WATER AND ENERGY SAVING MEASURES IN THE BENIDORM´S HOTEL SECTOR

MANAGING RESOURCES FOR CLIMATE CHANGE ADAPTATION

CLAUDIA ESPEJO VALLE-INCLAN

Msc Thesis in Climate Studies

January 2020

Supervised by: Bas Amelung
Course code: ESA-80436

WAGENINGEN UR
For quality of life

Water and Energy Saving Measures in Benidorm´s Hotel Sector

Managing Resources for Climate Change Adaptation

Claudia Espejo Valle-Inclán
MSc Thesis in Climate Studies
January 2021

Supervisor

1) Bas Amelung (ESA)
   bas.amelung@wur.nl

Examiners:

1st: Bas Amelung (ESA)
bas.amelung@wur.nl

2nd: Rik Leemans (ESA)
rik.leemans@wur.nl

WAGENINGEN UR
For quality of life

Abstract

In tourism, hotels are key actors for efficient demand management of water and energy resources. Current water and energy measures that are applied in Benidorm's hotel sector are identified by evaluating existing data and extensively reviewing the literature review. Forty-five measures were identified, and I classified them into the 4R framework, according to their technological and knowledge requirements. Reaching and reusing strategies were the most popular measures as they require the least technological investments. Hotels were mainly motivated to implement resource- saving measures that were related to reducing operational costs and environmental concerns. Moreover, significant variables that reduce water and energy consumption or /costs in hotels were mainly formalized action plans on faucet and toilet devices, and efficient irrigation systems. The implementation of solar panels also considerably saves kWhs and Euros. My study concludes with the need for tailored-specific resource conservation measures to improve the fit of strategies and technologies onto the existing hotel´s organizational and operational structures. It contributes advances in water and energy related research and addresses demand management for future resource scarcity in order to assist the tourism and the hotel sector in climate-change adaptation.

Key words: hotel sector, Benidorm, demand management, resource consumption, Climate change adaptation

Table of content

Chapter 1. Introduction

Water and energy are two resources that are essential for human wellbeing, and for economic and social development (Becken & McLennan, 2017). The water and tourism nexus alone has received large attention within tourism research. Tourism poses large pressures on water resources as a result of the intensive uses, while water is an essential resource for tourism development, as it is fundamental for drinking water and recreational activities (e.g. golf, waterparks, swimming-pools) (Sinha et al., 2020). Energy is also needed to prompt many of these activities, for instance, lighting, swimming pool operation or hot sanitary water (HSW) generation (Klontza et al., 2016). Energy is even consumed for producing drinking water, such as desalination process, transbasin projects and wastewater treatment. In destinations where water resources are scarce, reductions in both water and energy consumption are relevant.

Water and energy have been studied separately for years and only recent studies have shown the strong interdependence between both resources due to their impact on sustainable resource management (Warren & Becken, 2017; Yoon et al., 2018). Moreover, the nexus between water and energy has rarely been studied in relation to tourism. The link is made since the use of water usually requires the input of energy and vice versa: energy is required to extract, clean and pump water (*energy for water*), whilst water is required to generate energy (*water for energy*) (Becken & McLennan, 2017; Klontza et al., 2016; Yoon, 2018b). This two-way relationship is commonly referred to as the Water-Energy Nexus (WEN) and it addresses both trade-offs (i.e. Using one resource leads to scarcity of other resources) and synergies as stated by Nguyen et al. (2014) stated "when a water [or energy] management option results in benefits for either or both of the targets without any negative impact on either of the targets". For instance, the reduction of HSW consumption would translate into decreased energy consumption (Katircioglu et al., 2019). Increased importance has been given to management options that address water and energy jointly particularly in destinations where water and energy have an intensive use (Yoon, 2018b).

Benidorm, located in Marina Baja (Alicante), is a main tourism resort in the Mediterranean coastal region and the third most visited in Spain (Olcina Cantos et al., 2016; Rico et al., 2019; Yoon, 2018b). It´s to tourism development ´boomed´ already in the 1960s, since then the city concentrates large tourism flows. Benidorm is characterized by its high density, vertical and concentrated urban typology (Arahuetes et al., 2018; Baños et al., 2019). In addition, the hotel sector has a strong presence as the city holds one third of hotels in Valencia, and it is the fourth Spanish city in terms of number of hotels (Olcina Cantos et al., 2016; Rico et al., 2019). Due to its high dynamism, Benidorm consumes is a large consumer of water and energy resources, and around three quarters of their resource consumption is dedicated to the service sector including hotels (Yoon, 2018a).

Climate change is an increasingly important issue, especially in arid areas, such as Benidorm. The expected rising temperatures will likely create tourist discomfort leading to increases in water consumption (Gössling et al., 2012; Olcina Cantos & Miró Pérez, 2017; Olcina Cantos & Vera-Rebollo, 2016). The combination of the climate characteristics , the high water consumption and the seasonality of that consumption during the driest months, accentuates the risk for water scarcity events (Ricart et al., 2019). In this regard, Spain has opted for generating more water supply through conventional resources (i.e. dams, aquifers, and water transfers), and relatively recent use of non-conventional resources (i.e. desalination and treated water use). Discussions are taking place on whether the increasing use of non-conventional water resources is only "perpetuating the traditional policy of water supply", and will trade water scarcity for energy scarcity (March, 2015; Morote et al., 2019; Villar-Navascués et al., 2020; Yoon et al., 2018).

In this context the need to shift from measures that aim to increase water supply towards demand management and planning is emphasized (Rico-Amoros et al., 2013; Yoon, 2018b). The latter strategies aim to reduce demand through technological improvements, changing user behavior or changing policies for more efficient and sustainable use of water and energy (Baños et al., 2019; Rico-Amoros et al., 2013). Hence, the engagement of the hotel sector in resource demand management for reducing water and energy consumption is essential (Olcina Cantos & Vera-Rebollo, 2016). Besides, investing in water and energy saving measures may entail benefits such as the reduction of operational costs for the establishments (Becken & McLennan, 2017).

The limited research on the water-energy nexus in tourism has focused on monitoring water or energy consumption separately (Becken & McLennan, 2017; Klontza et al., 2016). The study of Yoon et al. (2018) has explored how water and or energy- intensive facilities influence energy and water consumption. In fact, Yoon et al. (2018) calls for the need to improve research on interactive demand management and the WEN, especially at the micro-level. This research focuses on the hotel sector in Benidorm as a key actor for demand management of resources in order to prevent water scarcity events in the context of climate change adaptation strategies.

Rico et al (2019) have identified numerous water-saving measures introduced in the hotel sector in Benidorm and studied the role of water conservation measures together with other factors such as hotel category and size, in reducing ´hotel water consumption` in Benidorm. Furthermore, Yoon (2018b) analyzes the WEN focusing on the energy used for water in the hotel sector in Benidorm. However, these studies have not jointly explored water- and energy-conservation measures and their implication on water and energy consumption in the hotel sector, both respectively (e.g. water-saving measures on water consumption) and within the WEN (i.e. water-saving measures on energy consumption). It is essential to fill this gap to improve the understanding of the implications of water and energy conservation measures on water and energy consumption in order to improve policy making for resource demand management. Doing this is relevant not only for the hotel sector but also for the climate change adaptation of tourism destinations as a whole.

Therefore, my study aims to explore which water- and energy-saving measures are available for the hotel sector and determine the extent to which the hotel sector in Benidorm is implementing these resource saving- measures, by analyzing the data from Rico et al. (2019) and Yoon (2018b). By using of these data and additional support from the literature, identify the drivers and the barriers that motivate the Benidorm´s hotel sector to implement those measures. Then, the relationship between the number and the type of measures implemented and the resource consumption by the hotels is assessed. I strongly focus on the relationship between the sector´s perceptions and attitudes on climate change (i.e. whether they care about it), and the actions undertaken in the hotel sector (i.e. whether hotels are implementing water or energy saving measures). My thesis finally proposes ways to improve water- and energy- saving measures as means to assist climate change adaptation in the hotel sector.

Purpose of the study: research objective and research questions

My study aims to extend and strengthen the ongoing research on water and energy saving measures in the hotel sector, on the demand side of the WEN. The case study of Benidorm (Alicante) illustrates to determine to what extent the hotel sector is undertaking these measures to assist strategic management for climate change adaptation. Therefore the objective of this paper is to propose mechanisms to better implement water-saving and energy-saving measures and policies to assist strategic management for climate change adaptation in the hotel sector in Benidorm.

In line with the objective and the previous research of Rico et al. (2019), Yoon (2018b), this study adopts the following research questions (RQ):

Secondary Research Questions (SRQ):

RQ1 What water and energy saving measures/policies are currently implemented in the hotel sector in Benidorm?

RQ2 What are the main drivers and main barriers for the implementation of water- and energy- saving measures/policies in the hotel sector in Benidorm?

RQ3 How are water and energy-saving measures/policies related to water and energy consumption in the hotel sector in Benidorm?

RQ4 How do the perceptions and attitudes of the hotel sector in Benidorm on climate change effects and adaptation relate to the implementation of water and energy-saving measures/policies in hotels?

In the following chapter I will give an overview of the literature on resource management in hotels and the synergies and trade-offs that the joint management of both resources entail. Moreover, the motivations and barriers for hotels to implement resource saving measures are reviewed to be applied for Benidorm´s case. I will also introduce you to the conceptual framework used as a building block for the analyses of the data. In Chapter 3, I describe the methodology followed in my study. In addition to the literature review, I used field data to obtain relevant results. The results from the numerous statistical analyses are presented in Chapter 4. These results are then discussed in Chapter 5 and I contrast them with comparable cases from the literature review. Limitations of this research are recognized and recommendations for further research are also presented in Chapter 5. The major findings are presented in Chapter 6 and revolve around avoiding counteracting the effect of the resource saving measures as well as overcoming the barriers that hinder hotels to apply them.

