorini stakeholders responded to this question.

Figure 44. Perception of the Santorini's Stakeholders about the highest water consuming economic sector.



Source: Author's own work.

Santorini has been facing water shortages for the last 10 years particularly during the summer months when the island population increases dramatically because of the tourism activity on the island. These water shortages have already been affecting the daily lives of the island's local population. At the same time, the water shortages are damaging the touristic destination image of the island. For that reason, we wanted to learn the perception of Santorini stakeholders and whether they have the perception that tourism activity on the island is behind these water shortages during the summer months. There were complaints from the island population regarding the water services that are being provided on the island by DEYATH as can be even observed in the local newspapers. Similar complaints were observed during the interviews with some of the stakeholders. Consequently, we wanted to know their perceptions of the hospitality stakeholders and whether they view the water resources management of DEYATH as the main reason behind the water shortages on the island.

Table 58. Perception of the Santorini Stakeholders about if water shortages are due to tourism activity in Santorini **(Q15)** and if short term based water resources management exist in Santorini or not **(Q16)**.

	Question 15				Question 16			
	HS	**PWA**	**OS**	**ALL**	**HS**	**PWA**	**OS**	**ALL**
Absolutely Agree (5)	0	1 (25%) / 5	5 (83.3%) / 25	6 (30%) / 30	1 (10%) / 5	0	4 (67%) / 20	5 (25%) / 25
Agree (4)	5 (50%) / 20	1 (25%) / 4	1 (16.7%) / 4	7 (35%) / 28	4 (40%) / 16	0	1 (16.5%) / 4	5 (25%) / 20
Maybe (3)	3 (30%) / 9	2 (50%) / 6	0	5 (40%) / 15	3 (30%) / 9	0	1 (16.5%) / 3	4 (20%) / 12
Disagree (2)	2 (20%) / 4	0	0	2 (10%) / 4	2 (20%) / 4	0	0	2 (10%) / 4
Absolutely Disagree (1)	0	0	0	0	0	4 (100%) / 4	0	4 (20%) / 4
Total N (%) / Total Values	10 (100%) / 33	4 (100%) / 15	6 (100%) / 29	20 (100%) / 77	10 (100%) / 34	4 (100%) / 4	6 (100%) / 27	20 (100%) / 65
Mean Value (SD)	3.3 (0.78)	3.75 (0.82)	4.83 (0.37)	3.85 (0.96)	3.4 (0.91)	1 (0)	4.5 (0.76)	3.25 (1.44)

Source: Author's own work.

As can be seen in Table 58, 50% of the hospitality stakeholders "agree" that water shortages are due to tourism in Santorini. In addition to this, %30 of the hospitality stakeholders have the perception that "maybe" tourism activity is behind the water shortages on the island. Public and water authorities have mixed perceptions and %50 of the respondents have the perception that "maybe" tourism activity has a role behind the water shortages in Santorini. On the contrary, the vast majority of the other stakeholders (83.3%) absolutely agree that water shortages are due to tourism activity in Santorini.

Table 58 also shows that half of the hospitality stakeholders absolutely agree (10%) or agree (40%) that short-term-based water resources management exists in Santorini. On the contrary, %100 of the public and water authorities "absolutely disagree" that there is bad water management in Santorini which leads to water shortages during the summer months. Finally, we can notice that 67% of the other stakeholders "absolutely agree" and 16.7% of the other stakeholders "agree" that there is short-term-based water resources management which led to summer water shortages on the island. Consequently, the majority of the hospitality stakeholders and other stakeholders believe that there is some degree of the role of the water resources management of DEYATH and public authorities behind the water shortages in Santorini.

The agriculture sector can lead to excessive water usage and it can even lead to water shortages during the summer months as can be observed in mainland Greece. As it was mentioned above, %15 of the Santorini stakeholders have the perception that the agriculture sector is the second highest water-consuming economic sector after the tourism sector. Hence, it was asked whether the water shortages are due to agricultural activity on the island. In addition to this, less rainfall and droughts have significant roles in the water shortages in many tourism destinations in the world. As it was analyzed above, Santorini stakeholders view "droughts" as the worst threat of climate change. Consequently, another following question was asked to the stakeholders whether water shortages are taking place on the island because of climate change.

As can be seen in Table 59, the vast majority of the hospitality stakeholders (70%) disagree that the agriculture activity in Santorini has a role in the water shortages. In addition to this, %75 of the public and water authorities and %100 of the other stakeholders "absolutely disagree" that the water shortages are due to the agricultural activity in Santorini. Consequently, there is a general consensus among the perceptions of Santorini's stakeholders that agriculture has not had a significant role in the water shortages unlike it is in the case of the tourism sector's activities on the island.

Furthermore, Table 59 also shows that the hospitality stakeholders have mixed opinions regarding the role of climate change in relation to the water shortages on the island. It has to be noted that, %20 of the tourism hospitality stakeholders "absolutely agree" and the other %20 of the hospitality stakeholders "agree" that the water shortages are due to climate change. In addition, %40 of the hospitality stakeholders have the perception that "maybe" climate change has a role behind the

water shortages. On the contrary, it can be observed in Table 59 that the vast majority of the public and water authorities "absolutely agree" (25%) and "agree" (50%) that the water shortages are due to climate change on the island. Meanwhile, the perceptions of the other stakeholders are mixed since 33.3% of the respondents "agree" but the other 50% of the respondents have the perception that "maybe" water shortages in Santorini are due to climate change. In short, there is not a general consensus on whether water shortages are due to climate change in Santorini.

Table 59. Perception of the Santorini Stakeholders about if water shortages are due to agriculture activity in Santorini **(Q17)** and if water shortages are due to climate change (**Q18)**.

	Question 17				**Question 18**			
	HS	**PWA**	**OS**	**ALL**	**HS**	**PWA**	**OS**	**ALL**
Absolutely Agree (5)	0	0	0	0	2 (20%) / 10	1 (25%) / 5	0	3 (15%) / 15
Agree (4)	2 (20 %) / 8	0	0	2 (10%) / 8	2 (20%) / 8	2 (50%) / 8	2 (33.3%) / 8	6 (30%) / 24
Maybe (3)	1 (10 %) / 3	1 (25%) / 3	0	2 (10%) / 6	4 (40%) / 12	1 (25%) / 3	3 (50%) / 9	8 (40%) / 24
Disagree (2)	7 (70 %) / 14	0	0	7 (35%) / 14	2 (20%) / 4	0	1 (16.7%) / 2	3 (15%) / 6
Absolutely Disagree (1)	0	3 (75%) / 3	6 (100 %) / 6	9 (45%) / 9	0	0	0	0
Total N (%) / Total Values	10 (100 %) / 25	4 (100 %) / 6	6 (100 %) / 6	20 (100 %) / 37	10 (100%) / 34	4 (100%) / 16	6 (100%) / 19	20 (100%) / 69
Mean Value (SD)	2.5 (0.8 0)	1.5 (0.86)	1 (0)	1.85 (0.96)	3.4 (1.01)	4 (0.70)	3.16 (0.68)	3.45 (0.92)

Source: Author's own work.

The water shortages in Santorini are generally taking place during the summer months as in the case of Mykonos Island and other Cyclades Islands. Nevertheless, the frequency of these water shortages has a certain importance for the daily lives of the local population and continuation as well as sustainability of tourism activities in Santorini. For that reason, it was asked Santorini stakeholders about the frequency of the water shortages:

As can be seen in Table 60, the vast majority of the hospitality stakeholders (80%) believe that water shortages are sometimes taking place on the island. On the other hand, the vast majority of the public and water authorities (75%) have a completely different perception and they believe that water shortages very rarely take place on the island. Finally, the majority of the other stakeholders (49.9%) believe that water shortages are frequently taking place on the island. In short, there are different opinions regarding the frequency of water shortages. However, as it can be observed half of all the respondents (10 out of 20) have the perception that water shortages are "sometimes" taking place on the island.

Table 60. Perception of the stakeholders about the frequency of the water shortages in Santorini.

	Question 19			
	HS	**PWA**	**OS**	**ALL**
Very Frequent	0	0	1 (16.7%)	1 (5%)
Frequent	1 (10%)	0	3 (49.9%)	4 (20%)
Sometimes	8 (80%)	1 (25%)	1 (16.7%)	10 (50%)
Rare	1 (10%)	0	1 (16.7%)	2 (10%)
Very Rare	0	3 (75%)	0	3 (15%)
Total	10 (100%)	4 (100%)	6 (100%)	20 (100%)

Source: Author's own work.

These results indicate that there are certain issues related to water resources management in Santorini and the stakeholder's perceptions give us an insight into the water supply quality (in terms of water availability). The water shortages can create dissatisfaction among the consumers even if they are taking place "sometimes" on the island. Hence, the satisfaction of water supply has significant importance to analyze the details of the bad water resources management. For that reason, it was asked the stakeholders whether they are satisfied with the water supply (in terms of water availability / quantity) in Santorini.

Table 61. Perception of the Santorini Stakeholders about if they have satisfaction of water supply (in terms of water availability / quantity) in Santorini.

	N (%) / Values			
	HS	**PWA**	**OS**	**ALL**
Very Satisfied (5)	0	0	0	0
Satisfied (4)	0	3 (75%) / 12	1 (16.7%) / 4	4 (20%) / 16
Neutral (3)	3 (30%) / 9	1 (25%) / 3	1 (16.7%) / 3	5 (25%) / 15
Unsatisfied (2)	5 (50%) / 10	0	0	5 (25%) / 10
Very unsatisfied (1)	2 (20%) / 2	0	4 (66.6%) / 4	6 (30%) / 6
Total N (%) / Total Values	10 (100%) / 21	4 (100%) / 15	6 (100%) / 11	20 (100%) / 47
Mean Value (SD)	2.1 (0.7)	3.75 (0.43)	1.83 (1.21)	2.35 (1.10)

Source: Author's own work.

As can be noticed from Table 61, 50% of the hospitality stakeholders are "unsatisfied", and the other 20% of the hospitality stakeholders are "very unsatisfied". On the contrary, 75% of the public and water authorities is satisfied with the water supply in Santorini. However, the other stakeholders share similar perceptions with the hospitality stakeholders because 66.6% of the other stakeholders are "very unsatisfied" with the water supply on the island.

Non-conventional water resources such as desalinated water, reclaimed water, or rainwater harvesting are being used by many different tourism destinations in the world (in particular the ones that have arid or semi-arid climates) in order to create water availability. As it was discussed above, new desalination plants are being built in Santorini in order to create more water supplies (water availability) for the very same purpose. For that reason, it was asked Santorini stakeholders whether desalination plants are the solution to overcome the water shortages and create more water availability on the island. In addition to this question, we asked the stakeholders whether they view reclaimed water as the solution for creating more water availability in Santorini.

Table 62. Perception of Santorini Stakeholders about if desalination plants are the solution to the water scarcity issues in Santorini **(Q21)** and if reclaimed water is the solution to the water scarcity issues in Santorini **(Q22)**.

	Question 21				**Question 22**			
	HS	**PWA**	**OS**	**ALL**	**HS**	**PWA**	**OS**	**ALL**
Absolutely Agree (5)	2 (20%) / 10	0	0	2 (10%) / 10	1 (10%) / 5	0	2 (33.3 %) / 10	3 (15%) / 15
Agree (4)	2 (20%) / 8	4 (100%) / 16	1 (16.7%) / 4	7 (35%) / 28	1 (10%) / 4	1 (25%) / 4	1 (16.7 %) / 4	3 (15%) / 16
Maybe (3)	4 (40%) / 12	0	0	4 (20%) / 12	3 (30%) / 9	2 (50%) / 6	2 (33.3 %) / 6	7 (35%) / 21
Disagree (2)	1 (10%) / 2	0	2 (33.3%) / 4	3 (15%) / 6	4 (40%) / 8	1 (25%) / 2	1 (16.7 %) / 2	6 (30%) / 12
Absolutely Disagree (1)	1 (10%) / 1	0	3 (50%) / 3	4 (20%) / 4	1 (10%) / 1	0	0	1 (5%) / 1
Total N (%) / Total Values	10 (100%) / 33	4 (100%) / 16	6 (100%) / 11	23 (100%) / 60	10 (100%) / 27	4 (100 %) / 12	6 (100%) / 22	23 (100%) / 61
Mean Value (SD)	3.3 (1.18)	4 (0)	1.83 (1.06)	3 (1.30)	2.7 (1.1)	3 (0.70)	3.66 (1.10)	3.05 (1.11)

Source: Author's own work.

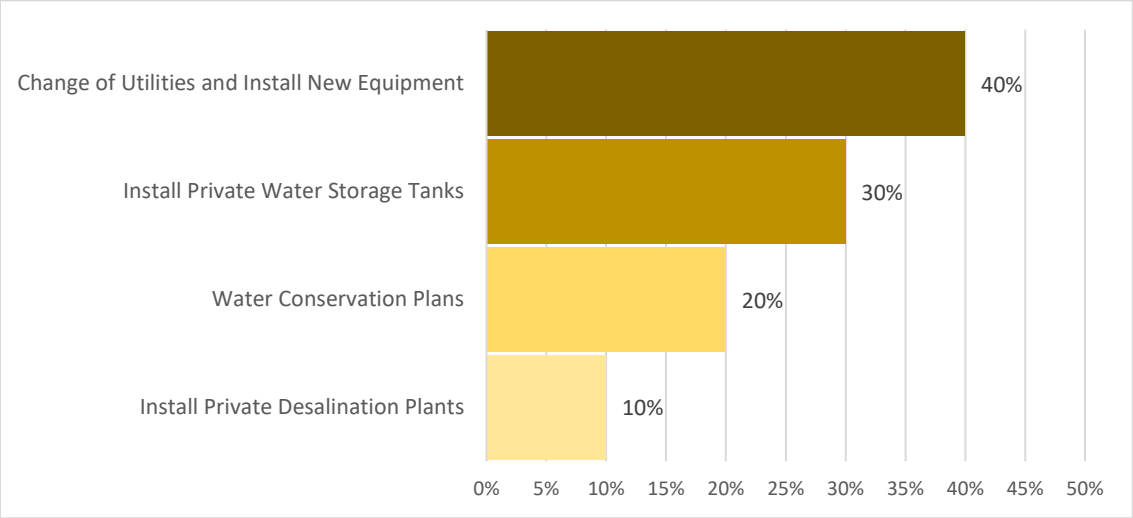
As can be noticed in Table 62, the hospitality stakeholders have varied perceptions of whether the desalination plants are the solution to the water scarcity problem in Santorini. It has to be noted that, 40% of the hospitality stakeholders have the perception that "maybe" desalination plants are the solution to the water scarcity problem. In addition to this, 20% of the hospitality stakeholders "absolutely agree" and the other 20% of them "agree" that the desalination plants are the solution to the water scarcity issues in Santorini. On the contrary, public and water authorities have a general consensus that desalination plants are the solution because all the respondents "agree" (100%) that desalination plants are the remedy. Meanwhile, the other stakeholders have totally different perceptions because 50% of the other stakeholders "absolutely disagree" and the other 33.3% of the other stakeholders "disagree" that the desalination plants are the solution to solve the water availability issues in Santorini.

Furthermore, 40% of the hospitality stakeholders "disagree" and the other %10 of the hospitality stakeholders "absolutely disagree" that reclaimed water is the solution to the water scarcity problem in Santorini. However, it has to be noted that 30% of the hospitality stakeholders have the perception that "maybe" reclaimed water is the solution to solve water availability issues on the island. On the other hand, public and water authorities have varied perceptions since 50% of the respondents have the perception that "maybe" reclaimed water is the solution. A similar trend can be observed with the other stakeholders because 33.3% of the other stakeholders have the perception that "maybe" reclaimed water is the solution to solve the water scarcity issues in Santorini. Nevertheless, the other 33.3% of the other stakeholders "absolutely agree" that reclaimed water is the remedy to solve the water availability issues in Santorini. In short, there are varied perceptions among Santorini stakeholders regarding the reclaimed water and there is not a general consensus.

As it was discussed above, private desalination plants are being built by hotels and resorts in many touristic destinations which face water scarcity issues. Hence, we wanted to learn whether the hospitality stakeholders use desalination plants in their premises in Santorini. The vast majority of the hospitality stakeholders absolutely disagreed (90%) that they had private desalination plants available at their premises. It has to be noted that, there was only one hospitality stakeholder among 10 who stated that a private desalination plant was available at their hotel back in 2015.

Water supply is crucial for the hotels and resorts to continue their operations and satisfy the needs of their customers. The majority of the hotels must have access to water supply even if there are water shortages taking place in the destination. As a matter of fact, different accommodation types such as hotels or resorts have to take necessary steps to guarantee water supply to their customers. For that reason, we wanted to learn the perceptions of the hospitality stakeholders, and we asked a special question to them whether they have any policies or strategies or they have any plans to guarantee water supply to their customers in Santorini:

Figure 45. Perception of the Santorini's Hospitality Stakeholders[57] about the policies, strategies or plans to guarantee water supply (Actions by the Hospitality Stakeholders).



Source: Author's own work.

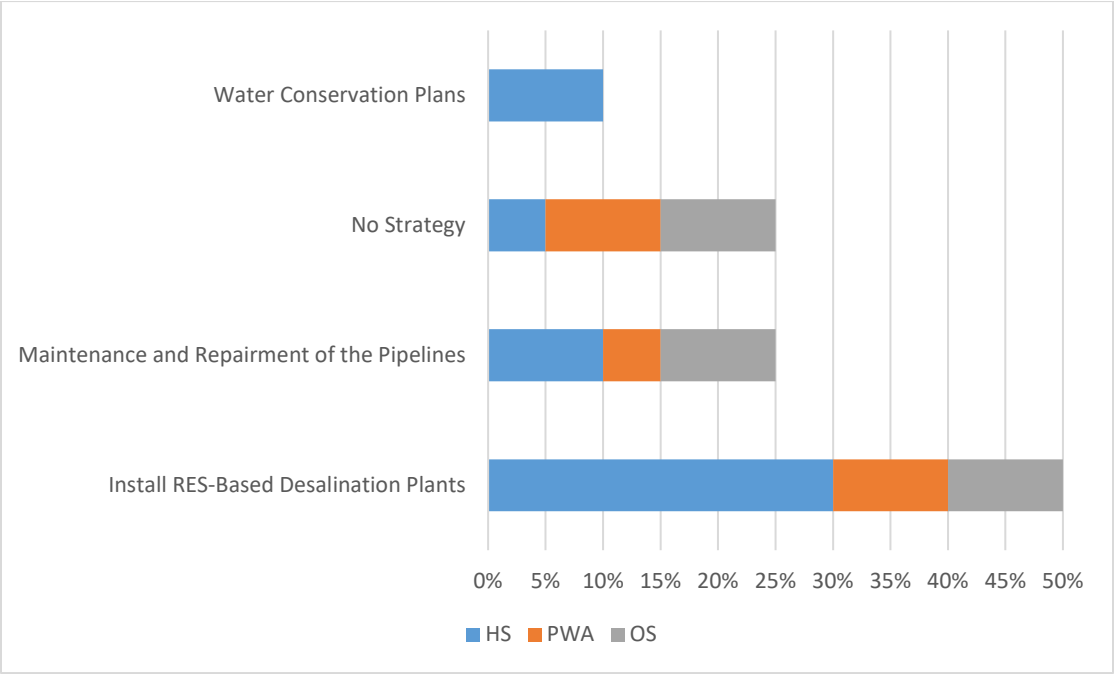
As can be seen in Figure 45, 40% of the hospitality stakeholders are changing their utilities, and they are installing new equipment (low-flush toilets, new pipelines, less water-consuming shower heads, etc.) or planning to do these, in order to guarantee water supply to their customers if there is any water shortage is taking place in Santorini. On the other hand, 30% of the Santorini hospitality stakeholders are installing or planning to install private water shortage tanks to guarantee water availability at their premises. Finally, 20% of the Santorini hospitality stakeholders are using or planning to use water conservation plans to guarantee water supply to their customers.

[57] 10 Hospitality Stakeholders responded to this question.

In short, changing utilities and installing private water storage tanks are among the most important measures to guarantee water supply by the hospitality stakeholders on the island. It has to be noted, there was only 1 hospitality stakeholder that said that they have installed a private desalination plant in Santorini.

It is one of the main responsibilities of the public and water authorities to guarantee water supply to their customers. Hence, we asked the same question to them whether they are taking or planning to take any actions to guarantee water supply in Santorini. It has to be noted that, we have asked this question to all of the Santorini Stakeholders including the hospitality stakeholders, public and water authorities, and the other stakeholders.

Figure 46. Perception of the Santorini's Stakeholders[58] about the policies, strategies or plans to guarantee water supply (Actions by the Public and Water Authorities).



Source: Author's own work.

Figure 46 shows that 50% of the Santorini Stakeholders have the perception that the public and water authorities are installing or planning to install RES-Based desalination plants in order to guarantee water supply in Santorini. In addition to this, 25% of the respondents have the perception

[58] All of the 20 Santorini Stakeholders responded to this question.

that the public and water authorities are repairing or planning to repair the pipelines and stop leakages that lead to water loss in Santorini. It has to be noted that, 15% of the Santorini Stakeholders are skeptical about the plans and strategies of the public and water authorities, and they have the perception that there is no strategy of the public and water authorities in Santorini to guarantee water supply. In short, the installment of RES-based desalination plants is seen as the most important strategy or plan of the public and water authorities by the Santorini stakeholders.

Water quality issues can be observed in many touristic destinations in which there are water scarcity issues. As it was discussed above, these water quality issues can have a negative impact on the sustainability of tourism and it can even end the lifecycle of a tourist destination. Therefore, bad water quality and water pollution can become important indicators for a tourist destination to lose its image and its lifecycle come to an end. Hence, we decided to ask Santorini Stakeholders if they are satisfied with the water quality or not.

Table 63. Perception of the Santorini Stakeholders about if they have satisfaction of water supply (in terms of water quality) in Santorini.

	N (%) / Values			
	HS	**PWA**	**OS**	**ALL**
Very Satisfied (5)	0	0	0	0
Satisfied (4)	0	4 (100%) / 16	1 (16.7%) / 4	5 (25%) / 20
Neutral (3)	3 (30%) / 9	0	0	3 (15%) / 9
Unsatisfied (2)	5 (50%) / 10	0	1 (16.7%) / 2	6 (30%) / 12
Very unsatisfied (1)	2 (20%) / 2	0	4 (66.6%) / 4	6 (30%) / 6
Total N (%) / Total Values	10 (100%) / 21	4 (100%) / 16	6 (100%) / 10	20 (100%) / 47
Mean Value (SD)	2.1 (0.7)	4 (0)	1.7 (1.10)	2.3 (1.15)

Source: Author's own work.

As seen in Table 63, the vast majority of the hospitality stakeholders are either unsatisfied (50%) or very unsatisfied (20%) with the water quality. On the contrary, the vast majority of the public and water authorities (100%) are satisfied with the water quality. Nevertheless, the other stakeholders share similar perceptions with the hospitality stakeholders since 66.6% of the other stakeholders are very unsatisfied, and the additional 16.7% are unsatisfied with the water quality which is supplied by DEYATH.

The frequency of water quality issues can be crucial for a touristic destination because it can degrade the image of the destination, and also can lead to even to the end of the tourism lifecycle of the destination. For that reason, water quality or water pollution issues can be crucial for the sustainability of a tourist destination. Hence, we asked an additional question regarding the frequency of these water quality issues in Santorini:

Table 64. Perception of the stakeholders about the frequency of the water quality problems in Santorini.

	Question 27			
	HS	**PWA**	**OS**	**ALL**
Very Frequent	0	0	2 (33.3%)	2 (10%)
Frequent	4 (40%)	0	2 (33.3%)	6 (30%)
Sometimes	4 (40%)	1 (25%)	1 (16.7%)	6 (30%)
Rare	0	0	1 (16.7%)	1 (5%)
Very Rare	2 (20%)	3 (75%)	0	5 (25%)
Total	10 (100%)	4 (100%)	6 (100%)	20 (100%)

Source: Author's own work.

As can be seen in Table 64, 40% of the hospitality stakeholders stated that water quality problems take place frequently in Santorini. On the other hand, the other 40% of the hospitality stakeholders said that water quality problems happen sometimes on the island. On the contrary, the vast majority of the public and water authorities have the perception that these water quality issues are very rare

in Santorini. However, the other stakeholders have a negative view regarding the frequency of water problems in Santorini because 33.3% of the hospitality stakeholders underlined that there are very frequently water quality problems, additionally, 33.3% of the hospitality stakeholders stated that these water quality problems are frequently in the island. In short, there are varied perceptions of Santorini stakeholders regarding the water quality problems on the island.

There can be a variety of reasons behind the water quality problems in tourist destinations. These reasons can include bad water resources management, agricultural activity, tourism activity, etc. Hence, we asked Santorini stakeholders their perceptions regarding the reasons behind the water quality problems on the island:

Table 65. Perception of the Santorini Stakeholders about if water quality issues are due to tourism activity in Santorini **(Q28)** and if water quality issues are related to bad water resources management **(Q29)**.

	Question 28				**Question 29**			
	HS	**PWA**	**OS**	**ALL**	**HS**	**PWA**	**OS**	**ALL**
Absolutely Agree (5)	0	1 (25%) / 5	3 (50%) / 15	4 (20%) / 20	0	0	4 (66.7%) / 20	4 (20%) / 20
Agree (4)	2 (20%) / 8	2 (50%) / 8	0	4 (20%) / 16	4 (40%) / 16	0	0	4 (20%) / 16
Maybe (3)	6 (60%) / 18	1 (25%) / 3	2 (33.3 %) / 6	9 (45%) / 27	4 (40%) / 12	0	2 (33.3%) / 6	6 (30%) / 18
Disagree (2)	0	0	1 (16.7 %) / 2	1 (5%) / 2	2 (20%) / 4	0	0	2 (10%) / 4
Absolutely Disagree (1)	2 (20%) / 2	0	0	2 (10%) / 2	0	4 (100%) / 4	0	4 (20%) / 4
Total N (%) / Total Values	10 (100 %) / 28	4 (100%) / 16	6 (100 %) / 23	20 (100%) / 67	10 (100%) / 32	4 (100%) / 4	6(100%) / 26	20 (100 %) / 62
Mean Value (SD)	2.8 (0.98)	4 (0.70)	3.83 (1.21)	3.35 (1.15)	3.2 (0.75)	1 (0)	4.33 (0.94)	3.1 (1.37)

Source: Author's own work.

Table 65 shows that the majority of the hospitality stakeholders (60%) have the perception that "maybe" the tourism activity in Santorini leads to water quality issues. In addition to this, 20% of the hospitality stakeholders agree but the other 20% of the hospitality stakeholders absolutely disagree that tourism activity causes water quality problems in Santorini. On the other hand, 50% of the public and water authorities "agree" that tourism activity has a role in the water quality issues on the island. Finally, as can be noticed in Table 65, 50% of the other stakeholders absolutely agree that tourism activity has a role in the water quality problems in Santorini. In short, we can see that there are varied perceptions regarding the role of tourism activity on the island in relation to the water quality problems.