Chapter 2. Literature Review and conceptual framework

2.1. Water and energy demand management: measures and policies in the hotel sector

The literature mentions a broad range of water- and energy-saving measures commonly implemented in the hotel sector (Becken et al., 2014). Often, the water and energy measures are studied and reviewed separately, whilst there is little literature on measures taken within the WEN. The following sections provide an overview.

2.1.1. Water-saving measures

Water is an essential resource for the tourism sector. Much water is consumed by the hotel sector (Gabarda-Mallorquí et al., 2017) as tourists tend to consume three times more water during their holidays than at home (Gössling et al., 2012). The hotel´s water becomes an important economic and environmental issue in places where there are many of beds and (seasonal) water shortages. However, the exact average consumption of hotels is difficult to determine since water consumption differs between hotels (Gabarda-Mallorquí et al., 2017).

Some studies have focused on the structure of water usage, so where exactly hotels consume most water. First, Gössling et al. (2012) showed that most water consumption is done outside the hotel rooms, especially in laundry areas and kitchen. The study from Deng and Burnett (2002) revealed that in hotels with laundries, most water use (47%) was consumed for laundry services, 30% in the rooms, and less water (20%) was consumed in the kitchen; hotels with no laundry services consumed most of the water in the kitchen (55%) and 44% in the rooms. In contrast, the study by Rico et al. (2019) for Benidorm – where laundry services are often outsourced - found that 80% of water consumption was made indoors, where 70% was used in the rooms and 10% in the kitchens, bars and other miscellaneous uses. Outdoor activities (garden, swimming pools) consumed 20% of the total water consumption. Cobacho et al. (2005) analyse the water uses inside rooms in Spanish hotels. He found that most water use goes to the washbasins (45%), shower (33%), and toilet (22%).

Tirado et al. (2019) identify the most implemented water-saving measures in hotels and classify them as ´simple´ and ´advanced´ conservation measures or ´innovations´. The former requires fewer technical complications and reduced investments for the hotel and can be implemented without disrupting the normal operation and inconveniences for the guests. The ´advanced` conservation measures do require higher economic investments, advanced knowledge and require major technical complexity, but the water savings are greater than the ones obtained in ´simple` measures. The results from Tirado et al. (2019) present a detailed description of the extent to which measures are implemented in Mallorca´s hotels. They found that 59.32% of the hotels in the sample introduced three or more ´simple´ innovations, while 25.42% implemented three or more ´advanced´ conservation measures. On the one hand, the ´simple` innovations that were introduced the most are the low-flow fittings in water-devices (66.1% of the sample have introduced the measure), low-flush toilets (64.4%), efficient irrigation systems (53%), while the least implemented are the infrared taps (8.5%). On the other hand, the most applied ´advanced` innovations are the systems of water pressure adjustment (50.8%), the development of systems for leak detection and control of water losses (45.8%) and the installation of submeters in water intensive areas (32.2%), while the least popular innovations are the collection and use of rainwater (17%) and the use of wastewater for irrigation (10.2%).

The results from the study by Torres-Bagur et al. (2019) on hotels in Girona (Spain) coincide with Tirado et al. (2019) in that their results indicate that the main measure was dual-flush toilet systems (78.9%). However, in contrast with Tirado et al. (2019) faucet sensors and timers were also widely implemented (73.7%), especially in the swimming pools´ showers (71%). From the hotels with gardens, 66% introduced efficient irrigation systems and only 16.2% have planted native species, or drought tolerant plants. Moreover, Torres-Bagur et al. (2019) also found that behavioral measures, such as towel and bed linen reuse policies were widely introduced (78.9%), and the placement of signs for water saving in bedrooms and other areas were implemented in 68.4% of the sampled hotels. Finally, 42.1% hoteliers indicated that their staff received training on water-saving practices. None of the hotels in the sample has installed graywater use systems, rainwater harvesting leak detection, or monitoring of water consumption.

For this research, I will use the survey data from Rico and colleagues (2019), who studied water conservation measures and water consumption in 22 hotels in Benidorm from the period 2005 to 2014. In their questionnaire, several water saving measures were selected by the establishments according to whether they had adopted them. Then, the researchers examined whether the adoption of conservation measures showed a decrease in hotel´s water consumption, and whether specific conservation measures tended to be more effective than others in reducing water consumption. In their study, they differentiated between economic, technical, and behavioral measures. Economic measures include economic instruments (e.g. taxes and prices) to reduce consumption, for instance taxes; technical measures include retrofitting devices in taps, showers and toilets, low consumption appliances and efficient irrigation systems; behavioral measures aim to influence attitudes and practices from staff and guests on water management, for instance information signs and staff trainings. A complete list of the water-saving measures identified in the literature is provided in Table 17 (see Appendix 1).

2.1.2. Energy-saving measures

Energy is an essential resource for the tourism sector (Katircioglu, Korhan, et al., 2019) and hotels consume a substantial amount of energy for their daily operations (Mardani et al., 2016; Sucheran & Bob, 2015). Studies on energy in the accommodation sector have mainly dealt with energy consumption (Beccali et al., 2009; Bianco et al., 2017) and GHG emissions, from this consumption (Beccali et al., 2009; Rosselló -Batle et al., 2010; Sanyé-Mengual et al., 2014). Roselló-Batle et al. (2010) found that hotels in the Balearic Islands consume almost 78% of energy in the operation phase, which is also responsible for most CO_2 emissions. It is during this time when the biggest energy reductions can be achieved by introducing energy saving measures, including renewable energies, in hotels for their daily operations.

A major part of the total energy consumption is the energy demand used for lighting, water pumping, kitchen, and laundries (Meschede et al., 2017). In addition, Dascalaki & Balaras, (2004) reveal that in European hotels, 61% of energy is consumed for space cooling, heating, and ventilation, 25% is consumed by services, and 15% by hot water production. Among energy sources, electricity is the most common energy carrier in hotels (Meschede et al., 2017; Yoon, 2018b). It is mainly used for HSW, lighting, water pumping, electric kitchen devices, restaurant, and laundries. Then, Yoon (2018b) found that the second most common energy carrier in Benidorm´s hotel sector is propane, used for outdoor cooking; followed by Diesel and Natural Gas used for water heating. Energy sources release more carbon based on the carbon they have in relation to their weight. Thus energy sources are cleaner, in order: Natural Gas, Propane, Butane and Diesel (Nair et al., 2018).

In addition to the selection of energy sources as an energy-saving method, hotels can implement other energy conservation measures (Chan et al., 2017). Often these are technological measures, such as low-emitting diode (LED) light, building management systems, energy-saving kitchen equipment and solar and wind technologies. As electricity is the primary source, energy -measures are often related to renewable energy including solar photovoltaic, solar thermal, wind, bioenergy and ´green´ energy purchase (Beccali et al., 2009, 2018; Dhirasasna et al., 2020; Mardani et al., 2016), which can supply up to 63% of hotels electricity demand according to Meschede et al. (2017). But also, other actions, such as energy certifications (i.e. ISO 14001) and energy management systems, that include energy monitoring development of energy indicators or key card systems in guestrooms (Agencia Provincial de la Energia de Alicante, 2013).

In a study in South Africa, Sucheran & Bob (Sucheran & Bob, 2015) analyzed the implementation of energy conservation measures in sixty hotels. The most popular energy-saving measure was efficient light bulbs (98%), while the least widespread measures were solar systems (22%) and the key card system (23%). Similar to their study, the investigation from Nikoloau et al. (2012) in Corfu Island (Greece) found that 81% from a sample of ninety hotels, installed key card systems, efficient light bulbs were also widespread among hotels and solar systems were not so popular (52%) However, 84.3% of a sample of 32 hotels in Crete did have solar thermal systems (Zografakis et al., 2011). Lastly , only 2% of hotels in Corfu Island has the energy certifications (Nikolaou et al., 2012), and 9.38% in the case of Crete (Zografakis et al., 2011).

Mardani et al. (2017) have also performed a study to evaluate the ´energy saving technologies and solutions´ of the ten most important hotels in Iran. In their investigation, they make two rankings of measures, the first one from five main groups of measures and the second one from seventeen specific measures. The first ranking revealed that the most implemented measures were efficient equipment and system efficiency (e.g. energy saving light bulbs, highly efficient boilers, the control of lighting and key card systems). The least ranked were energy management (i.e. energy monitoring, information on energy consumption) and renewable energy (e.g. heat pumps, solar thermal panels). From the seventeen groups of measures, active space cooling (or free cooling), building insulation, EU Eco-label, lighting control, and micro hydropower were ranked based on their potential for energy conservation. A list of specific energy- saving measures is provided in Table 18 (See Appendix 2)

Little or no review on the effectiveness of the energy measures in the hotel sector´s energy consumption (Yoon et al., 2018). For this study, the investigation of Yoon (2018b) will be used to explore the energy-saving measures in Benidorm´s hotel sector, and its relationship with energy consumption. Moreover, the link between energy-measures and water consumption will be assessed to examine the water-energy nexus.

2.2. The Water-Energy Nexus: synergies and trade-offs

The water-energy nexus (WEN) has been increasingly studied since the 1990s and has become a priority subject in sustainability assessments. The term was coined to capture the two-way connection between the two resources. There are two fundamental conceptual approaches from which the WEN is commonly studied: “water for energy” as water is needed to generate energy; and “energy for water” as energy is needed for water treatment and distribution (Hardy et al., 2012). The bidirectional relationship has implications for sustainable water and energy management, in terms of efficiency, number of resources involved, good or poor management, and the choice of technologies (Hardy et al., 2012). Despite the strong linkages, water and energy resources have been managed in isolation. Authors such as Williams et al. (2014) and

Yoon et al. (2018) have called for an integrative management or co-management of these resources.