As can be seen in Table 65, half of the hospitality stakeholders "absolutely agree" that bad water resources management in Santorini has a role in the water quality problems. On the contrary, the vast majority of the public and water authorities (100%) "absolutely disagree" that the reason behind the water quality issues is bad water resources management. Finally, the majority of the other stakeholders (66.7%) "absolutely agree" that bad water resources management has a role in the water quality issues in Santorini. Hence, there are different perceptions among Santorini stakeholders regarding the role of bad water resources management behind the water quality problems.

As it was discussed above, the agriculture sector is seen as the second most water-consuming sector after the tourism sector in Santorini. Hence, we asked the stakeholders whether agricultural activity has a role in the water quality problems in Santorini. In addition to this, we wanted to know whether climate change is seen as another reason behind the water quality problems on the island. For that reason, we asked another question regarding the role of climate change behind the water quality issues in Santorini.

Table 66 shows that there the majority of the hospitality stakeholders (60%) disagree that agriculture activity has a role in the water quality problems in Santorini. In addition to this, %20 of the hospitality stakeholders "absolutely disagree" that there are water quality issues because of agriculture activity. Similar responses can be observed by the public and water authorities because all the public and water authorities "absolutely disagree" that the agriculture sector has a role in the water quality issues in Santorini. Finally, the other stakeholders share similar responses with the hospitality stakeholders and public and water authorities since 83.3% of the respondents

absolutely disagree that agriculture activity has a role in the water quality problems on the island. Consequently, we can notice that there is a general consensus among Santorini stakeholders that agriculture activity has no role in the water quality problems in Santorini.

Table 66. Perception of the Santorini Stakeholders about if water quality problems are due to agriculture activity in Santorini **(Q29)** and if water quality issues are due to climate change (**Q30)**.

	Question 30				**Question 31**			
	HS	**PWA**	**OS**	**ALL**	**HS**	**PWA**	**OS**	**ALL**
Absolutely Agree (5)	0	0	0	0	0	0	0	0
Agree (4)	0	0	0	0	0	0	0	0
Maybe (3)	2 (20%) / 6	0	1 (16.7 %) / 3	3 (15%) / 9	2 (20%) / 6	1 (25%) / 3	0	3 (15%) / 9
Disagree (2)	6 (60%) / 12	0	0	6 (30%) / 12	5 (50%) / 10	1 (25%) / 2	1 (16.7 %) / 2	7 (35%) / 14
Absolutely Disagree (1)	2 (20%) / 2	4 (100 %) / 4	5 (83.3 %) / 5	11 (55%) / 11	3 (30%) / 3	2 (50%) / 2	5 (83.3 %) / 5	10 (50%) / 10
Total N (%) / Total Values	10 (100%) / 20	4 (100 %) / 4	6 (100 %) / 8	20 (100 %) / 32	10 (100%) / 17	4 (100%) / 7	6(100 %) / 7	20 (100%) / 33
Mean Value (SD)	2 (0.63)	1 (0)	1.3 (0.74)	1.6 (0.73)	1.9 (0.7)	1.75 (0.82)	1.16 (0.37)	1.65 (0.73)

Source: Author's own work.

As can be noticed in Table 66, the vast majority of the hospitality stakeholders have the perception either "disagree" (50%) or "absolutely disagree" (30%) that climate change has a role in the water quality problems on the island. Similar responses can be observed by the public and water authorities since 50% of the respondents have the perception "absolutely disagree", and an additional 25% of the respondents have the perception "disagree" that climate change has a role in the water quality problems in Santorini. Finally, the vast majority of the other stakeholders share similar perceptions with the tourism hospitality stakeholders and public and water authorities because 83.3% of the respondents "absolutely disagree", and an additional 16.7% of the

respondents “disagree” that climate change has a role in the water quality problems in Santorini. In short, there is another general consensus among Santorini stakeholders that climate change has no role in water quality issues on the island.

The water quantity and water quality issues have significant importance for the sustainability and continuation of tourism activity. Hence, we asked a specific question to the public and water authorities as well as the other stakeholders regarding their role in guaranteeing better water quality and quantity in Santorini.

Table 67. The role played by your institution/organization in order to guarantee water supply (quantity and quality).

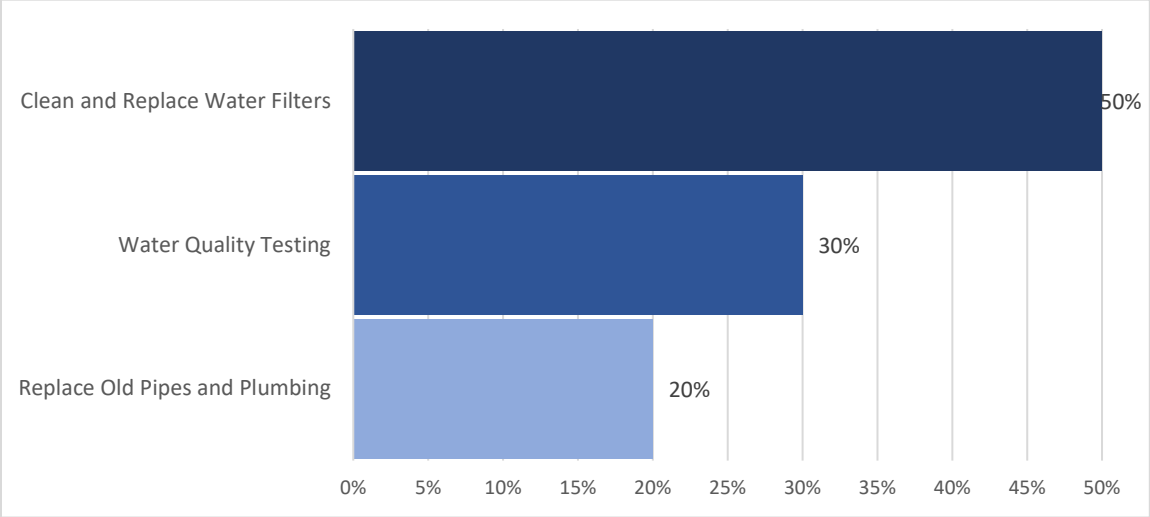
	Public & Water Authorities	**Other Stakeholders**
The main role, it is the leader	2 (50%)	0
Key role	2 (50%)	1 (16,7%)
Collaboration with the main and the key actors	0	2 (33,3%)
Supporting strategies designed by the main actors	0	3 (50%)
Total	4 (100%)	6 (100%)

Source: Author’s own work.

Table 67 shows that the public and water authorities have either the main role (50%) or the key role (50%) to guarantee water supply (quantity and quality). On the contrary, the other stakeholders have the role of supporting strategies designed by the main actors (50%) as well as they have the role of collaborating with the main and the key actors. Consequently, we can notice that public and water authorities do have the awareness that they have rather the main role or the role of guaranteeing better water supply (water quantity and quality).

Good water quality is essential for hotels because it is directly linked to the health and satisfaction of their customers. It has to be noted that, a hotel or a resort with poor water quality can lose its customers. For that reason, we wanted to know if the Santorini hospitality stakeholders are taking any measures to provide good water quality at their hotels and resorts, and we asked a specific question regarding this matter only to them:

Figure 47. Perception of the Santorini's Hospitality Stakeholders[59] about the policies, strategies or plans to guarantee better water quality (Actions by the Hospitality Stakeholders).



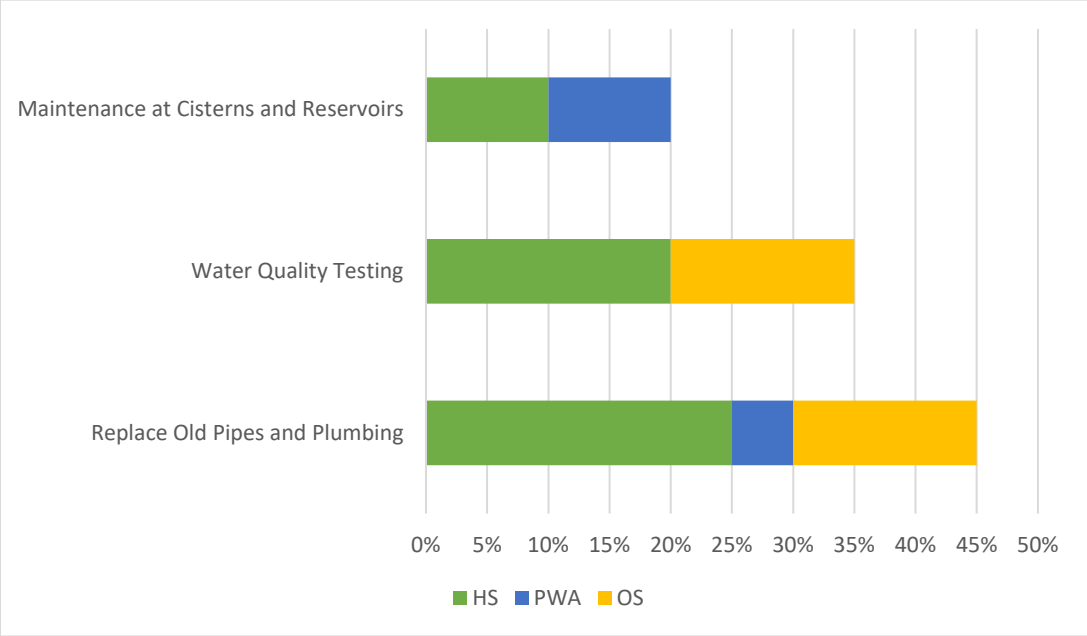
Source: Author's own work.

As can be seen in Figure 47, 50% of the hospitality stakeholders are cleaning and replacing water filters (planning to clean and replace water filters) in order to have better water quality on their premises. On the other hand, 30% of the hospitality stakeholders are testing their water quality (or planning to test) in order to understand whether water has any pollutants or not. Finally, 20% of the hospitality stakeholders are replacing old pipes and plumbing (or planning to replace old pipes and plumbing) in order to increase the water quality. In short, the majority of the hospitality stakeholders are cleaning and replacing water filters in order to have better water quality in Santorini.

It is the essential task of the public and water authorities to ensure a better water quality for the local population as well as for the hotels and resorts in a tourist destination. The poor water quality can degrade the positive image of a tourist destination, and it can even lead to end of the tourist lifecycle. On the other hand, water pollution can lead to serious health issues not only for the local population but also for the tourists that are visiting the tourist destination. Hence, we asked all the Santorini stakeholders whether the public and water authorities are taking any measures or planning to take any steps to have better water quality in Santorini:

[59] 10 Hospitality Stakeholders responded to this question.

Figure 48. Perception of the Santorini's Stakeholders[60] about the policies, strategies or plans to guarantee better water quality (Actions by the Public and Water Authorities).



Source: Author's own work.

As can be seen in Figure 48, 45% of the Santorini stakeholders have the perception that the public and water authorities are replacing old pipes and plumbing in order to increase the water quality in Santorini. Furthermore, 35% of the Santorini stakeholders stated that the public and water authorities are testing the water quality for pollutants in order to provide better water quality. Finally, 20% of the Santorini stakeholders have the perception that the public and water authorities are doing maintenance at cisterns and reservoirs in order to increase the water quality. In short, the majority of the Santorini stakeholders have the perception that replacing old pipes and plumbing as well as testing water for pollutants are the two main measures that are being taken by the public and water authorities to provide better water quality in Santorini.

[60] All of the 20 Santorini Stakeholders responded to this question.

UNIVERSITAT ROVIRA I VIRGILI
THE WATER SCARCITY AND SUSTAINABLE TOURISM IN THE GREEK ISLANDS: FOCUS CYCLADES ISLANDS
Itri Atay

7.3. DISCUSSION

The tourism sector is Greece's largest economic sector, and Mykonos and Santorini are two of the world's most well-known tourist destinations. It is crucial that environmental and tourism regulations are coordinated, to ensure the longevity and viability of the tourism industry on both islands. However, the majority of the interviewees claimed that tourism and environmental regulations in Mykonos and Santorini are not coordinated. It has to be underlined that, the overwhelming majority of the hospitality stakeholders and other stakeholders in both of the islands did not believe Mykonos' and Santorini's tourism and environmental strategies (policies) were coordinated.

On the contrary, we can notice that the public and water authorities in both Mykonos and Santorini have the very same perception that; the tourist and environmental strategies were totally coordinated in each of the islands. The main cause of these contradicting perceptions is directly connected to the decisions made unilaterally by government officials and water company authorities. Tourism and climate change are concerns that cut across sectors and call for coordination and coherence across many policy domains and levels of government, as Santos-Lacueva and Velasco Gonzalez (2018) pointed out. The efficacy and efficiency of public activities and policies can be increased with such coordination and coherence among many stakeholders (Santos-Lacueva and Velasco Gonzales, 2018).

It should be highlighted that the vast majority of respondents believed that tourism and environmental regulations should be coordinated, and they understand that this is the only way to ensure the sustainability and durability of the tourism lifecycles in Mykonos and Santorini. It should be noted that the vast majority of hospitality stakeholders and other stakeholders on both islands have similar perceptions. However, the public and water authorities in Santorini agree more than the public and water authorities in Mykonos that tourist and environmental policies should be coordinated. In summary, we can see that the perceptions are relatively similar, despite some changes when we compare the perceptions of stakeholders on both islands. As Santos-Lacueva et al., (2019) pointed out, insufficient knowledge and poor coordination between decision-makers and the private sector, such as in Alt Maresme, Spain, can potentially convert the planned destination into a less-desired one.