The WEN entails structural tensions and synergies between the application of water- and energy- saving measures. The tensions encompass the developments in the conservation of one resource (i.e. water or energy) that may lead to increasing pressures on the other, or stresses in one resource can become stresses for the other resource (Williams et al., 2014). Williams et al. (2014) claims that these tensions create a "´vicious cycle´, where adaptations to pressures in one sector necessitates adaptation in the other" (p.12). The failure to manage the tensions can entail trade-offs between water and energy. For example, desalination has become a key water resource as an adaptation strategy to climate change in areas experiencing water-scarcity (i.e. climate proof and drought resilient option). Yet, desalination is very energy intensive (Baños et al., 2019; March, 2015; J. Williams et al., 2014; Yoon et al., 2018), while it may also lead to increases in water consumption as supply is guaranteed (Baños et al., 2019). Hence, desalination may assure sufficiency of water but not efficiency of water resource use (Baños et al., 2019), leading to [climate] ´maladaptation` (March et al., 2014; Olcina et al., 2016; Williams et al., 2014).

In addition to tensions, synergies in the WEN exist from a supply-side and demand-side perspective. On the supply side, technical solutions are proposed such as the co-production of heat and water, recovering energy from wastewater treatment, using off-peak renewable energy for desalination plants and integrated infrastructures for water and energy distribution (Agencia Provincial de la Energia de Alicante, 2020; Asociación Técnica Española de Climatización y Refrigeración & Instituto para la Diversificación y Ahorro de la Energía, 2010; Villar-Navascués et al., 2020). On the demand side, there is more emphasis on efficiency actions that lead to resource conservation, such as efficient hot water systems and efficient household devices (Agencia Provincial de la Energia de Alicante, 2020; Asociación Técnica Española de Climatización y Refrigeración & Instituto para la Diversificación y Ahorro de la Energía, 2010).

These synergies are of great interest for water and energy savings in the tourism sector. Yet, the WEN has only recently started to be studied within the sector (Becken & McLennan, 2017; Warren & Becken, 2017; Yoon, 2018b). In the tourism literature, there are growing discussions on the measurement and monitoring of resource use, for instance to optimize management decisions (Becken & McLennan, 2017), resource efficiency investments (Pinto et al., 2017) and the introduction of new technologies (Coles et al., 2016; Pace, 2016). Moreover, much of the literature has focused on the supply-side of the WEN, while only a few studies focus on the demand side of the WEN. Yoon (2018a) claims that "we need further research on interactive demand management and the water-energy nexus relationship" (p.386). This study will focus on hotels as key actors in the tourism sector for WEN management from a demand-side perspective.

Table 1. Actions addressing the WEN in hotels (Becken et al. (2017))

Aspect	Explanation
Air conditioning	Air conditioning requires both water and energy. Reducing the need for cooling (i.e. higher temperatures settings or ventilation) will result in dual savings.
Bathrooms	Reducing the use of hot water (e.g. low flow shower heads, guest education) achieves water and energy savings.
Laundry	Laundries use water and electricity. Reducing the volume of laundry, full loads and buying efficient equipment will save water and energy
Pumps	Reducing the need for pumping water into guest rooms and gardens will achieve dual savings.
Swimming pools	Running swimming pools requires energy for heating and running pumps and filters. Pool covers reduce evaporation and prevent heat loss.
Desalination	Resorts that rely on desalination for freshwater can save energy by reducing the need for potable water, for example by recycling greywater for irrigation.

The WEN in the hotel sector is evident as energy and water are consumed for essential activities such as air conditioning, bathrooms, laundry, pumps, and swimming pools (and desalination if the hotel relies on desalination for freshwater supplies). Many times, the implementation of one measure to generate savings for one resource (e.g. water), can also entail savings in the other (e.g. energy) without having the intention to target both resources at the same time. Becken et al. (2017) lists several actions that are examples of the water and energy nexus in hotels (see Table 1). For instance, air conditioning consumes both water and energy, and by decreasing the need for cooling (e.g. establishing higher or minimum temperatures, closing curtains) will lead to savings in both water and energy consumption. These and other measures are presented in Table 17 and Table 18 (see Appendices 1 and 2).

Pinto et al. (2017) investigate the influence that the type of showerheads has on water and energy consumption. In their study, they measure the energy consumption associated with water consumption (i.e. heating and pumping) and assess the hydric efficiency of different showers in Portuguese hotels. The study shows the effect of the application of pressure reducers in showers and conclude that these must not fall below a certain flow (i.e. 5l/min). Below that value, the users tend to shower for a longer time, which may reverse the trend on decreased consumption (Pinto et al., 2017), an effect known as ´backfiring` (Freire-González, 2019). Pinto et al. (2017) concludes that the application of shower efficient devices is a cost-effective measure to be considered that can lead to 35% of consumption reduction, even though it is still needed to increase the hydric efficiency to decrease water and energy consumption from showers.

Moreover, the production and consumption of HSW represents around 30% of the total energy consumption in hotels (Deng & Burnett, 2000). Most of the hotels in Alicante use Diesel and Propane as a main energy source for producing HSW, and in some cases, there are solar thermic installations for water heating (Agencia Provincial de la Energia de Alicante, 2020; Yoon, 2018b). The latter option produces HSW ´for free´ harnessing the energy coming from the sun and the savings are very high, despite the required investments (Beccali et al., 2018; Michopoulos et al., 2017). According to Yoon (2018b), solar thermal systems contributed to saving 25% to 40% of energy for heating water, even though it did not lead to a reduction in total *energy for water* in Benidorm. Explanations can be the backfiring effect or Jevon´s paradox, where hotels undertake conservation measures but implement other water- and energy- intensive (Dumont et al., 2013).

Michopoulos et al. (2017) and Lumelco (n.d)[1] further suggest phasing out the use of boiler systems and promote the use of solar thermal systems in combination with air-source heat pumps for the production of hot water, as these systems lead to the lowest energy consumption. These systems are not only effective for energy saving, but also the hot water accumulators allow HSW to be delivered almost instantly, which saves water that is otherwise lost on the heating process. Moreover, pumps for the distribution of water in buildings strongly represent the water and energy nexus. Pumping water is an essential activity, especially in high-rise buildings (Cheung et al., 2013), which is the case of Benidorm establishments are equipped with several pumps for the distribution of potable and HSW (Yoon, 2018b).

To continue, kitchen and laundry devices in hotels consume both water and energy consumption. Therefore, not only the investment in efficient washing and dry machines is essential, but also the use of kitchen and laundry appliances with full loads and the optimization of water temperature in washing machines can have an influence energy consumption (Agencia Provincial de la Energia de Alicante, 2013). Moreover, swimming pools use energy for filtering and/or warming water, and both facilities require energy for pumping (Buonomano et al., 2015).

[1] https://www.lumelco.es/

Therefore, pool covers, closed water systems and solar energy for pumping and can be good solutions (Ibrahim & Altunc, 2012). Gardens use large amounts of water for irrigation and the introduction of local plant species, greywater use for irrigation and localized irrigation systems, can reduce water consumption and have a positive effect on energy (i.e. localized irrigation systems) or a negative effect on (i.e.) water recycling (Matos et al., 2014; Tarjuelo et al., 2015)

The implementation of wastewater and greywater reuse systems is a water saving for hotels that can be included within the WEN. Matos et al. (2015) suggests the existence of two opposites: wastewater, which is often treated in a central wastewater treatment plant and reused in public/private areas, and greywater which is treated and used in-situ (i.e. decentralized system). The results of their case study suggest that in-situ greywater systems used 11.8 and 37.5% of energy of a wastewater system for garden irrigation. Wastewater centralized systems consume more energy for the distribution of water (Matos et al., 2014; Yoon, 2018a). Atanasova et al. (2017) prove the economic feasibility of wastewater systems with a payback period of three to seven years according to the amount of water treated (m^3/day). March et al. (2004) and Gual et al. (2007) undertake an investigation in two hotels in Mallorca on greywater reuse for toilet flushing. While there is no reporting on energy consumption, energy is considered for the economic feasibility and the results show that reused water has a lower price than freshwater (Gual et al., 2008).

Approaching water and energy consumption through the awareness from and communication to the staff and guests is important (Gabarda-Mallorquí et al., 2018; C. Warren et al., 2017). The staff can participate in water and energy management by reporting on whether there is any damage or losses of the appliances, hot water use savings, closing taps and use the devices and machines responsibly (e.g. full loads). Moreover, awareness programs with, for instance signs with information on water and energy consumption, for the clients seem to be a relevant element for resource consumption management (Gabarda-Mallorquí et al., 2018; Pinto et al., 2017).

2.3. Drivers and barriers for resource measure implementation

The consumption of resources in hotels often depends on variables such as hotel size and hotel category (i.e. stars) (Gabarda-Mallorqui & Palom, 2018; Rico et al., 2019). For instance, hotel size in terms of beds is important to determine water and energy consumption, where large hotels consume more per guest that small hotels (Kasim et al., 2014), as they are able to achieve economies of scale and reduce consumption per guest (Rico et al., 2019). Moreover, higher hotel categories tend to have higher levels of resource consumption as the services, facilities and quality standards offered are higher. Yet, they may have a proactive attitude to introduce resource saving measures (Tirado et al., 2019). Older hotels are more active to implement innovations (Olcina Cantos et al., 2016; Rico et al., 2019; Tirado et al., 2019). Other variables are occupancy rates, climate (Barberán et al., 2013) and the services or amenities provided by the hotel (i.e laundry facilities, swimming pool, garden, etc.) (Mclennan et al., 2017), and chain affiliation (Bohdanowicz & Martinac, 2007).