During the interviews with the hospitality stakeholders, it was pointed out that both DEYAM and DEYATH received complaints from some of the hospitality stakeholders which were directly linked to unilateral decisions of the public and water authorities. Furthermore, there were continuous issues of water supply to accommodation facilities, which forced hospitality stakeholders to shut down such facilities as swimming pools and spas in Mykonos and Santorini during the peak season which mean summer months (Mykonos Hospitality Stakeholder 4, Authors' Interview, August 2014; Santorini Hospitality Stakeholder 2, Authors' Interview, August 2014).

Additionally, it was noted that the overwhelming majority of the hospitality stakeholders in both of the islands had environmental concerns on their agendas and that this was directly tied to the viability of the tourist destination and to economic profits. It has to be noted that, hospitality stakeholders in Santorini prioritize environmental issues in their hotels or resorts compared to Mykonos hospitality stakeholders. Although Mykonos hospitality stakeholders give importance to environmental issues, they place less emphasis on environmental issues in their hotels or resorts. As in the instance of Girona, Spain, tensions between socioeconomic sectors (such as tourism) that depend on water for survival are projected to get worse due to water shortages, changing climate conditions, and rising tourist numbers in the Mediterranean region (Bagur et al., 2019). As a result, hospitality stakeholders think that tourism and environmental policies should be coordinated and that environmental issues should be high on their priority list because they directly threaten the sustainability of the industry.

The sustainability and longevity of tourism operations on both islands depend heavily on the availability of water. Therefore, whether tourism regulations and administration take into account environmental challenges, notably water supply, is crucial for an island tourist destination that has an arid or semi-arid climate (such as Mykonos and Santorini). Hence, one can notice that the majority of the other stakeholders in both of the islands strongly disagree or disagree that this is true. On the contrary, the overwhelming majority of the public and water authorities in both of the islands strongly agree or agree that environmental issues are taken into account by tourism regulations and administration. Finally, there are mixed perceptions among the hospitality stakeholders whether environmental issues are taken into account by tourism regulations and administration or not but Mykonos hospitality stakeholders have more negative perceptions compared to Santorini hospitality stakeholders. As a matter of fact, a higher number of interviewees

claim that environmental issues are not taken into account by the tourism regulations and administration.

As Becken and Clapcott (2011) discussed, there are similar concerns of the stakeholders in Fiji and New Zealand; since several national policies did not take climate change and environmental issues into consideration to the extent that stakeholders in the tourism industry believed was necessary or did not take into account the unique needs of the tourism industry. For that reason, the stakeholders in Fiji and New Zealand have certain concerns regarding the sustainability and longevity of tourism operations can disrupt or even end due to a lack of tourism regulations, national policies, and administrative planning that take environmental issues and climate change into account.

Water-scarce tourist locations in dry and semi-arid regions are significantly impacted by climate change. The overwhelming majority of those interviewed thought that climate change has some impact on the islands' tourism industries. Mykonos and Santorini stakeholders have similar perceptions of the impact of climate change on tourism activity, but Mykonos stakeholders have relatively stronger perceptions than Santorini stakeholders as a result of the severe droughts and water crises that took place on the island. Given that both islands were directly impacted by the effects of climate change (such as droughts), this shows that stakeholders in the hospitality industry, public and water authorities, and other stakeholders are aware of the issue. This awareness is directly tied to economic losses since droughts increase water scarcity, which can lead to a loss of business for hotels. Droughts have a negative impact on island residents' daily lives because they prevent them from accessing water resources during the summer, which is when tourism is at its highest. As a result, people's trust in public and water authorities and the decisions they make can change, which has a direct impact on local governance.

Hotels are water-intensive industries, according to Popely and Moreno-Melgarejo (2020), and the tourism industry is significantly threatened by water scarcity since it depends on a continuous water supply to meet visitor demands. In fact, the water crisis in Mykonos and Santorini in 2014 increased pressure on and discontent with public and water authorities in the islands. It should be noted that DEYAM and DEYATH both received numerous complaints, and even street protests (organized by the local island populations) took place because their policies and strategies were not sufficient to meet the demand for water (Hospitality Stakeholder Mykonos 10, Author’s Interview, July 2015; Other Stakeholder Santorini 6, Author’s Interview, August 2015).

In Mykonos and Santorini, it has been noted that climate change and its effects worsen environmental problems, water shortages, and economic losses in the tourism sector. Droughts, economic losses, and temperature rise were considered by the majority of interviewees to be the three greatest dangers posed by climate change to the island's tourism industries. However, it should be underlined that Mykonos stakeholders are more concerned about the droughts than Santorini stakeholders. It should also be mentioned that the severe droughts that began in 2013 led to the 2014 water crisis on both islands. The second-worst threat posed by climate change to tourism on both islands, according to interviewees, is economic losses.

A large number of hotels in Mykonos and Santorini were unable to get enough water during the summer of 2014. Since there was not even enough water to take a shower, flush the toilet, or use hotel amenities like swimming pools and spas, many hotels and resorts lost their guests as a result of the water crisis (Hospitality Stakeholder Mykonos 9, Authors' Interview, July 2015; Hospitality Stakeholder Santorini 10, August 2015). Water rates in Mykonos have risen as a result of the water scarcity situation, reaching a high of 3.87 EUR/m3 at the start of 2015 (Hospitality Stakeholder Mykonos 9, Authors' Interview, July 2015).

In 2014, the cost of water was roughly 3.65 EUR/m3, which was high when compared to other Greek islands before the crisis. Further complaints of DEYAM's management of water resources followed the summer's large rise in water prices and supply problems. Contrarily, during the water shortage crisis in 2014, water prices did not significantly increase in Santorini, and DEYATH officials concentrated primarily on developing alternative water supplies to address the water crisis, such as planning the installation of new RES-Based desalination plants, but this resulted in an increase in the municipality taxes on the island (Public and Water Authority Santorini 4, Authors' Interview, August 2015).

As a matter of fact, the majority of the Mykonos' residents, hotels, and local media started to openly protest the policies of DEYAM and the municipality of Mykonos (Hospitality Stakeholder Mykonos 9, Authors' Interview, July 2015). Nevertheless, there was no such level of protest against DEYATH in Santorini but there were many complaints because of having no access to water resources (Other Stakeholder Santorini 3, Authors' Interview, August 2015). It has to be noted that, stakeholders in Gran Canaria, Spain, share similar perceptions with the stakeholders in Mykonos and Santorini: they view droughts and economic losses as the worst threats of climate change to

the tourism sector, and they believe that both have the potential to end the tourism industry in water-scarce island tourism destinations (Popely and Moreno-Melgarejo, 2020). Consequently, climate change's threats such as droughts and economic losses threaten not only Cyclades Islands in the Aegean Sea but also Canary Islands in the Atlantic Sea. For that reason, the worst threats of climate change are global and they can cause negative impacts on any tourism destination in the world.

As a result, some type of collaboration between public decision-makers and commercial players (such as hospitality stakeholders) is required to combat the effects of climate change. The potential effects of climate change on the tourism industry necessitate this requirement. The majority of interviewees agreed that actors should coordinate their efforts to combat the effects of climate change. It should be noted that the public and water authorities, as well as other stakeholders on both islands, believe that collaboration between public decision-makers and commercial players should be increased. At the same time, Santorini's hospitality stakeholders have similar perceptions. Even though the water scarcity problem in Mykonos is worse than in Santorini, only one-third of Mykonos hospitality stakeholders agree. As a result, water scarcity in Mykonos and Santorini has become more severe as a result of actors' lack of cooperation, unilateral decisions by public bodies, and unilateral actions by some hospitality stakeholders.

In fact, this finally caused a water problem that sparked a dispute between local residents and the tourism industry, placing DEYAM and the municipality of Mykonos in the center of it. DEYATH and the locals of Santorini did not have any conflicts of this nature. However, Santorini inhabitants and the tourism industry both complained to government agencies and water authorities about the scarcity of water. This situation led DEYAM to change its demand-side water conservation strategy, and they started to focus on increasing the water supply for the island (Hospitality Stakeholder Mykonos 11, Authors' Interview, July 2015). Even though, DEYATH received less complains compared to DEYAM, they changed their demand-side water conservation strategy as well, and they started to focus on building RES-based desalination plants on the island in order to increase the water supply (Other Stakeholder Santorini 3, Authors' Interview, August 2015).

Each stakeholder group has a different role to play in the effort to mitigate the effects of climate change. The majority of the interviewees in the public and water officials' subgroup have stated that they have rather a main role or a key role in both of the islands, in order to fight against the

impacts of climate change. Nevertheless, public and water authorities in Mykonos believe that they have more responsibility in the fight against climate change compared to the public and water authorities in Santorini. On the other hand, the majority of the interviewees among the other stakeholders' subgroup have stated that they have rather a collaborative role with the main and key actors or they have a supportive role in order to assist the strategies designed by the main actors in both of the islands. However, the other stakeholders' subgroup in Santorini have the perception that they have more responsibility to maintain collaboration with the main and key actors compared to the other stakeholders' subgroup in Mykonos.

As Pittock (2011) underlined, governments face additional difficulties in creating integrated policies that provide a variety of advantages because of the conflicts and synergies between climate, energy, water, and environmental policies. As a matter of fact, the engagement of each actor is vital even though their roles can even be a minor role or a major role. Hence, engagement of senior political leaders, cyclical policy development, multi-agency and stakeholder processes, and improved accountability and enforcement mechanisms are success factors for better policy formation (Pittock, 2011).

Climate change mitigation strategies are critical for dealing with the consequences of changing climate conditions. It should be noted that half of the Mykonos interviewees thought that increasing the use of RES was the most important mitigation strategy for addressing the effects of climate change on tourism activity in Mykonos. Simultaneously, a quarter of respondents thought that energy-saving measures/energy efficiency were the second most important mitigation strategy in Mykonos. On the other hand, one-third of the Santorini interviewees believed that energy-saving actions/energy efficiency, and the other one-third believed that monitoring energy and water use, were the most important mitigation strategies for addressing the impacts of climate change on tourism activity. As a result, there is a clear distinction between Mykonos and Santorini stakeholders in terms of the most important mitigation strategies to mitigate the impact of climate change.

As Zeppel and Beaumont (2013) underlined, energy efficiency and the utilization of RES were two of the top three mitigating methods proposed by hospitality stakeholders in Queensland, Australia. On the other hand, Elum and Momodu (2017) discussed that climate change mitigation strategies in Nigeria should focus more on the utilization of RES and energy efficiency, by increasing the

penetration of renewable energy deployment and taking local action to encourage the uptake of renewable energy. According to Durlacher and Gössling (2021), accommodation establishments in Austria used to consume a lot of energy until significant measures were implemented by public officials and hospitality stakeholders, which resulted in significant savings in energy costs as well as higher occupancy rates: in other words, energy efficiency led to an increase in economic revenues in the tourism sector. Consequently, it can be noticed that similar mitigation strategies or policies are being implemented or suggested by different stakeholders globally because climate change is a global issue that does not affect a single location.

A financial commitment and long-term planning may also be necessary for climate change adaptation strategies or policies, which concentrate on minimizing negative effects and seizing any possibilities that may present themselves. There is a clear similarity between Mykonos and Santorini stakeholders since the majority of Mykonos and Santorini stakeholders have the perceptions that the use of desalination plants is the most important adaptation strategy to reduce the negative effects of climate change on the tourism industry in the islands. The interviewees believed that desalination plants could supply the tourism industry with enough water during droughts and could diminish the negative effects of climate change on the tourism industry.

Nevertheless, there are clear differences regarding the second most important adaptation strategies between Mykonos and Santorini stakeholders. It has to be noted that, a quarter of the Mykonos stakeholders had the perception that rainwater harvesting / reclaimed water is the second most important climate change adaptation strategy. The perceptions of Santorini stakeholders are different because a quarter of Santorini stakeholders believed water conservation plans are the second most important adaptation strategy while another quarter of Santorini stakeholders believe raising awareness/education is the second most important climate change strategy.

The use of desalination plants is regarded as the most important climate change adaptation strategy between Mykonos and Santorini. When conventional resources are insufficient to supply water to a specific area, the general perception of using non-conventional water resources is directly related to this perception. However, it should be noted that the majority of respondents in our interviews stated that their attitudes toward desalination plants did not necessarily imply that they supported the installation of numerous desalination plants in Mykonos and Santorini. Furthermore, there are significant perception differences between the hospitality stakeholders and the public and water

authorities on both islands. Furthermore, in comparison to hospitality stakeholders or other stakeholders, public and water authorities see installing desalination plants as the primary adaptation strategy in both Mykonos and Santorini.

It has to be noted that, some of the hospitality stakeholders in both of the islands viewed desalination plants as the last choice to save the tourism industry on the islands (Hospitality Stakeholder Mykonos 12, Authors' Interviews, July 2015; Hospitality Stakeholder Santorini 10, Author's Interview, August 2015). On the contrary, the majority of the public and water authorities in both of the islands view desalination plants as the first and only choice to save the tourism industry on the islands, and they believed that unless these desalination plants are constructed, the tourism lifecycle will stagnate on both of the islands (Public and Water Authority Mykonos 2, Author's Interview, July 2014; Public and Water Authority Santorini 3, Author's Interview, August 2015).

Before desalination technology is used, all conservation measures must be put in place, and there should be regulations to minimize water demand through adaptation, as was seen in the case study analysis of the Sonora region in Arizona, USA, according to McEvoy and Wilder (2012). In other words, even though the area is located in an arid climate with acute water scarcity, desalination facilities shouldn't be the first option for decision-makers. This means that various water conservation strategies must be put into place before desalination facilities are built. The Water Crisis of 2014 prompted public officials and water agencies to take unilateral actions without considering other water saving strategies, and additional desalination facilities have been set up on both islands every year since.

According to the official authorities of DEYAM and the municipality of Mykonos, the installation of the first desalination plant was completed in 2018 and the second one in 2019; this was viewed as a big success (DEYAM, personal communication, 11 August 2019). Due to lower administrative costs brought on by the new desalination plants, DEYAM reduced water pricing. As a result, the 2019 water price was reduced from a peak of 3.87 EUR/m3 in 2015 to 2.93 EUR/m3. The price of water remained unchanged from 2019 through the summer of 2021 (during the COVID-19 pandemic). However, the Municipality of Mykonos was compelled to take action to lower water demand because the decline in water costs, the diminished importance placed on water

conservation initiatives, and the rise in water demand from the tourism industry did not resolve the water stress issue.

On the other hand, in Santorini, the installation of a major RES-based desalination plant with a capacity of 1.800.000 m3 /year (+ 900.000 m3 /year after future additional capacity) was completed in 2020 (DEYATH, personal communication, 22 August 2021). As a consequence, the water price was reduced from a peak of 2.90 EUR/m3 to 2.10 EUR/m3 as is in the case of Mykonos. At the same time, the price of water remained unchanged from 2020 through the summer of 2021 (during the COVID-19 pandemic). The demand for water continuously increased because of the reduced water tariffs and the notion that "there is enough water for everyone" after the installment of the major RES-based desalination plant in 2020. Nevertheless, DEYATH officials noticed that the capacity is still not enough for the growing number of tourist arrivals after the COVID-19 pandemic. For that reason, they decided to build another RES-based desalination plant (scheduled to be finished in the summer of 2022) with a capacity of 1000 m3/day (DEYATH, personal communication, 4 June 2022).

The vast majority of interviewees were aware that tourism consumes the most water and is the most important economic sector on both Mykonos and Santorini. Agriculture, on the other hand, is regarded as the second-highest water-consuming economic sector on both islands. Furthermore, Mykonos stakeholders believe that, unlike Santorini, the shipping and industry sectors are among the water-consuming economic sectors on the island, following tourism and agriculture.

According to the Hellenic Statistical Authority (2021), Mykonos received roughly 247,000 foreign air arrivals in 2014, which nearly doubled to approximately 536,000 arrivals in 2019. On the other side, prior to the COVID-19 outbreak, Santorini had a rise in foreign air arrivals from 310,000 in 2014 to 576,000 in 2019 (Hellenic Statistical Authority, 2021). Furthermore, in 2014, Mykonos recorded 610,000 cruise ship arrivals, which grew to 787,000 in 2019 (Hellenic Statistical Authority, 2021). Furthermore, prior to the outbreak of COVID-19, Santorini received 742,000 cruise ship arrivals, which jumped to approximately 981,000 in 2019 (Hellenic Statistical Authority, 2021). As a result, the tourism industry consumes a substantial amount of water, particularly during the summer, which is the peak season for tourism. According to Hadjikakou et al., (2013), tourism activities in Eastern Mediterranean tourism hotspots such as Turkey, Cyprus, and Greece result in high direct and indirect water consumption. Similarly, Mykonos and Santorini

are experiencing water supply challenges each summer as a result of increased demand from the tourism industry.

Despite these findings, one-third of interviewees stated that "maybe" tourism activities are to blame for Mykonos' water problems. At the same time, some of the hospitality stakeholders even disagreed that tourism is the primary cause of Mykonos' water scarcity. On the contrary, a quarter of interviewees said tourism is "maybe" to blame for Santorini's water constraints, while few interviewees said tourism is not to blame. It has to be noted that, half of the hospitality stakeholders and the overwhelming majority of the other stakeholders absolutely agree that tourism activity has a role in water shortages in Santorini. In addition to this, half of the public and water authorities have the perception that “maybe” tourism activity has a role in water shortages while the other half rather agree or absolutely agree that tourism activity causes the water shortages in Santorini. In short, Santorini stakeholders are quite certain that tourism activity is one of the reasons for the island's water issues. This suggests that Mykonos stakeholders believe in various explanations for the water problems, such as short-term water resource management.

It should be underlined that, one can notice that in both of the islands public and water authorities disagree or absolutely disagree that the water shortages are taking place on both of the islands because of poor water resources management. However, the majority of the hospitality stakeholders and the other stakeholders believe the opposite and they think that the water shortages are occurring on the islands as a result of poor water resources management. Hence, more than half of the interviewees in Mykonos believed that there is short-term water resource management on the island, and the policies of DEYAM are to blame for the water scarcity issues during the summer months when it is the tourism peak season on the island.

On the other hand, one can also notice that half of the interviewees in Santorini believed that short-term water resource management is another factor behind the water scarcity issues on the island. Consequently, Santorini stakeholders view both tourism activity and short-term water resource management as the factors behind the water scarcity issues.

As previously stated, DEYAM decided to shift its demand-side water conservation strategy and begin focusing on increasing water supply; this new strategy focused more on non-conventional water resources, such as desalination plants, because the island's conventional water resources (e.g., the *Marathi* and *Ano Meras* dams and the 1000 wells) were insufficient to meet the demand. As a

result, the mayor of Mykonos and DEYAM decided to restore two non-operational fossil fuel-based desalination plants and use them to supply water during the summer months of 2015 to meet the demand of residents and tourism stakeholders (DEYAM, personal communication, 20 August 2015).

These two desalination plants were disadvantageous because they had high administrative expenses, used fossil fuels, and frequently suffered technical problems during the summer months, when water use was highest (DEYAM, personal communication, 20 August 2015). As a result, the water situation in Mykonos grew significantly more chaotic following the partial drought in the winter of 2016, because conventional water resources were insufficient, fossil fuel-based desalination plants were underperforming, and tourist water demand was skyrocketing.

The new RES-based desalination facilities were chosen to reduce administrative costs as well as water costs for the local population and tourism sector (DEYAM, personal communication, 20 August 2015). A second unilateral decision to construct two new desalination plants in Mykonos by 2019 was also made by the mayor of Mykonos and DEYAM (DEYAM, personal communication, 20 August 2015). The island experienced water shortages for at least 8 days during the busiest travel season in 2016, which drew complaints from locals and tourist stakeholders (Hospitality Stakeholder Mykonos 12, Authors' Interview, July 2015).

However, the most intriguing aspect of this decision concerned the kind of desalination plants that were being considered: the new plants were going to be installed as portable SWRO-based RES-based desalination plants, with an additional capacity of 1,260,000 m3/year. In other words, the decision-makers in charge of water resource management decided to employ RES-based desalination facilities to enhance water supply and lower water prices rather than reduce water demand in Mykonos.

The majority of hospitality stakeholders in Mykonos are either unsatisfied or very unsatisfied with the water supply (in terms of water availability / quantity). On the contrary, the majority of public and water authorities are either very satisfied or satisfied with the water supply (in terms of water availability / quantity). At last, the majority of other stakeholders in Mykonos share similar perceptions with hospitality stakeholders since overwhelming majority of the other stakeholders are either very unsatisfied and or unsatisfied with the water supply on the island. Consequently, it can be observed that more than half of the respondents in Mykonos agreed that water resources

management is short-term based as a result of continuous water shortages and water supply issues, and two-thirds of the respondents were not satisfied with the water supply in Mykonos.

On the other hand, DEYATH had a similar change in their demand-side water conservation strategy and began focusing on raising water supply; since *Zoodochos Pigi* (Life-giving spring), and 100 wells around the island were not sufficient enough to supply the increasing demand during the summer months (DEYATH, personal communication, 24 August 2015). It has to be noted that DEYATH changed their demand-side water conservation strategy to increase water supply much earlier compared to Mykonos due to more tourist arrivals and less available conventional water resources in Santorini. Nevertheless, water scarcity problems on the island continued since DEYATH decided to build fossil-fuel-based desalination plants with low capacity, and the 5 desalination plants which were built until the summer of 2012, were consuming high energy and required high operation costs (DEYATH, personal communication, 22 August 2021).

Consequently, the mayor of Santorini and DEYATH decided to build a bigger fossil fuel-based desalination plant but then they changed their decision and shifted to an RES-based desalination plant due to lower operational costs and less energy consumption (DEYATH, personal communication, 22 August 2021). Nevertheless, the RES-based desalination plant which was completed in 2020, was not sufficient enough to fulfill the water demand during the summer months due to high tourism activity (DEYATH, personal communication, 22 August 2021). There were supply issues during the summer of 2021 and this led DEYATH to build one more additional RES-based desalination plant (scheduled to be finished in the summer of 2022) as it was mentioned above.

The long and the short of it is that, the decision-makers in charge of water resource management decided to employ RES-based desalination facilities to increase water supply and lower water prices rather than decrease water demand in Santorini; as it is in the case of Mykonos. It has to be noted that, the vast majority of the hospitality stakeholders in Santorini are either unsatisfied or very unsatisfied with the water supply. On the contrary, the overwhelming majority of public and water authorities in Santorini are satisfied with the water supply while the vast majority of other stakeholders are very unsatisfied with the water supply (in terms of water availability/quantity) on the island. For that reason, it can be observed that half of the interviewees in Santorini agreed that

water resources management is short-term based as a result of water scarcity problems and supply issues, and more than half of the respondents were not satisfied with the water supply in Santorini.

Agricultural water consumption can be high in tourism destinations and this can lead to additional water scarcity issues in island tourist destinations which are located in arid and semi-arid climates such as in the case of Crete Island, Greece (Kourgialas et al., 2018). It can be noticed that, the vast majority of the interviewees in both of the islands believed that agricultural water consumption did not have any additional impact on the water consumption and there is a common perception that agriculture activity has no significant role in water shortages which are happening during the summer months in both of the islands. Hence, agricultural activity is not seen one of the factors behind the water scarcity issues in Mykonos and Santorini unlike in the case of Crete Island.

As Filho (2022) underlined, heat waves tend to increase water and energy consumption (especially for air conditioning), and tourism destinations in Greece such as Athens and Corfu has been already affected dramatically as a result of the changing climate conditions. It has to be noted that, peak temperatures are being recorded globally each year and the heatwaves have already affected Greece (Athens: 46.3 °C on 2 August 2021 and Corfu 36 °C on 26 July 2021) during the summer of 2021 (Filho, 2022).

For that reason, climate change was seen as one of the main factors that was responsible for the water shortages since the vast majority of the respondents in Mykonos believed climate change had a role in water scarcity problems in the islands. It should be highlighted that the majority of hospitality stakeholders either absolutely agree or agree that climate change causes water shortages in Mykonos. In addition to this, the majority of the public and water authorities agree that water shortages are taking place because of climate change. Finally, half of the other stakeholders either agree or absolutely agree that climate change has an impact on water shortages in Mykonos. In short, there is a general consensus among Mykonos stakeholders regarding the role of climate change in water shortages on the island.

The perceptions of Santorini stakeholders are different and there is a variety of different opinions regarding the role of climate change. It should be noted that two-fifths of the hospitality stakeholders in Santorini have the perception that “maybe” climate change has a role in water shortages while the other two-fifths either agree or absolutely agree that climate change causes water shortages on the island. On the contrary, two-thirds of the public and water authorities either

absolutely agree or agree that climate change is the reason for water shortages in Santorini. At last, half of the other stakeholders have the perception that “maybe” climate change is the reason for water shortages while one-third of them agree that climate change has a role in water shortages. Consequently, there are mixed perceptions among Santorini stakeholders and there is no general consensus that climate change has a role in water scarcity problems in the islands as it is in the case of Mykonos.

Climate change is a global phenomenon and all tourist destinations can be affected by its impacts. Water shortages can take place more frequently even in destinations that are not located in arid or semi-arid climates. As Foghagen and Alriksson (2023) discussed water shortages are going to be more frequent with the increasing water consumption by agriculture and tourism sectors, and changing climate conditions in island tourist destinations such as Öland and Gotland, Sweden. As can be noticed, the majority of the interviewees in Mykonos stated that the water shortages are rather very frequent or frequently taking place during the summer months on the island. In addition to this, the remaining one-fourth of Mykonos stakeholders assume that water shortages are sometimes happening on the island, particularly among the public and water authorities subgroup. It should be highlighted that the stakeholders of Santorini have different perceptions compared to Mykonos stakeholders.

It should be noted that only one-fourth of Santorini stakeholders stated that water shortages are either very frequent or frequent on the island. However, half of Santorini stakeholders believe that water shortages occur on the island at times. To summarize, Mykonos stakeholders are more frequently affected by water shortages than Santorini stakeholders. Moreover, while both islands face water shortages, the frequency of these shortages is much higher in Mykonos than in Santorini. The chaotic situation prompted the municipality of Mykonos to implement one of the most remarkable measures: effectively forbidding the use of swimming pools, which resulted in a fine of EUR 10.000 for the summer of 2019's water crisis (the decision had already been made in the summer of 2018). (Kathimerini, 2021).