There are several drivers and barriers common to several hotels to implement water and energy saving measures (see Table 19 in Appendix 3). According to Tirado et al (2019), the main drivers for introducing resource saving measures were reducing operational and maintenance costs, concerns for the environment, and customer loyalty. Other important drivers are the improvement of reputation and marketing of the hotel, adaptation to climate change, and legal requirements to implement environmental management systems or compulsory legislation (Gabarda-Mallorqui & Palom, 2018). Two examples are the international standard norms ISO

50.001 or the UNE-ISO 14001:2015 to which Spanish hotels have been incentivized to comply in the past years (HOSBEC, n.d.)[2].

The barriers for introducing resource saving technologies can be divided into internal barriers and external barriers (see Table 19, Appendix 3)(Chan et al., 2018). To start with, lack of environmental awareness is a main internal barrier to adopting saving measures. For example, Charalambous et al. (2012) found that 28 out of 36 hotels in Cyprus have experienced negative impacts due to water scarcity during drought periods. Still, hotels did not see water shortages and droughts to be a problem for the tourism activity (Charalambous et al., 2012), that can be attributed to an extensive supply system (March et al., 2014). Another important internal barrier is lack of knowledge (Chan et al., 2018, 2020; Tirado et al., 2019; Torres-Bagur et al., 2019), either on environmental issues or on the existence, importance, functioning or benefits of resource saving measures. Moreover, the implementation of technologies and management systems can be a long process, requires commitment and attitudes and requires investment (Chan et al., 2018, 2020; Torres-Bagur et al., 2019). Sometimes, there is lack of budget and resources to undertake these investments, perhaps due to the difficulties to quantify environmental gains and benefits (Orr et al., 2019; Zografakis et al., 2011). Finally, there may be issues with the practical implementation of the measures in the hotel operations, and it requires the involvement of staff that must be qualified to monitor the appliances and policies (Razumova et al., 2016; Renwick et al., 2013; Torres-Bagur et al., 2019).

External factors include aspects that influence the hotel from the outside environment and hinder the implementation of resource saving measures. First, there may be limited external motivation and absence of political, regulatory or economic frameworks to implement an environmental or resource management system (Chan et al., 2020; Orr et al., 2019; Torres-Bagur et al., 2019). An example is the ´tax on the sun` implemented in Spain in 2015 to the production of in-house solar energy (Ministerio de Industria Energía y Turismo, 2015). The absence of appropriate socio-economic frameworks can also be related to the limited scientific data on the applicability of the numerous water- and energy- saving measures and limited evidence of the benefits (i.e. financial and saving advantages) from the efforts to implement these measures (Orr et al., 2019; Williams et al., 2010). Second, there might be lack of sector-specific devices tailored to hotels, that adapts to the infrastructural needs and client demands (Chan et al., 2018; Krizaj et al., 2014). Third, related to the latter, there can be difficulties to fit technologies to the operations and the category of the hotel (Krizaj et al., 2014; Torres-Bagur et al., 2019; Zografakis et al., 2011).

The motivations and limitations to implement resource saving action can be different for each measure. Simple innovations such as dual-flush toilet systems, sensors, timers or aerators in taps and showers, bedding and towel reuse policies, water/energy signs or energy efficient lighting (LED) require low investment and provide high returns in terms of reductions in operating costs and consumption with a short payback period (Barberán et al., 2013; Kasim et al., 2014; Tirado et al., 2019; Torres-Bagur et al., 2019). Conversely, water and energy meters to monitor consumption for specific areas are more sophisticated (Torres-Bagur et al. 2019) even if those do not require high technological investment (Kasim et al., 2014). Moreover, Torres - Bagur et al. (2019) found that reasons for hotels to not shift from bath were related to quality, marketing and publicity, legislation, and regulation barriers and even loss of clients.

The introduction of water-saving strategies for gardens such as the installation of new and efficient irrigation systems or planting native or drought tolerant plants are cost-efficient and are often driven by environmental awareness (Torres-Bagur et al., 2019). However, marketing

[2] https://www.hosbec.com/web/index.html#/home

and category of the hotel, as well as the lack of technical knowledge can hinder these strategies to be implemented (Torres-Bagur et al., 2019). Moreover, technologies such as rainwater harvesting, greywater systems, wastewater treatment systems require more effort in terms of investments, advanced technologies, technical knowledge and have a longer payback period (Kasim et al., 2014; Rico et al., 2019; Tirado et al., 2019).

Renewable energy technology in hotels can be driven by the financial benefits, the strong environmental values that it entails, the provision of energy security for the hotel, the support by green programs, such as the one from the hotel association in Benidorm: "HOSBEC and Energy" (HOSBEC, n.d.)[3], and, if present, government incentives (Dhirasasna et al., 2020). The barriers for implementation of renewable energy technologies, such as solar energy, in the hotel sector are often related to financial factors, lack of awareness of the benefits, lack of technical knowledge, lack of experienced engineers or training for the installation and maintenance of the technologies, lack of incentives (Dhirasasna et al., 2020; Sucheran & Bob, 2015), and the difficulty to integrate the technologies (e.g. solar collectors) in the hotels, for instance, due to availability of space in the façade or aesthetics (Zografakis et al., 2011).

2.4. Conceptual framework

Kasim et al. (2014) developed a ´sustainability framework` for water management in the hotel sector. The framework emphasizes on the importance of environmental management through the concept of innovation and accounts for several levels of technological and knowledge abilities. This triggers hotels for technological and system´s innovation to better manage resources. Building on the well-known 3R (Reducing, Reusing and Recycling) model in environmental management, this new model adds a new R (Reaching). Kasim et al (2014) proposes that water management in the hotel sector can be achieved through implementing these 4R Innovations. However, the framework is flexible to be adjusted to other resource management issues and any type of accommodation. Besides, any measures can be assigned to the same drivers and barriers as well as advantages and disadvantages. This allows hotel managers to make better decisions on resource management.

For this research, I have adjusted the definitions given by Kasim et al. (2014) not only to explore water management, but also energy management in the hotel sector. The Innovative Rs are explained according to the definition given by Kasim et al. (2014), and the adjustments taken for this study:

1. <u>Innovative Reaching:</u> these are measures that are low technological intensive but require knowledge on resource management. Reaching strategies aim to ´reach` stakeholders and to influence them to achieve resource consumption reduction. Reaching can be accomplished through collaboration, education, and compensation. According to Kasim et al. (2014) collaboration is reached by connecting with staff, guests, or other hotel operators, to raise awareness and improve water management. Reaching further aims to educate stakeholders to minimize water consumption. For instance, employees are encouraged to participate in water actions or guests can be informed through policies and operational standards. Reaching innovatively through compensation aims to compensate an action from the hotel through other activities (i.e. planting trees), according to Kasim et al. (2014).

   For my research, collaboration is interpreted as the commitment of hotels to environmental principles through the implementation of environmental management systems (EMS), codes of conduct, and eco-labels. The implementation of these actions

[3] https://www.hosbec.com/web/index.html#/content/CALIDAD/a63c0ff9460d11e883f0bc5ff4671db4

reveals the collaboration of hotels with other hotels, with resource management institutions and international. In addition, environmental certifications can be a form of compensation for (positive) actions undertaken by hotels, which can be included as a Reaching strategy. Finally, for this study, staff training for resource management, staff participation in resource management as educational measures for employees are accounted. Moreover, we consider information signs on resource use or linen reuse programs as initiatives to increase guest's awareness on environmental management.

2. Innovative Reducing: depicts strategies that require low knowledge and technological capabilities to deal with resource management. According to Kasim et al. (2014) Reducing innovations involve behavioral changes in the application of resource conservation measures, and the monitoring of the daily basic activities in the hotel. Hotel staff play an important role by making sure that previously mentioned appliances are being well-maintained. For instance, cleaning and kitchen attendants can control leakages, control temperature of water or the loads of dishwasher and washing machines. In their view, due to their simplicity, actions in this category can be suitable for numerous accommodation establishments other than hotels, such as homestays, motels, bed & breakfast.

   According to the definition from Kasim et al. (2014), measures such as trainings and participation from employees to be vigilant for water use, control water temperature laundry on full machine loads, control water temperature and water flow, as well as guest notices (i.e. towel signs) to care for water, would be included within this quadrant. However, for this study, these measures have been revised and reclassified as they qualify more as Reaching innovations. Instead, for this research Reducing strategies encompass measures such as water or energy meters, retrofitting devices in taps and toilets, low consumption equipment in kitchen and laundries and efficient irrigation systems. As in appropriate fit with the definition by Kasim et al. (2014), the proposed measures require reduced knowledge abilities and technological capabilities, while they require intensive monitoring for its correct functioning.

3. Innovative Reusing: depicts a situation where hotels do not have high knowledge capabilities, but they have large technological capacity. This type of strategies includes water and energy reuse solutions for decreasing resource consumption. Greywater from laundries, kitchens and sinks can be reused within the hotel, with the appropriate systems. Thus, this category does not require high knowledge, but does require high technology capabilities and capacities. These are not hotel-specific innovations, instead organizations can provide hotels with these sustainable solutions. For this study, we have considered on-site rainwater harvesting, greywater use and solar panels that generate water energy to be used for air conditioners, irrigation of gardens or toilet flushing, for example.

4. Innovative Recycling: this category involves recycling intensively used resources into brand new sources for the hotel (e.g. from polluted water to drinkable water). Thus, these strategies are most feasible for hotels with both high knowledge and technological capabilities to engage in resource management. In this research closed water treatment systems for swimming pools have been considered an innovative Recycling strategy in hotels to address water and energy management.

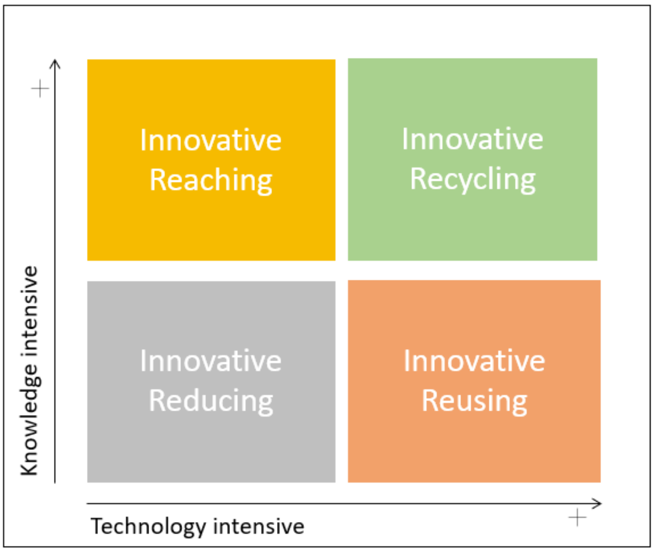

Figure 1 The 4R Framework (Kasim et al. 2014)

Chapter 3. Benidorm

Benidorm, which is located in the Marina Baja county (Alicante, Valencian Community) (Figure 3), is the main tourism resort in the Mediterranean, and the fourth most visited destination in Spain after Madrid, Barcelona, and the Canary Islands. In 2019, the city received around 2 million tourists with more than 11 million overnight stays achieving an 84.2% of hotel occupancy (HOSBEC, n.d.). The high season corresponds to the months between June and September when the city´s population tends to double or triple the permanent population (Baños et al., 2019).

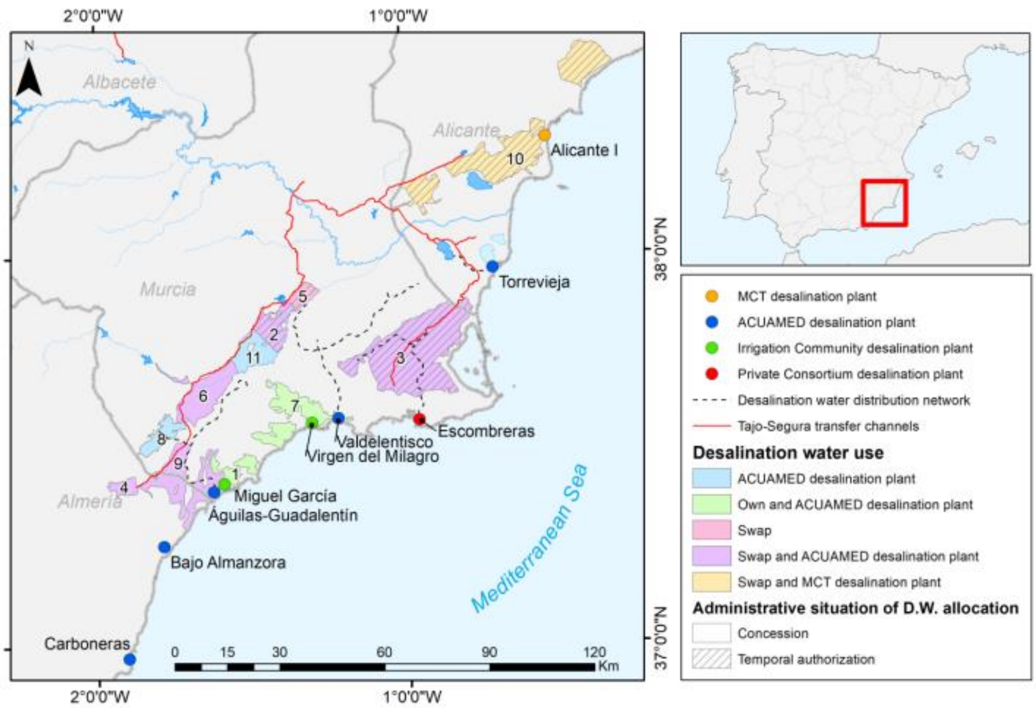

Figure 2. Study area location, placement of desalination plants and Tajo-Segura transfer channels. The group of irrigation communities according to their use of desalinated plants (Villar-Navascués et al. (2020)).

The Mediterranean climate with mild temperatures in the summer and moderate temperatures during the winter, the abundance of clear days, the mild water temperatures, and the fresh sea breeze, makes Benidorm a privileged ´sun, sea, sand´ (3S) tourism destination. In that sense, Benidorm is already exploiting their climatic condition as a source of competitive advantage and it is considered as a main European sun and beach tourism destination (Olcina Cantos & Miró Pérez, 2017). However, tourism development in Benidorm is highly dependent on natural resources, such as water and energy resources, which are sometimes limited (Olcina Cantos & Miró Pérez, 2017). In fact, Benidorm is a large consumer of water and energy due to its tourism activities (Yoon et al., 2018). Around half of the water from Marina Baja is consumed in Benidorm, which dedicated two-thirds of its water use to tourist and recreational activities (Yoon et al., 2018). Also over two-thirds of energy is consumed by the service sector, which includes the hotel sector.

The Intergovernmental Panel on Climate Change (IPCC) has estimated a one-tenth reduction in water resources in the Mediterranean basin in a 1.5°C scenario, and the Centre for Public Works Studies and Experimentation (CEDEX) reported a decrease in water resources between 7% (RCP 4.5) and 14% (RCP 8.5), between 2070 and 2100. The distribution in the precipitation will also experience changes. This is highly relevant for the hydrological resources. Moreover, the climatic projections indicate that the spring and summer months are becoming drier, and the number of days with no precipitation is increasing (AEMET, 2020). Also, the tendencies for non-extreme precipitation in autumn and spring are decreasing, which are essential to ensure reliable water supply for the summer period (Olcina Cantos & Miró Pérez, 2017).

In this sense, climate change is expected to exacerbate the water-related issues that have characterized many regions of the Mediterranean coast for the past 60 years. Benidorm has been through five serious water crises (1965-1969, 1978, 1981- 1984, 1992-1996, 1999-2001, 2005-2008, and 2014-2016) (Hernández-Sánchez et al., 2017). The Marina Baja Consortium was created in 1977 as a public water management agency to improve the water supply network and has been a key actor in the integrated water management of the Marina Baja region, including Benidorm. The crises have been overcome by taking measures on the water supply system, including groundwater pumping and the interconnection between two reservoirs (Amadorio and Algar-Guadalest). In case of water emergency, water is brought by the Rabasa-Fenollar-Amadorio Pipeline, which is connected to Mancomunidad de Canales del Taibillia water system, and the desalination plant of Mutxamiel-El Campello. Finally, a measure that stands out in the Benidorm case is the informal agreement to exchange freshwater between the agricultural sector and urban areas, including the tourism sector, in case of water emergency. These group of measures largely ensure the supply of water for Alicante. Yet, it is questioned whether their use will shift the problem with water availability to energy scarcity issues, particularly with the expected decrease in precipitation and dry periods that can make Alicante highly dependent on these energy intensive water supply systems (March et al., 2014; Ricart et al., 2019; Yoon, 2018b).

The introduction of resource saving measures at the local scale is key to implement effective climate change adaption. As mentioned, the availability of water and energy has strong implications for the tourism activity and development in Benidorm. Tourism areas in Alicante, including Benidorm still present ´high` vulnerabilities to the reduction of water availability (Olcina-Cantos & Vera-Rebollo, 2016; Saurí et al., 2013). The report "Tourism Activity and Climate change in the Valencian Community" (Olcina Cantos & Miró Pérez, 2017) identified four projected climate change impacts that are relevant to be accounted for regional planning : 1. Changes in the climate comfort indexes; 2. Sea level rise 3. Increased extreme weather events (e.g. heat waves, windstorms); 4. Changes in precipitation patterns on the expenses of resource scarcity. To cope with these challenges, Olcina Cantos & Miró Pérez (2017) proposed four mechanisms essential in the tourism planning. First, making changes or adjusting the tourism seasons, through de-seasonality strategies, according to the new comfort indexes (i.e. HCI). Second, monitoring the rise of sea level, implementing structural measures, and improving spatial planning are key to face future sea level rise. Third, developing sustainable land planning and emergency management projects in the tourism sector to deal with extreme weather events. Fourth, investing in hydrological planning and the development of response mechanisms to face changes in precipitation.

Plans to tackle the vulnerability of the tourism sector have been developed at the regional level (i.e. Valencian Community), including the promotion of sustainable destinations, programs to incentivize the implementation of resource saving measures, and educational programs for staff and campaigns to inform clients (Agencia Provincial de la Energía de Alicante, 2020; Olcina Cantos & Miró Pérez, 2017). Moreover, the Hotel Business Association of Benidorm, Costa Blanca and Comunidad Valenciana (HOSBEC, n.d.) takes large responsibility for resource saving actions and offers a large range of services including, among others, the provision of information on any aspect, consultancy and defense on any issue, negotiations, and collective agreements to improve competitive advantage, statistical information, marketing commission, and quality programs.

Moreover, HOSBEC strongly focuses on energy-saving initiatives and energy-efficiency projects within the 'HOSBEC and energy'[4]. First, the association has an ´Energy Observatory´ that reports monthly the price of the different energy sources and CO2 emissions. Second, HOSBEC together with the Provincial Agency for Energy of Alicante have developed a ´Guide of good practices for energy efficiency´ that provides information on sustainable guidelines and responsible energy consumption in the hotel sector (Agencia Provincial de la Energia de Alicante, 2020). Third, HOSBEC offers a Service on Hotel Energy and in 2013, the Provincial Agency for Energy of Alicante provided a ´Guide for energy efficiency and saving in hotels´ (Agencia Provincial de la Energia de Alicante, 2013). The main objectives are to define and update the energetic profile of hotels, to establish energy consumption indicators and to advice on the implementation of the ISO 50001 Norm and ISO14001 Norm. Therefore, the hotels in Alicante are motivated to implement energy- saving measures to face the challenges that future climate change may entail.