The municipality also made the decision to limit cruise ship arrivals at the island's port (Municipality of Mykonos, personal communication, 12 August 2019). Due to the fact that the overall number of cruise ship arrivals in 2019 was 787,400, or almost 1.3 million tourist arrivals (including arrivals by international air), the municipality sought to limit the number of cruise ship

arrivals. Additionally, DEYAM and the municipality of Mykonos unilaterally decided to develop a second 360,000 m3/year RES-based desalination plant (DEYAM, personal communication, 11 August 2019). According to public remarks made by DEYAM and municipality representatives, the island's water shortage will be resolved by the new desalination plant (DEYAM, personal communication, 11 August 2019).

As it was discussed above, Santorini had also water shortages during the summer water crisis in 2014. As a matter of fact, half of the respondents in Santorini stated that the water shortages are "sometimes" taking place on the island. This is directly linked to DEYATH and the Municipality of Thira's supply based policy to create more water availability for the island through building more RES-based desalination plants and the support coming from the Ministry of Environment and Energy (Public and Water Authority 3, Author's Interview, August 2015). The summer of 2014 was a turning point for the Municipality of Thira and DEYATH because many hotels and accommodation facilities had no access to water, and the taps ran dry for hours (Public and Water Authority Santorini 2, Author's Interview, August 2015). Nevertheless, there were still water scarcity problems that took place during the summer of 2019; and many local residents complained that they had water and electricity shortages due to tourism activity (Hellas Journal, 2021). Hence, this leads us to the debate whether desalination plants (including private desalination plants) are the solution to solve the water scarcity issues on the islands.

It should be underlined that, there are both public and private desalination plants existing in Mykonos and Santorini. Hotels and resorts with sufficient financial means and connections are installing (or planning to install) private desalination plants, and the main driver is directly related to the challenges like water shortages that were encountered during the Water Crisis of 2014 (Other Stakeholder Mykonos 5, Author's Interview, August 2015; Other Stakeholder Santorini 6, Author's Interview, August 2015). This can indicate that some of the hotels and resorts tried to take the initiative to their own hands right after the summer of 2014. Nevertheless, in Mykonos and Santorini, just two (2 out of 43) of the hospitality stakeholders claimed to have a private desalination plant on their property.

Furthermore, more than half of the hospitality stakeholders in Mykonos have the perception that "maybe" desalination plants are the solution to the water scarcity issues while only one-third of them either agree or absolutely agree that the desalination plants are the solution to the water

scarcity issues in Mykonos. On the other hand, the overwhelming majority of the public and water authorities in Mykonos agree that the desalination plants are the solution. In contrast to this, the majority of the other stakeholders absolutely disagree that they are the remedy to the water scarcity problem on the island.

Similar responses among Santorini stakeholders can be observed since two-fifths of hospitality stakeholders have the perception that "maybe" desalination plants are the solution to the water scarcity issues in Santorini while the other two-fifths either agree or absolutely agree that desalination plants are the solution. In addition to this, the overwhelming majority of public and water authorities agree that desalination plants are the solution to solve the water scarcity problem on the island. On the contrary, the vast majority of other stakeholders in Santorini either absolutely disagree or disagree that desalination plants are the solution. In short, each stakeholder subgroup has its own perceptions regarding the desalination plants' role in solving the water scarcity problem on the islands.

Nevertheless, the overwhelming majority of public and water authorities view desalination plants as the ultimate solution to the scarcity problem while the overwhelming majority of the other stakeholders are opposed to this perception in both of the islands. It has to be noted that, the perceptions of the hospitality stakeholders are not that clear and they are somehow in between these perceptions in both of the islands. In short, there is no doubt that opinions on whether desalination plants are the answer to the islands' water shortage problems are divided.

As Arahuetes and Villar (2016) described, the first desalination plants were set up in the 1970s in water-strapped island tourist hotspots like Spain's Balearic Islands and the Canary Islands (particularly Fuerteventura and Lanzarote Islands). These island groups have extremely limited water availability and high seasonal tourism activity as it is in the case of Cyclades Islands. Nonetheless, the number of desalination plants increased even though those facilities could not fully address the problems associated with water scarcity in the Balearic Islands and Canary Islands (Arahuetes and Villar, 2016).

In addition, due to the high agricultural and residential water demand in Catalonia and Valencia, desalination facilities have already begun to be erected in mainland Spain (Arahuetes and Villar, 2016). Similar to this, there is some skepticism among the respondents as to whether the desalination plants will solve the issue of Mykonos and Santorini's water scarcity; some of the

respondents were aware of other water-scarce island tourist locations that had had mixed results. For that reason, this led us to discuss whether reclaimed water could be a solution to the water scarcity problems in Mykonos and Santorini with the respondents.

In their article, Perez et al., (2020) explain how Ibiza, Spain, is a water-scarce island tourist destination that can benefit from the use of reclaimed water. They note that the energy costs and environmental externalities of treated (reclaimed) water are significantly lower than those of desalinated water. Reclaimed water has not been on the agenda of public officials, water authorities, or hospitality stakeholders, albeit Ibiza has three desalination facilities (Perez et al., 2020).

According to a case study analysis of Spain, there is a prevalent misconception that reclaimed water does not provide better water quality and can even be harmful to human health if improperly treated (Jodar-Abellan et al., 2019). In the cases of Mykonos and Santorini, where the vast majority of hospitality stakeholders preferred desalinated water to reclaimed water, a similar belief could be seen. This finding suggests that due to its superior quality and lower health concerns, desalinated water is preferred by stakeholders in the hotel industry over reclaimed water. Hence, this led us to the debate whether the hospitality stakeholders are taking any actions or any plans to guarantee water supply to their customers in Mykonos and Santorini.

As Morris and Arbuckle (2021) underlined, conservation planning is a voluntarily undertaken natural resource problem-solving and management process that integrates economic, social, cultural, and ecological considerations to meet private and public needs. Conservation planning is being used by many countries such as the United States, and it has become a primary tool to guarantee water supply in locations where there is the potential risk of drought as a result of anthropogenic activities and climate change (Morris and Arbuckle, 2021). As a matter of fact, water conservation plans can guarantee water supply in locations where there are limited water resources. As a matter of fact, half of the hospitality stakeholders in Mykonos stated that they have water conservation plans to guarantee water supply to their customers on the island during the water shortages.

Water losses occur in all drinking water utilities, however, the extent varies from system to system, and there is always a need to change the utilities and install new equipment in order to limit the water losses (American Water Works Association, 2017). As a matter of fact, almost half of the

Santorini hospitality stakeholders stated that they have the strategy of changing the utilities and installing new equipment as their primary action or strategy to guarantee water supply to their customers during the water shortages. As can be seen from the responses of the hospitality stakeholders in Mykonos and Santorini, they have certain knowledge and awareness regarding the plans, actions, and strategies that are being used globally in locations where water resources are limited.

There is a general consensus among Mykonos and Santorini stakeholders that installing RES-based desalination plants has been the most important policy (strategy or plan) to guarantee water supply for the islands. It has to be noted that, the installment of the RES-based desalination plants created advantages for Mykonos and Santorini in the short term, such as higher water availability, energy efficiency, and occupancy rates. As Soliman et al., (2021) underlined, the selection of desalination technologies is influenced by geographical location and feed water source rather than product quality. Hence, a RES-based desalination plant can be very useful in a destination that has an arid or semi-arid climate not only in the short-term but also in the long run if there is sustainable water resources management (Soliman et al., 2021). Consequently, there may be no certain guarantee of water supply in the long term through installing high-quality RES-based desalination plants in Mykonos and Santorini unless both tourism management, and water resources management, are settled sustainably by the public and water authorities.

Water quality is essential for sustainable tourism and poor quality can have a negative impact on a tourist destination's image. The vast majority of the hospitality stakeholders and other stakeholders in Mykonos stated that they are not satisfied with the water quality that is being supplied by DEYAM. It has to be noted that, Mykonos had issues with poor quality for many years, and this used to be related to the poor pipeline materials which were used for transferring the desalinated water (Other Stakeholder 2 Mykonos, Author's Interview, July 2014). As Cai et al., (2023) discussed, desalinated saltwater is typically mildly acidic, has extremely low hardness and alkalinity, is unstable, and is highly corrosive. As a matter of fact, desalinated water must be stable and safe before it reaches the municipal pipe network, and pipeline materials such as cement mortar lined ductile iron pipes should be used to supply water with superior quality into the network (Cai et al., 2023). At the same time, the desalinated seawater pipeline networks require maintenance remotely such as in the case of sewage water treatment system pipelines.

Nonetheless, Mykonos had suffered severe issues with its pipeline network including the sewage water treatment system pipeline. It has to be noted that, muddy water was running from the pipelines during the Water Crisis in 2014 (Other Stakeholder 5 Mykonos, Author's Interview, July 2015). The same problem repeated itself when a leakage in the pipeline forced the local population to use muddy water for almost 2 days in 2021 (Greek City Times, 2021). The sewage treatment system pipeline experienced major technical troubles in 2021, and sewage water was spilled into the sea, forcing many tourists to cancel their holidays and depart the island (The Press Project, 2021).

As a result of these changes, water pollution and water quality issues began to emerge alongside water scarcity difficulties in Mykonos. Prior to the COVID-19 outbreak, the municipality of Mykonos and DEYAM were solely working to fix water quantity issues, but today there are several layers of difficulties connected to both water quantity and water quality. Consequently, the overwhelming majority of the hospitality stakeholders and the other stakeholders in Mykonos stated that the poor water quality problems do not occur rarely, in fact do occur sometimes or frequently on the island.

The perceptions of the hospitality stakeholders and other stakeholders in Santorini are similar to those of the hospitality stakeholders and other stakeholders in Mykonos. It should be highlighted that the vast majority of the hospitality stakeholders and the other stakeholders stated that they are rather unsatisfied or very unsatisfied with the water quality that is being supplied by DEYATH on the island. It has to be noted that, the water quality problems of Santorini is directly related to the groundwater's poor quality that is being supplied by DEYATH through the pipelines (Other Stakeholder Santorini 6, Author's Interview, August 2015).

As it was discussed above, Santorini rely on the desalination plants that were installed on the island ever since the tourism started to grow, and desalination plants have a central role for the continuation and the sustainability of the tourism activity on the island. Nevertheless, there are even water quality issues with the desalinated water that is being supplied by DEYATH to the hotels and households (Other Stakeholder Santorini 5, Author's Interview, August 2015).

As Lahav and Birnhack (2007) underlined, soft waters can damage water distribution systems and that mixing soft waters with other sources can have a number of negative consequences, including metal corrosion and red water episodes. As a matter of fact, these kind of red water episodes and

metal corrosion have been occurring on the island and there were complaints from the hospitality stakeholders (Hospitality Stakeholder Santorini 8, Author's Interview, August 2015).

The poor water quality problems in Santorini are still taking place even though superior quality RES-based desalination plant is installed on the island. The problems with poor water quality became even a public matter when the President of the Municipal Community of Thirasia openly criticized the poor water quality on a public radio show in 2021 (Santorini Press, 2021). Consequently, the overwhelming majority of the hospitality stakeholders and the other stakeholders stated that poor water quality problems do not take place rarely, in fact do occur sometimes or frequently in Santorini.

On the contrary, it can be observed that overwhelming majority of the public and water authorities in Santorini and in Mykonos are rather satisfied or very satisfied with the water quality unlike the majority of the hospitality stakeholders and the other stakeholders in both of the islands. According to the overwhelming majority of the public and water authorities, the water quality problems do not occur frequently in both Mykonos and Santorini Islands. It should be highlighted that Santorini hospitality stakeholders and other stakeholders have a higher degree of dissatisfaction with the water quality compared to Mykonos stakeholders.

A range of variables might contribute to water quality issues in tourist destinations. Poor water resource management, agricultural activity, tourism activities, and so on are all possible causes. According to the study by Sun and Liu (2020), the causes for the growth in water pollution in the West Lake Basin (Hangzhou, China) include that the increase in visitor numbers led to an increase in rubbish, and the government pursued tourism economic gains unilaterally while ignoring the pollution caused by tourism activities. As a matter of fact, almost half of the stakeholders in Mykonos stated that tourism activity has a role on the poor water quality problems on the island. On the other contrary, almost half of the interviewees in Santorini had the perception that "maybe" tourism activity on the island had a role on water quality issues. Consequently, Mykonos and Santorini have similar perceptions regarding the tourism activity's role in poor water quality issues on the islands. However, we can also observe that the majority of the public and water authorities as well as the other stakeholders believe that tourism activity has a certain role while it is not that clearly visible among the perceptions of the hospitality stakeholders in both of the islands. In short,

it can be observed that tourism activity has a certain degree of negative impact on the water quality that is available on the islands.

Short-term-based water resources management was seen as one of the main causes behind the water supply problems by the hospitality stakeholders and other stakeholders on both of the islands. In addition to the water supply problems, almost half of the hospitality stakeholders in Mykonos and Santorini and the vast majority of the other stakeholders in Mykonos and Santorini) agreed that; the poor water quality problems in both of the islands are directly linked to the short-term policies and strategies of DEYAM and DEYATH. On the contrary, the vast majority of the public and water authorities in both of the islands share similar perceptions that there are no poor water quality problems on the island because of bad water resources management. Nonetheless, the major difference between Mykonos and Santorini stakeholders is related to the perceptions of the hospitality stakeholders, as the hospitality stakeholders in Mykonos are relatively more dissatisfied with the water resources management. They have a clear perception compared to the Santorini hospitality stakeholders that there is short-term water resources management which has a direct impact on both water quantity and quality which negatively affects the tourism management and development in Mykonos.

As Phong and Tien (2021) discussed, the sustainability of tourism development in Phu Quoc, Vietnam is jeopardized due to a lack of focus on water resource management, inadequate wastewater treatment, and ineffective law enforcement. In other words, the short-term water-based water resources endanger the sustainability and durability of the tourism sector in Phu Quoc, Vietnam since pollution and poor water quality damage the image of the island and stagnate the tourism lifecycle of the island (Phong and Tien, 2021). Consequently, it is necessary to have better environmental regulations and long-term-based water resources management in order to have better water quality in Mykonos and Santorini.

Agricultural activity is seen as one of the elements contributing to poor water quality issues in many parts of the world. According to Kourgialas et al., (2018), water-scarce islands such as Crete, Greece, suffer from poor water quality issues as a direct result of agricultural and tourism-related activities. Nevertheless, the overwhelming majority of the interviewees in Mykonos and in Santorini disagreed that agricultural activity has a role behind the poor water quality problems on

the islands. As a consequence, agricultural activity is not seen as one of the factors that are related to water quality issues in Mykonos and Santorini, unlike the case of Crete.

Changes in air temperature and rainfall are expected to impact river flows, and thus the mobility and dilution of toxins; increased water temperatures will impact chemical reaction kinetics and, when accompanied by quality degradation, freshwater ecological condition (Whitehead et al., 2009). Thus, climate change will also have an impact on water quality, since higher water temperatures and more frequent floods and droughts are expected to increase various types of water pollution, ranging from sediments to pathogens and pesticides (IPCC, 2019).

Although, the interviewees in Mykonos and Santorini view climate change as a direct threat to water supply (in terms of quantity); the vast majority of the respondents in Mykonos and in Santorini disagreed that climate change has a role in poor quality issues in the islands. For that reason, tourism activity and short-term-based water resources management are seen as the two main key factors behind the poor water quality problems, and climate change is seen as only a factor behind the water supply (in terms of quantity).

It should be highlighted that on both islands, water quantity difficulties are regarded as key issues, while water quality problems are regarded as secondary. As a matter of fact, there is much more emphasis on water quantity problems and it was observed during the interviews that the majority of the public and water authorities as well as the other stakeholders viewed poor water quality issues as a secondary problem. Nevertheless, the majority of the public and water authorities in Mykonos and in Santorini stated that they have the main role of providing better water quality to the tourism facilities and local residents. However, it can be also noticed that public and water authorities in Mykonos believe that they have more responsibility for guaranteeing water supply (in terms of quantity and quality) compared to the public and water authorities in Santorini.

On the other hand, the overall half of the other stakeholders in Mykonos and in Santorini stated that they have supporting roles to assist the main actors in providing better water quality in Mykonos and Santorini. Hence, we can understand that the stakeholders have some sort of division of labor in order to provide better water quality to the local residents and tourists in both of the islands. As Okumah et al., (2020) underscored, the necessity to incorporate stakeholders' perspectives into environmental policy is gaining traction since it allows for the development of sustainable and synergistic environmental solutions. In fact, it is critical and significant for each

actor to work together to preserve higher and superior water quality. Lastly, it can be observed that other stakeholders in Santorini have the perception that they have a greater responsibility to maintain collaboration with the main and key actors compared to the perceptions of the other stakeholders in Mykonos.

The hospitality stakeholders in Mykonos and Santorini believe that changing and cleaning water filters is the most important policy (strategy or plan) to ensure better water quality. Water filtering and treatment systems are crucial for better water resources management, as Gössling et al., (2015) noted. There are numerous instances worldwide where hospitality stakeholders benefit from using filtering and treatment systems to offer customers superior water quality. The Phinda Natural Reserve in South Africa serves as an example of the significance of using water filters in an area where better water quality is necessary for the survival and sustainability of tourism (Mearns and Grobler, 2016). Therefore, the opinions of the hospitality stakeholders in Mykonos and Santorini regarding the replacement and cleaning of water filters are regarded as one of the most significant actions of the stakeholders in the tourism sector globally to ensure enhanced water quality.

There are significant perception differences among Mykonos and Santorini stakeholders regarding the actions of the public and water authorities to ensure better water quality (Actions by the Public and Water Authorities). It should be noted that almost half of the interviewees in Mykonos believe that the island's public and water authorities have no policy or strategy in place to ensure better water quality. On the contrary, almost half of the respondents in Santorini have the perception that the most important action taken by the public and water authorities in Santorini to ensure better water quality is the replacement of old pipes and plumbing. As a result, unlike Mykonos stakeholders, Santorini stakeholders believe that public and water authorities have policies or strategies in place.

According to Steinebach (2019), EU Water Policies are more effective in nations with greater administrative capacity, and the greatest potential for further increasing the efficiency of EU Water Policies lies in developing national implementation capacities and adapting them to the requirements of the various instrument types used. The discrepancy in interviewee perceptions of public and water authorities' measures to guarantee better water quality on the islands is a good example of Greece's national implementation capacities. There is an uneven distribution of national implementation capacities not just across different river basin districts (RBDs), but even within the

same RBD, Aegean Islands GR14 in Greece. Consequently, Mykonos stakeholders have clear negative perceptions of the public and water authorities' actions to ensure better quality compared to Santorini stakeholders, indicating that there are not only clear perception differences but also clear administrative capacity differences and policy differences in this matter.

One of the primary goals of this research was to investigate the relationship between water resource management and tourism development in the Mediterranean basin, specifically in the Greek Islands. As evidenced by the responses of stakeholders, there is a clear link between water resource management and tourism development in the Mediterranean Basin, particularly in Greek islands such as Mykonos and Santorini. We discovered that the majority of the hospitality stakeholders' climate change adaptation policies or strategies are related to increasing water availability for their customers because it is essential and vital for the longevity and continuation of tourism development. In other words, better water resource management means more sustainable tourism development in the Mediterranean basin, particularly in the Greek Islands, which are located in the Mediterranean Basin's arid and semi-arid climate zones.

Second, another goal of this study was to investigate stakeholders' perceptions of water scarcity and climate change in island tourism destinations such as Mykonos and Santorini. As can be seen, stakeholder perceptions are critical for better water resource management and tourism management. According to the perceptions of hospitality stakeholders in Mykonos and Santorini, water scarcity and climate change are potential threats to the islands' tourism activities. We have seen similar responses from the other stakeholders subgroup. Although the public and water authorities have opposing views on water shortages and climate change, we can understand that they want to increase water availability through supply-based water policies; however, this confirms that they are aware of the potential risks of climate change and what water shortages could lead to in the long run.

Hence, this leads us to the third objective of this study which was to assess whether the same stakeholders feel that RES-based desalination plants are the solution to water scarcity in island tourism destinations such as Mykonos and Santorini. The public and water authorities have been seeking a remedy by installing bigger desalination plants on both of the islands. Nevertheless, the problem may not be solved through the installation of bigger desalination plants on the islands. We need to just have a quick look at what happened during and after the COVID-19 pandemic in

Mykonos and Santorini. The outbreak of COVID-19 was actually seen as a chance to decrease the pressure on the water scarcity problems in both of the islands. It is a fact that the COVID-19 pandemic drastically reduced summer tourist water demand, with arrivals dropping by over 70% compared to 2019 in both of the islands (Mykonos Daily, 2020; CNN, 2020). Nonetheless, the summer of 2021 produced unanticipated results: water consumption surged dramatically as a result of hotels and resorts being fully booked after the Greek central government chose to open its borders to vaccinated visitors (Reporter Greece, 2021; Greek Travel Pages, 2021).

The summer of 2021 was a good example of understanding that bigger desalination plants cannot overcome this complex issue. In Mykonos, the operation of three RES-based desalination facilities was insufficient to meet the 30% increase in water demand after the summer of 2019, and there were days with water shortages in July and August 2021 (Typosthes, 2021). DEYAM's announcement explains the details of the water scarcity: "Due to the intense two-year drought, the level of the dams has dropped dramatically, resulting in extremely limited water pumping from them." (Eleutheranea, 2021). As a result, 24-hour desalination must cover nearly the entire island's consumption (including *Ano Mera*).

Santorini, on the other hand, performed no better than Mykonos during the summer of 2021. According to Hellas Journal (2021), water usage on the island soared by more than 100%, causing Santorini's networks to run dry and oversaturate since the process of filtration and desalination of seawater was stymied by over-tourism. At the same time, this increased the amount of drinking water imported from mainland Greece in plastic bottles, which resulted in sea pollution because millions of visiting tourists consumed millions of plastic bottles during the summer of 2021 (Hellas Journal, 2021). It has to be noted that, the Mayor of Santorini started a new tourism campaign called *"Plastic Free Santorini"* right after COVID-19 back in 2020 (Greek Travel Pages, 2020).

In brief, unsustainable tourism, along with climate change, short-term water resource management, and financial concerns, creates a textbook example of the *Tragedy of the Commons* in Mykonos and Santorini. The construction of each new, private or public but "legal" desalination plant with larger capacities for use in the tourism sector is akin to the "illegal" digging of thousands of boreholes by farmers in mainland Greece in order to withdraw underground water for the agriculture sector. Kjellen (2006) termed the digging of thousands of illegal boreholes as "*Spaghettization*," which is the use of illegal self-pipelines instead of legal pipelines where there

are many users, resulting in network "thinning out." Indeed, the constant expansion of desalination plants is a legal type of "*Spaghettization*" process that may result in the installation of private desalination plants by hotels or resorts, contributing to significant environmental externalities in Mykonos and Santorini. The continuance of this "process" may result in Butler's tourism lifecycle stagnation, and may even terminate the tourism lifecycles of both islands in the long run.

Therefore, this leads us to the fourth and final objective of this study which was to explore the complex relationship between tourism management and water resources management by having an insight into the perceptions of the stakeholders and decision-making progress in tourism and environmental management in island tourism destinations such as Mykonos and Santorini. We can notice from the stakeholders' responses that Mykonos and Santorini have water scarcity problems due to a combination of different factors. These different factors are the islands' geographical characteristics (being located in an arid or semi-arid zone), changing climate conditions, short-term water resources management, unsustainable tourism management (including seasonality of tourism and over-tourism), administrative incapability, and financial matters.

The long and the short of it is that, we can indicate that the relationship between tourism management and water resources management is a far more complex relationship on both of the islands after having an insight into the perceptions of the stakeholders. We have also observed that once the combination of these factors takes place at the very same time then the "complex relationship" evolves into a "perfect storm". In other words, a more complex relationship between water resources management and tourism management means more externalities in fact water scarcity in Mykonos and Santorini is not based on only one factor and there are many different factors as has been discussed in this study. The main hypothesis of this dissertation was to assess that the great majority of stakeholders acknowledge that water scarcity poses a threat to the development of the Mykonos and Santorini Islands tourism industry, they differ significantly in how they choose to respond to it. The detailed analysis of the perceptions of the stakeholders indicate that the main hypothesis of this dissertation has been achieved.

CHAPTER 8 – CONCLUSIONS

UNIVERSITAT ROVIRA I VIRGILI
THE WATER SCARCITY AND SUSTAINABLE TOURISM IN THE GREEK ISLANDS: FOCUS CYCLADES ISLANDS
Itri Atay

8 - CONCLUSIONS

Climate change is having an impact on the daily lives of many people around the world. The heat waves of the summer of 2023 demonstrated that changing climate conditions will have a greater impact on our daily lives. There is a risk of severe droughts, extreme weather events, sea level rise, and so on, and the severity of these risks is increasing because of ongoing anthropogenic and natural causes. The majority of the hospitality and other stakeholders we interviewed for this study were aware of the effects of climate change on tourism activity. Furthermore, they regarded droughts and economic losses as the most serious threats to tourism activity posed by climate change. However, they believed that climate change is not the only cause of water shortages on both islands, particularly during the summer months; rather, they believed that unilateral decisions made by water authorities play a role in these water shortages.

Water is necessary for human survival, and it is impossible to live without it. Water resources are required for tourism to exist. Therefore, water resource management is critical for the long-term viability of tourism development. Sustainable tourism necessitates a balance of supply and demand for water resources. As a result, supply-based water policies cannot meet the needs of the growing number of tourists visiting tourist destinations such as Mykonos and Santorini Islands.

As discussed in this work, unsustainable mass tourism, over-tourism and seasonality of tourism can put additional strain on water resources. Consequently, there is also a need to maintain an optimal limit of tourist arrivals to tourist destinations like Mykonos and Santorini Islands. The overuse of water resources is directly related to the phenomenon of mass tourism. The majority of interviewees stated that tourism plays a role in water shortages and scarcity problems on the islands due to excessive use of water resources during the summer months, which is also directly related to tourism's seasonality.

It should not be forgotten that irreplaceable natural and cultural resources can be harmed by unsustainable mass tourism and that valuable tourism resources will be irreversibly damaged in the long run (Briassoulis, 2003). As Coccossis (2001) stated, tourism can even destroy an island's ecology, culture, monuments, local people, and even the quality of the visitor's experience, jeopardizing the foundation of tourist development even though it creates job opportunities and

financial gains. As a consequence, in terms of balancing natural resource management and tourism management, this is a dilemma that exists in many touristic destinations around the world, including the Mediterranean region. As a result, whether tourism should be allowed to flourish as long as it generates more financial gains for the economy is debatable (Briassoulis, 2003).

Since other industries began to lose market share in Greece, the country has become more reliant on tourism. Tourism revenues and employment are critical for countries that rely on tourism, and it makes sustainable water resource management and tourism management assessment difficult, as demonstrated by Mykonos and Santorini. The decision-making process for effective water resource and tourism management must go beyond tourism outputs (tourism revenues and employment) and adopt a multidimensional view which includes socioeconomic, ecological, and institutional arrangements in the total system evaluation. Sustainable water resource management and tourism management should begin a "portfolio" of approaches in order to sustain multidimensional options to the challenging issues that they must address.