In relation to water conservation, the hotel sector in Benidorm has already started taking actions to manage water demand and face climate change consequences (Rico et al., 2019). Numerous hotels have introduced technical measures such flow reductors, dual-flush toilets, or efficient irrigation systems. Other actions such as signs with conservation messages, and programs for linen reuse are widely implemented to increase guest and staff awareness on water conservation (Rico et al., 2019). Overall Benidorm makes a good case study for the study of water- and energy-saving measure implementation, the motivations to be implemented and their effects on water and energy consumption. Supported by HOSBEC and the initiative from the establishments, the Benidorm´s hotel sector is well prepared to invest in demand management actions to improve the sector´s adaptation to climate changes.

[4] https://www.hosbec.com/web/index.html#/content/CALIDAD/a63c0ff9460d11e883f0bc5ff4671db4

Chapter 4. Methodology

4.1. Research Design

For the purpose of my study, the studies from Rico et al. (2019) and Yoon et al. (2019) have been the key to develop a research conceptual framework (Figure 4). The conceptual framework followed the structure of the research questions for this study.

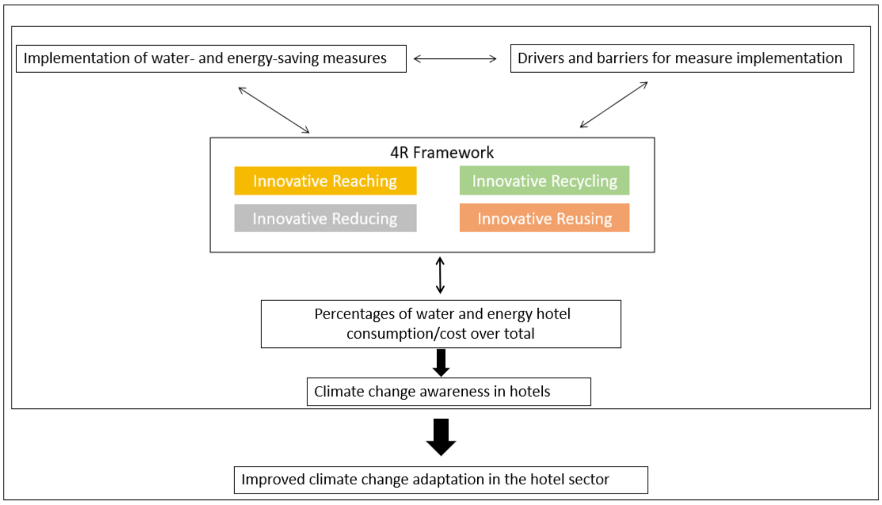

Figure 3. Conceptual framework for this study

I first explored the implementation of water- and energy- saving measures in the hotel sector in Benidorm. According to previous literature, the characteristics of the measures influence the motivational factors or barriers to be implemented, while these factors further affect whether measures are implemented, resulting in a two-way interaction addressed in the study (Chan et al., 2018; Dhirasasna et al., 2020; Tirado et al., 2019; Torres-Bagur et al., 2019). Then, the measures were classified into the 4R framework, and so the drivers and barriers in accordance.

After, the relationship between the implementation of water- and energy- saving measures and hotel water and energy consumption was explored, both within the same resource (i.e. water measures and water consumption) and between different resources (i.e. water measures and energy consumption) to address the WEN. Moreover, emphasis has been given to climate change awareness in hotels, which is evaluated according to the number of measures implemented and the motives that hotels have to do so.

4.2. Data Collection

I intended to extend the existing data collected by Rico et al (2019) and Yoon (2018b). However, due to the COVID-19 conditions during the research period, the collection of data was limited to using already existing data. Thus, I mainly reviewed the literature, and used the questionnaires collected by the studies from Rico et al (2019) in 2014, and Yoon (2018b) in 2016- 2017. The surveys from these studies were selected as main data sources as they were conducted with numerous hotels in Benidorm.

The first research objective aimed to identify which water and energy measures are implemented in the hotel sector in Benidorm (RQ1). For this aim I reviewed the literature, and sectoral reports (incl. municipality reports, hotel reports, newspapers) on the main water and energy measures that are implemented in the hotel sector in general. In the survey performed by Rico et al. (2019), several options for water-saving measures were given to be selected by the hotels. The measures included in the survey are both technological (i.e. efficient systems and water-economizing devices) and behavioral (i.e. sensibilization programs) measures. The survey by Yoon (2018b) further includes questions on measures related to water and energy consumption (i.e. main energy sources, number of pool pumps, solar panels, laundry services, garden services etc.). An analysis of the survey results was performed to obtain to what extent water and energy saving measures are being implemented in the hotel sector in Benidorm in particular.

The drivers and barriers to implement water and energy measures are essential to understand the motives for the hotel sector in Benidorm to implement or ignore those measures (RQ2). The survey from Rico et al. (2019) includes a section on “Factors that motivate the adoption of practices for water conservation”. The survey gives the option to select the following motivational factors or drivers:

- Legal compliance/environmental regulation;
- Reduction of operational costs;
- Hotel image improvement;
- Amount of investment required to adopt the measures is reduced/low;
- Maintain/gain competitive advantage;
- Increased demand/awareness/sensitivity expressed by the clients/users;
- Awareness/concerns to environmental issues expressed by the hotel property;
- Because the sector/industry is adopting this type of measures;
- Concerns for the market barriers that the environmental issues can entail;
- Experience of droughts events in the past years;
- Concerns, awareness, and adaption future climate change projections; and
- Others (to be specified).

The motivational factors for energy-saving measures implementation and the barriers to implement both, water- and energy- saving measures were retrieved from the literature analysis, as these were not included in none of the surveys. Moreover, the drivers and barriers were identified for each category in the 4R framework.

RQ3 explored the relationship between water- and energy-saving measures and the consumption of water and energy. The survey from Rico et al. (2019) includes the percentage that the consumption/cost of water has represented for the total operational costs of the hotel in the previous year: “What is the percentage that water consumption/cost of water has represented over the total operational expenditures/costs from the hotel in the last year?”. The survey by Yoon (2018b) also covers the water consumption/cost percentage, and further includes the percentage of heating and cooling over the total consumption/cost of hotel energy: “What has the percentage that water consumption/cost of water represented over the total operational expenditures/costs from the hotel in the last year?”.

Moreover, the water- and energy- saving measures were compared to the hotel´s water consumption. Water measures are compared to the ´hotel water consumption` in 2014 (i.e. when Rico et al. (2019) retrieved the data), while energy measures (only from the four hotels common to both surveys) are compared to the ´hotel water consumption` in 2016 (i.e. when Yoon (2018b) retrieved the data). These studies were to explore the effect of implementing a resource measure on the same resource´s consumption, and on the other resource´s consumption to address the WEN.

RQ4 explored the relationship between the perceptions and attitudes of the hotel sector in Benidorm towards climate change and the implementation of water and energy-saving measures. Rico et al. (2019) proposes as a motivational factor the “Concerns, awareness and adaption future climate change projections”. Also, the survey includes a section “Droughts” that ask three questions: 1. ´During the last drought events in Alicante, have you undertaken any measures to face the drought? `; 2. ´Is your hotel planning to take down the measures undertaken after the drought? `; 3. ´Has the water consumption of the client decreased during the drought periods? `. Moreover, one of the options from motivation factors is the “Experience of droughts in the past years”. The “Concerns, awareness and adaption future climate change projections” and the “Experience of droughts in the past years” have been interpreted as climate change effects and concerns on adaptation for the analysis of this question.

4.2.1. Target population and sampling method

The target population for this study were the hotels involved in the tourism activity of Benidorm. The method of sampling was convenient and targeted non-random sampling, since the actors for the study have been chosen according to the surveys obtained by Rico et al (2019) and Yoon (2018b). Most of the hotels that have been surveyed belong to the HOSBEC Hotel Association that stands for Hotel Business Association of Benidorm, Costa Blanca and Valencian Community.

The survey from Rico et al. (2019) obtained 22 responses from hotels in Benidorm representing 17 percent of the total number of hotels in Benidorm, and around a third of hotel beds of Benidorm. As Rico et al. (2019) argues the total number of respondents may seem to be low but the sample size might be similar or even larger in comparison to other studies (references from Rico et al.). The sample includes 2 five-star hotels (out of 3); 9 four-star hotels (out of 35) and 11 three-star hotels (out of 58). The survey from Yoon (2018b) obtained 16 responses from hotels in Benidorm. From the respondents, 12 hotels fully completed the survey, accounting for 16% of the total number of beds in three-star and four-star.

4.2.2. Research instruments

As motivated before, the data for this study was obtained from the surveys performed by Rico et al. (2019) and Yoon (2018b). In addition, an extensive literature review was conducted. The questionnaire from Rico et al. (2019) includes fifty questions related to the hotel water measures implementation and water consumption. The annual water consumption was obtained from the water company supplying Benidorm for the 22 hotels for the period 2005-2014. In addition, Rico et al. (2019) complemented the survey with interviews to managers and technical staff of the hotels. The questionnaire from Yoon (2018b) includes four sections dealing with general information on the hotel´s characteristic (i.e. height, number of rooms, category etc.), water consumption, energy consumption and, finally, a request to provide their energy and waterlogs by the hotel management team. Moreover, a dataset was provided by Antonio Rico, that included the water consumption of numerous hotels between the years 2005 and 2017. This dataset was used for SRQ3.

An effort was be made to obtain primary data from hotels. A short questionnaire was meant to be sent out by email to the hotels participating in previous studies and other hotels, to extend the existing data. The proposed questionnaire can be found in Appendix 4.

4.3. Data Analysis

For the analysis of the data, statistical analyses were conducted using R programming. A general analysis of the data was performed on the number of beds, average stay, the measures implemented per hotel stars and average percentages of energy and water consumption over the total cost. For the secondary research questions different analytical procedures were followed.

SRQ1- For the first question we counted the water- and energy-saving measures that hotels participating in the survey are currently applying. Thus, the number and percentages of water- and energy saving measures applied by each hotel, and the type of measures that are implemented was obtained. The R functions `sum ()`, `percent ()` were used to obtain the number of hotels implementing water and energy measures according to the category of the hotel. Capture 1 below presents the function that was used in this study.

Caption 1. Function in RStudio used for RQ1.

```
meaures_perStar <- function(df, column) {
  table <- table(df[, c("Category_HotelStars",column)])
  table <- as.data.frame.matrix(table)
  #write.csv2(table,file=paste("AThesis/Ecuestas/test_",column,".csv", sep=""))
  total <- sum(rowSums(table))
  percentages <- apply(table, 2, function(x){
    n <- sum(x)
    p <- percent(n/total, accuracy=.01)
    return(p)
  })
  table <- rbind(table,percentages)
  return(table)
}
```

SRQ2- The analysis for this question was made separately for the drivers and the barriers. First, the survey motivational factors in Rico et al. (2019)´s survey were related to the implementation of resource saving measures. So, what are the specific drivers from hotels to implement a water-saving measures. To analyze the drivers, a chi-square test, and a fisher´s test was performed since both variables (i.e. drivers and water-saving measures) are categorical. The fisher´s test was performed as the sample size was small (less than five observations) (Field, 2016) with the function in R `fisher.test()`(Caption 2) An example of how it looked in R is shown below (note, the measures are grouped into vectors for practical purposes). The fisher´s exact test only states the probability (i.e. p-value) of that H_0 is true (i.e. there is no relationship between the two categorical variables). For the analysis, the assumption of independence, that the variables contribute only to one cell, is met. To check the reliability of the method, the fisher´s exact test was performed individually for the significant variables, and to other selected random variables. The tests resulted to have the same results as the ensembled function (see Appendix 5) on the significant variables, and also for the selected random variables. The outcome of the test results several contingency tables.

Both the drivers and the barriers to measure implementation were categorized according to the water- and energy- saving measure in each category of the 4R framework as shown in Figure 5 below.

Caption 2. Function in RStudio used for RQ2.

```
Chisquaretest <- function(x) {
  chisquare <- cbind(lapply(EncuestasAguaFinal[,c(28:50, 36:53, 55:61)], function(x) {
    ch <- chisq.test(EncuestasAguaFinal$Legalcompliance_environmentalregulations,x)
    c(ch$p.value)
  }))
  return(chisquare)}

Chisquaretest("Legalcompliance_environmentalregulations")

Fishertest <- function(x) {
  fishertest <- cbind(lapply(EncuestasAguaFinal[,c(28:50, 36:53, 55:61)], function(x) {
    fi <- fisher.test(EncuestasAguaFinal$Legalcompliance_environmentalregulations,x)
    c(fi$statistic)
  }))
  return(fishertest)}
```

SRQ3- The third research question analyzed the relationship between water- and energy-saving measures and the consumption/cost of water and energy in hotels. The analyses for each resource were done according to the concordant survey. The analyses to address the WEN were done for four hotel hotels from which the data from the two surveys was gathered. The analyses on the relationship are done as follows:

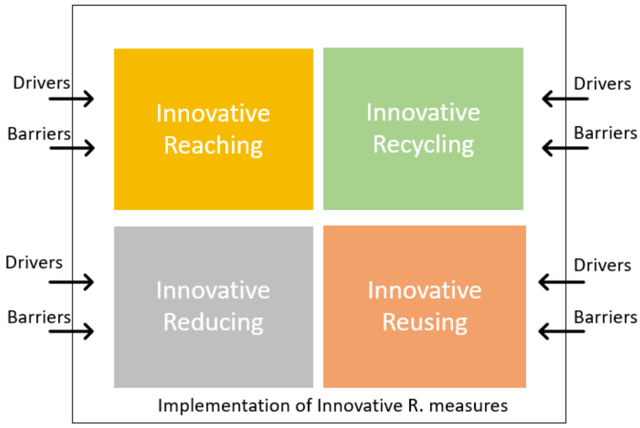

Figure 4. Drivers and Barriers for the 4R quadrants (based on Kasim et al. (2014))

1. The water-saving measures were related to the percentage of total consumption/cost of water (Rico et al., 2019) and the ´hotel water consumption` in 2014 (Rico et al., 2019). For the analyses, several linear or multiple regressions were performed by ´forced entry´ multiple regression method where all the variables were entered at the same time, in order to predict ´´percentage of water consumption/cost` over the total` by each of the 4R categories from the 4R Framework.

   To address the WEN from a *´water for energy`* perspective water-saving measures were related to the percentage of total consumption/cost energy for heating/cooling (Yoon, 2018b) (see Figure 7). This part of the analysis was done only for the four hotels that were common to the survey of Rico et al. (2019) and Yoon (2018b), focused on water and energy, respectively.

2. The energy-saving measures were related to percentage of total consumption/cost energy for heating/cooling and the percentage of total consumption/cost energy for lighting (Yoon, 2018b) (see figure 6). Multiple regression and regression analyses were performed to assess the relationship and the relative importance of each energy measures and the percentage

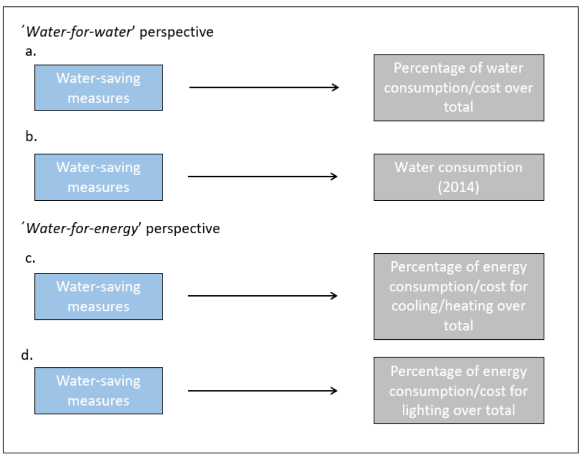

Figure 5. Regression analyses representing the ´Water for water` and ´Water for energy´ perspectives.

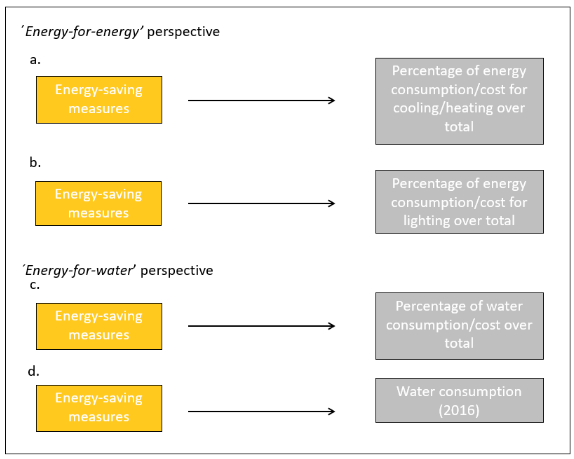

Figure 6. Regression analyses representing the ´Energy for energy´ and ´Energy for water´ perspectives.

of energy consumption/cost for the hotels. The test for each of the categories was performed by ´forced entry´ multiple regression method where all the variables were entered at the same time, in order to predict percentage of energy consumption/cost over the total by each of the 4R categories from the 4R Framework. To address the WEN from an *´energy for water`* perspective, energy-saving measures were related to the percentage of total consumption/cost of water (Rico et al., 2019), the ´hotel water consumption` in 2016 (Rico et al., 2019). However, only two of the hotels answered on the ´percentage of water consumption/cost` over the total. Thus, due to missing data in the survey, this test could not be performed.

The statistical analyses included multiple regression or linear regression tests of whether the implementation of water and energy measures (i.e. categorical variable) has an effect on the percentage water and energy over total consumption/cost (i.e. continuous variable). Thus, the water and energy measures are predictors for water and energy consumption. In the regression test we test whether the null hypothesis/model (i.e. indicates that there is no effect[5]), is true. For that we calculate the probability (i.e. *p*-value) of getting a model if the null hypothesis is true. In case the null hypothesis is rejected (p< 0.5), we gain confidence on the alternative hypothesis (i.e. there is an effect between predictor and outcome) (Field, 2016).

I used the functions in R `lm ()` (i.e. regression) and `summarise ()` (i.e. to summarize the results) from the package dplyr. The output consists of graphs, and tables that show: Coefficient: Standard error (i.e. tells you how precisely the estimate was measured), t-value (i.e. used to test whether or not the coefficient is significantly different from zero) and Pr(>|t|) (i.e. indicates the significance level and the probability of rejecting the null hypothesis); Performance Measures: Residual standard error (i.e. standard deviation from the residuals), R square (i.e. the amount of variance explained by the model) or Adjusted R square (i.e. for the amount of variance explained by the model adjusted the number of variables. For multiple regression tests), F-statistic (i.e. shows if at least one variable is significantly different from zero) and p value (shows whether the F statistic is significant, if p<0.05, or not, p>0.05).

SRQ4- The fourth research question aimed to explore the relationship between the perceptions and attitudes of the hotel sector in Benidorm towards climate change, and the implementation of water and energy-saving measures (see Figure 8). This question was analyzed by a multiple regression analysis relating the option from the motivational factors in the survey by Rico et al (2019) "Concerns, awareness and adaption future climate change projections" named as ´Climate change awareness´ variable, with the implementation of water saving measures undertaken in the hotels from the survey of Rico et al (2019) and with the energy saving

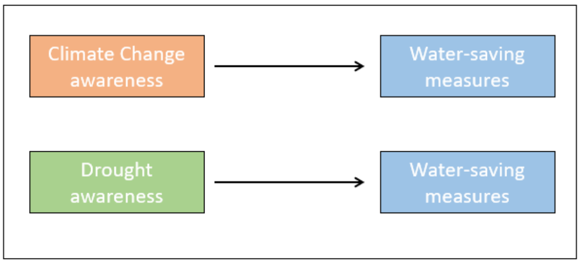

Figure 7. Regression analyses between ´Climate change awareness` and ´Drought awareness`, and the implementation of water-saving measures.