Nonetheless, the true contribution of mass tourism to local population prosperity and the sustainability of local natural resources has become a point of contention (Buhalis, 1999). Some academic works even label the exploitation of natural resources and local population labor as Neo-colonization (Bianchi, 2009; Buhalis, 1999; Hall, 1994). Tourism, in fact, can have a variety of negative externalities other than environmental ones. As Tortella and Tirado, (2011) underlined there can be negative attitudes among the resident population due to high numbers of tourists that are visiting their residences each year. Conversely, some recent scholarly studies, like Mejjad et al., (2022), view mass tourism as a means of promoting the Mediterranean Basin's sustainability and economic growth and they focus only on economic gains.

For that reason, this study makes a substantial contribution to the scholarly discourse due to its extremely intellectually dense combination of chapters on the literature review, theoretical framework, results, and discussion. Specifically, the "Vicious Cycle of Renewable Energy Sources (RES)-Based Desalination Plants" offers a valuable framework that other researchers can apply to their own studies that address related research questions to the ones this study has addressed. Supply-based water policies may result in negative effects on the economy, society, and even culture in addition to negative effects on the environment. It is also important to note that there are

not many scholarly works that integrate Butler's Tourism Lifecycle model with the Common Pool Resources theoretical framework.

Nonetheless, this dissertation has certain limitations associated with sample size, stakeholder profiles, and data age. There could have been many more interviewees than the ones included in this study, but time and budgetary constraints prevented this from happening. Simultaneously, major health complications prevented this dissertation from being published sooner. We were unable to conduct interviews and questionnaires with more hospitality stakeholders due to time constraints and the fact that some hotels and public and water authorities declined to participate in the research or did not respond to our request. Without a doubt, more people interviewed would have allowed for a more in-depth analysis. Nonetheless, because this study combines both qualitative and quantitative approaches, we believe the sample size is sufficient to achieve the research objectives.

Furthermore, this study has made use of the information gathered from the surveys and in-depth interviews that were carried out in 2014 and 2015. Mykonos' and Santorini's water scarcity problems are currently more chaotic and complex than it was 7-8 years ago. Tourist arrivals are increasing, and the negative effects of climate change are putting additional strain on water resource availability, particularly during the summer. In addition, new hotels and resorts are built on both of the islands every year, resulting in an increase in hospitality stakeholders. Furthermore, Airbnb has begun to account for a significant portion of Mykonos and Santorini tourism, as they provide cheaper lodging options for tourists and consume a significant portion of the islands' water supply. As a matter of fact, there are clearly different tourism stakeholder characteristics and profiles today than there were 7-8 years ago. Nevertheless, there have been recent developments since the Covid-19 pandemic which show that the water scarcity problem in Mykonos and Santorini is not improving due to a combination of different factors, as discussed in this study.

These changes pave the way for future lines of research to investigate the current situation with a larger sample size; as the number of lodging facilities has grown, so has the number of stakeholders. At the same time, future research can look into Airbnb and Mykonos and Santorini second-home owners: because their share of the tourism sector has grown significantly in the last 5-6 years, they can be considered hospitality stakeholders. Furthermore, stakeholder perceptions can also differ from island to island. If another scholar conducts different sets of questionnaires and in-depth

interviews with different groups of interviewees, the results may be different. As a result, this opens up new research opportunities for other scholars within the future. In addition to this, our study only focused on two of the Cyclades Islands, but there are more Cyclades Islands and other Greek Islands such as the Dodecanese Islands, Rhodes Island, Crete Island, and so forth. It is possible to conduct various comparative studies among these islands, which opens up fresh possibilities for academic research.

The long and the short of it is that, Mykonos and Santorini are excellent examples of how a lack of coordination among the actors involved in the decision-making processes of water resource management and tourism management can result in a vicious cycle in island tourist destinations. Furthermore, the Greek economic crisis and the country's reliance on tourism revenues had a significant impact on water authorities' decisions, which were short-term in nature, despite the fact that the majority of hospitality stakeholders were aware of water availability issues, the environmental impact of tourism activities, and the impact of climate change on tourism activity in Mykonos and Santorini. Desalination plants are useful in increasing water availability, but they cannot be viewed as the sole solution to a multi-faceted problem that necessitates Integrated Water Resources Management (IWRM) and coordination among actors involved in environmental management and tourism management. While maximizing economic and social welfare, the IWRM process can promote synchronized tourism and water resource development. Simultaneously, IWRM can extend the tourism lifecycle by ensuring the long-term viability of critical ecosystems. In short, a more comprehensive approach to tourism and water resource management is required for both Mykonos and Santorini Islands.

CHAPTER 9 – REFERENCES

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APPENDIX

UNIVERSITAT ROVIRA I VIRGILI
THE WATER SCARCITY AND SUSTAINABLE TOURISM IN THE GREEK ISLANDS: FOCUS CYCLADES ISLANDS
Itri Atay

APPENDIX

APPENDIX 1- HOSPITALITY STAKEHOLDERS QUESTIONNAIRE SAMPLE

HOSPITALITY STAKEHOLDERS (hotels, resorts, etc.)

Information about the hotel, etc.

Name:

Chain: (if appropriate)

Hotel (number of stars):

Resort (category):

Number of beds:

Number of floors:

With restaurant: (yes or not)

It is in the front coast: (yes or not)

Year it was building:

Year last reform:

Number of workers:

Information about the informant

Name / Gender / Age / Position / years in the position

---

1. Tourism and environmental policies are coordinated

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

2. Tourism and environmental policies should be coordinated

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

3. Tourism policies and administration take into account environmental issues, especially water availability.

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

4. Environmental policies and administration take into account tourism activity issues

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

5. Your hotel/resort takes into account environmental issues

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

6. Influence of climate change on tourism activity in Mykonos/Santorini at present and in the future

From 1 to 5 (1 very few influence and 5 very high influence)

From 1 to 5 (1 very few influence and 5 very high influence)

7. The worst impacts or threats on tourism activity in Mykonos/Santorini due to climate change are because of: (mark 3 maximum and rank)

a) Global warming

b) Sea level rise

c) Drought

d) Extreme weather events

e) Ocean acidification

f) Other (say which one)

8. Contribution of tourism activity to climate change

From 1 to 5 (1 very small contribution and 5 very high contribution)

9. Should policy makers and tourism stakeholders act in order to fight against climate change impacts on tourism?

a) Yes, they should

b) Yes, and they are acting at present

c) No, they should not now, but they should in a future

d) No, they should never.

10. Tell me what are or what should be the most important strategies to *mitigate* climate change impacts on tourism sector (only if your answer to question 5 has been *a, b* or *c*).

Open answer, indicating if they are at present or if they should be implemented in a future.

11. Tell me what are or what should be the most important *adaptation* strategies of tourism sector in front the impacts of climate change (only if your answer to question 5 has been *a, b* or *c*).

Open answer, indicating if they are at present or if they should be implemented in a future.

12. Tell me what are or what should be the most important actions from tourism and hospitality stakeholders to reduce the contribution to climate change

Open answer, indicating if they are at present or if they should be implemented in a future.

13. Which ones are applying your hotel/resort (or are planning)

Open answer, indicating if they are at present or if they should be implemented in a future.

14. What do you think is the economic activity/sector in Mykonos/Santorini with higher water consumption?

a) Agriculture

b) Shipping

c) Industry

d) Tourism

e) Commerce

f) Other services activities

15. Water shortages are due to tourism activity.

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

16. Water shortages are due to a short-term water management.

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

17. Water shortages are due to agriculture activity.

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

18. Water shortages are due to climate change (drought – rainfall diminishing).

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

19. How frequent are water shortages in your hotel/resort?

From 1 to 5 (1 very few frequent and 5 very frequent)

20. Satisfaction level of water supply (availability) in Mykonos/Santorini

From 1 to 5 (1 very few satisfied and 5 very satisfied)

21. Is there a desalination plant available in your hotel/resort?

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

22. Desalination plants are the solution to water shortages

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

23. Reclaimed water is the solution to water shortages

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

24. Tell me what policies/strategies are or are planning to be implemented by your hotel/resort to guarantee water supply (availability)

Open answer

25. Tell me what policies/strategies are or are planning to be implemented by water authorities to guarantee water supply (availability) *and if you agree*

Open answer

26. Satisfaction level with water supply (quality)

From 1 to 5 (1 very few satisfied and 5 very satisfied)

27. How frequent are water quality problems?

From 1 to 5 (1 very few frequent and 5 very frequent)

28. Water quality issues are due to tourism activity.

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

29. Water quality issues are due to short-term water management.

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

30. Water quality issues are due to agriculture activity.

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

31. Water quality issues are due to climate change.

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

32. Tell me what policies/strategies have been or are being implemented by your hotel/resort to guarantee water supply (quality)

Open answer

33. Tell me what policies/strategies have been or are being implemented by water authorities to guarantee water supply (quality) *and if you agree*

Open answer

34. Final considerations *Open answer*

THANK YOU FOR YOUR COLLABORATION!!!

APPENDIX 2- PUBLIC AND WATER AUTHORITIES AND OTHER STAKEHOLDERS QUESTIONNAIRE SAMPLE

POLICY MAKERS AND STAKEHOLDERS **(except hospitality stakeholders)**

Information about the institution or organism

Name

Regional level (country, province/island, local)

Sector: tourism, environment, agriculture, water supply, other (say which one)

Information about the informant

Name / Gender / Age / Position / Profile (technician, manager, politic, ...)

---

1. Tourism and environmental policies are coordinated

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

2. Tourism and environmental policies should be coordinated

a) Yes

b) No

3. Tourism policies and administration take into account environmental issues, especially water availability.

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

4. Environmental policies and administration take into account tourism activity issues

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

5. Influence of climate change on tourism activity in Mykonos/Santorini at present and in the future

From 1 to 5 (1 very few influence and 5 very high influence)

From 1 to 5 (1 very few influence and 5 very high influence)

6. Contribution of tourism activity to climate change

From 1 to 5 (1 very small contribution and 5 very high contribution)

7. The worst impacts or threats on tourism activity in Mykonos/Santorini due to climate change are because of: (mark 3 maximum and rank)

a) Global warming

b) Sea level rise

c) Drought

d) Extreme weather events

e) Ocean acidification

f) Other (say which one)

8. Should policy makers and tourism stakeholders act in order to fight against climate change impacts on tourism?

a) Yes, they should

b) Yes, and they are acting at present

c) No, they should not now, but they should in a future

d) No, they should never.

9. The role played by your institution/organization in order to fight against climate change

a) The main role. It is the leader.

b) A key role

c) Collaboration with the main and the key actors

d) Supporting and/or applying strategies designed by the main actors.

10. Please indicate what are or what should be the most important strategies to *mitigate* climate change impacts on tourism sector (only if your answer to question 5 has been *a, b* or *c*).

Open answer, indicating if they are at present or if they should be implemented in a future.

11. Please indicate what are or what should be the most important *adaptation* strategies of tourism sector in front the impacts of climate change (only if your answer to question 5 has been *a, b* or *c*).

Open answer, indicating if they are at present or if they should be implemented in a future.

12. Please indicate what are or what should be the most important actions from tourism and hospitality stakeholders to reduce the contribution to climate change

Open answer, indicating if they are at present or if they should be implemented in a future.

13. What do you think is the economic activity/sector in Mykonos/Santorini with higher water consumption?

a) Agriculture

b) Shipping

c) Industry

d) Tourism

e) Commerce

f) Other services activities

14. Water shortages in Mykonos/Santorini are due to tourism activity.

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

15. Water shortages in Mykonos/Santorini are due to short-term water management.

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

16. Water shortages in Mykonos/Santorini are due to agriculture activity.

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

17. Water shortages in Mykonos/Santorini are due to climate change (drought – rainfall diminishing).

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

18. How frequent are water shortages in Mykonos/Santorini?

From 1 to 5 (1 very few frequent and 5 very frequent)

19. Satisfaction level of water supply (availability) in Mykonos/Santorini

From 1 to 5 (1 very few satisfied and 5 very satisfied)

20. Desalination plants are the solution to water shortages

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

21. Reclaimed water is the solution to water shortages

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

22. Tell me what policies/strategies have been or are being implemented by water authorities to guarantee water supply (availability) ***and if you agree***

Open answer

23. Satisfaction level with water supply (quality)

From 1 to 5 (1 very few satisfied and 5 very satisfied)

24. How frequent are water quality problems (pollution) in Mykonos/Santorini?

From 1 to 5 (1 very few frequent and 5 very frequent)

25. Water quality issues in Mykonos/Santorini are due to tourism activity.

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

26. Water quality issues in Mykonos/Santorini are due to short-term water management.

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

27. Water quality issues in Mykonos/Santorini are due to agriculture activity.

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

28. Water quality issues in Mykonos/Santorini are due to climate change.

From 1 to 5 (1 absolutely disagree and 5 absolutely agree)

29. The role played by your institution/organization in order to guarantee water supply (quantity and quality)

a) The main role. It is the leader.

b) A key role

c) Collaboration with the main and the key actors

d) Supporting and/or applying strategies designed by the main actors.

30. Tell me what policies/strategies have been or are being implemented by water authorities to guarantee water supply (quality) *and if you agree*

Open answer

31. Final considerations – Open Answer

THANK YOU FOR YOUR COLLABORATION!!!

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