[5] A regression model has an equation model: $outcome_i = (b_0 + b_1X_1) + error_{i.;}$ being b_1… b_x the predictors. The null hypothesis represents a model where b_1 is no different from zero, therefore H_0: $B_1 = 0$.
The alternative hypothesis is the opposite: H_A: $B1 \neq 0$.
The null model has an equation: $outcome_i = b_0 + error_i$, which is a model with no predictors.

measures obtained from Yoon (2018b). The analysis was done only for the four hotels that responded both surveys. In addition, the concerns and awareness of the droughts were accounted to represent the awareness of the hotel sector on extreme weather events (i.e. ´Drought awareness´ variable).

The analyses were done through multiple simple regression analyses, using the functions `lm()` (regression) and `summarise()` in R. The output consists of tables and graphs that show the coefficient and performance measures, just explained above.

Chapter 5. Results

5.1. General analysis of the hotel sector

The surveys by Rico et al. (2019) and Yoon (2018b) were analyzed jointly and this resulted in a total sample of thirty-three hotels to obtain an overview of the sample. Most of these hotels were constructed between 1965 and 1975. The sixteen hotels that responded to Yoon (2018b) ´s survey were 37.1 meters high and had on average 11.5 floors. Most hotels (12) had between 500 and 1000 beds and offer a total of 18267 beds which represents half of the total hotel availability in Benidorm (see Table 2).

Table 2. Description of the hotel sample (source: own elaboration based on Rico et al. (2019) and Yoon (2018b)).

Hotel size (number of beds per hotel)	Number of hotels	Total number of beds	Average stay (nights)	Average surface (m^2)
<250	6	1066	4	2859
250-500	11	4219	5	7944
500-1000	12	8226	5	12562
>1000	3	4756	5	26125

The category of hotels in the sample were, 2-stars (1), 3 stars (14), 4 stars (16) and 5 stars (2) category. The facilities offered by the hotels that were analyzed based in both surveys from Rico et al. (2019) and Yoon (2018b) are shown in Table 3. Laundry services were mainly externalized (55%), while hotels with laundry services had a low percentage of the load done in the hotel. 39% of the sample had SPA or wellness facilities; these facilities were widely popular among 4-star and 5-star hotels. Moreover, almost all hotels had a swimming pool (97%), and most hotels had a garden (67%) at least with a surface lower than 500m^2. The rest of the hotels had a garden between 501m^2 and 2500m^2 (4), or bigger than 2500m^2 (4).

Table 3. Hotel category and hotel services/facilities offered by hotels (source: own elaboration based on Rico et al. (2019) and Yoon (2018b))

Hotel category		*2 stars*	*3 stars*	*4 stars*	*5 stars*	*Total (%)*
Number of hotels		1	14	16	2	
Laundry	Yes	1	7	6	0	42
	No (externalized)	0	7	10	1	55
	No answer	0	0	0	1	3
SPA	Yes	0	3	9	1	39
	No	1	11	7	0	58
	No answer	0	0	0	1	3
Swimming pool	Yes	1	14	16	1	97
	No	0	0	0	0	0
	No answer	0	0	0	1	3
Garden	Yes	1	11	9	1	67
	No	0	3	7	0	30
	No answer	0	0	0	1	3

The water and energy consumption from the hotels are analyzed separately for the sample in Rico et al. (2019) and Yoon (2018b). Both surveys include the variables ´Percentage of water consumption in the total operational costs in the past year`. In addition, Yoon (2018b) included ´The percentage of lighting in the total energy costs in the past year` and ´The percentage of heating and cooling (H/C) in total energy costs in the past year`. The results for the ´average resource consumption over the total operational costs` are summarized in Table 4 according to hotel category.

Table 4. Hotel category and water and energy average consumption/cost over the total hotel operational cost) (source: own elaboration based on Rico et al. (2019) and Yoon (2018b)) (NA= not applicable)

Hotel category	**Average water consumption/cost (%)**	**Average lighting consumption/cost (%)**	**Average H/C consumption/cost (%)**
	Rico et al. (2019) & Yoon (2018b)	Yoon (2018b)	Yoon (2018b)
2-stars	NA	NA	NA
3-stars	5.1	6.9	20.2
4-stars	3.3	17.5	54.2
5-stars	0.01	NA	NA

As shown in Table 4, 3-stars hotels have the highest average percentage of water consumption/cost over the total operational costs of the hotels, followed by 4-stars hotels and 5-stars hotels. Hotel average water consumption/cost in 5-stars hotels has limited observations, reasons for such a low number can be due to low water consumption, or a high total. The average lighting and H/C consumption/cost over the total operational cost ranked highest for 4-stars hotels. The survey done by Yoon (2018b) did not include 2-stars and 5-stars hotels in their sample, therefore the result is not applicable (NA). The average heating and cooling consumption/cost over total operational costs is higher than lighting consumption/cost over total operational costs.

5.2. Water- and energy-saving measures in Benidorm

This section provides an overview of the water-saving measures implemented by the 22 surveyed hotels by Rico et al. (2019), and an overview of the energy-saving measures implemented by the 16 hotels surveyed hotels by Yoon (2018b). The measures are classified according to Kasim et al.´s (2014) 4R framework adjusted for this study.

5.2.1. Water-saving measures

Innovative Reaching

From the survey, nine variables were assigned to the ´Innovative Reaching´ category. The variables on formalized policies and formalized action plan for water management and water-saving, and standard certifications were included within the ´collaboration` dimension of Reaching strategies, that ensures and improves the environmental performance of the hotel. Measures that are related to staff training and staff participation in water management, as well as the involvement of the guests in water-saving initiatives such as information signs, towel reusing policies and bedding policies were related to ´educational` measures. ´Plantation of native species` was also included in this category as it requires knowledge on adapted and native species but low technological investments.

The promotion of ´responsible participation of staff` in water management was applied by all hotels in the sample, whilst the least popular measures were ´plantation of native species` (36.36%), and the ´acquisition of standard certification`. Then, ´linen reusing policies ´ and ´ staff training` were widely applied by the hotels (86%) particularly in 3-stars hotel from which all of them have applied. The same goes for information signs which were applied by all 3-stars hotels (10) and 2-stars hotels (1). The only 2-stars hotel applied all the educational measures and the ´plantation of native species`, but it was not involved in collaboration measures. Moreover, 4-stars hotels have mainly introduced ´staff participation´, ´formalized water policies´, a ´ formalized water-saving action plans´, and ´towel reusing policies´. Five stars hotels mainly had a ´formalized water-saving action plan´ and were involved in staff educational measures. Only one 5-star hotel has introduced ´formalized water policies´, ´standard certification`, ´towel reusing policies`, ´bedding reusing policies´ and ´staff training´. None of the 5-stars hotels had information signs or has introduced native species in their gardens (Table 5).

Table 5. Implementation of water-saving Reaching strategies in Benidorm hotels (based on Rico et al. (2019)) (na= no answer)

		Formalized water management policies			Formalized water-saving action plan			Standard certification		
Hotel category	**Number hotels**	Yes	No	na	Yes	No	na	Yes	No	na
2 stars	1	0	1	0	0	1	0	0	1	0
3 stars	10	5	4	1	5	4	1	1	7	2
4 stars	9	7	2	0	7	2	0	3	5	1
5 stars	2	1	1	0	2	0	0	1	0	1
Total (%)	22	60	35	5	65	30	5	23	59	18

		Information signs			Towel reusing policies			Bedding reusing policies		
Hotel category	**Number hotels**	Yes	No	na	Yes	No	na	Yes	No	na
2 stars	1	1	0	0	1	0	0	1	0	0
3 stars	10	10	0	0	10	0	0	7	3	0
4 stars	9	6	3	0	7	1	1	3	5	1
5 stars	2	0	2	0	1	1	0	1	1	0
Total (%)		77	23	0	86	9	5	54	41	5

		Staff training			Staff participation in water management			Plantation of native species		
Hotel category	**Number hotels**	Yes	No	na	Yes	No	na	Yes	No	na
2 stars	1	1	0	0	1	0	0	1	0	0
3 stars	10	10	0	0	10	0	0	4	3	3
4 stars	9	6	3	0	9	0	0	4	3	2
5 stars	2	2	0	0	2	0	0	0	2	0
Total (%)		86	14	0	100	0	0	36	41	23

Innovative Reducing

Nineteen variables were selected within the Reducing category for water-saving measures. These measures are not knowledge or technology intensive but aim to reduce the consumption of water. The analysis showed that ´water meters` were widely introduced in the hotels (68%), while the rest of the respondents did not know whether they were installed. ´General flow reductors` were not so popular, more than half of the respondents indicated that they did not have general flow reductors, including all 5-stars hotels in the sample.

From the tap measures, the ´flow reducer/limiter` was the most implemented measure among the hotels (64%), especially in 2-, 3- and 4-stars hotels. None of the 5-stars hotels has introduced this measure. In contrast, ´taps aerator/diffusers` were the least implemented, though they were introduced in both 5-stars hotels. These results are similar to shower devices, where the most introduced tools were the ´shower flow reducer/limiter` (59%) and ´shower aerators` (55%), and only one 5-star hotel implemented both. The rest of the respondents stated that they had not implemented these measures. ´Thermostatic taps in showers`, and ´shower taps timers` were, the least implemented measures in showers. With respect to toilet devices, and ´fill or flush cistern limiting system` more popular across hotels (41%). In contrast, counterbalance systems in toilets were the least introduced by hotels (18%) (Table 6).

The most widely introduced irrigation system for hotel gardens were ´dripping systems` (59%), followed by ´localized systems` (50%), and ´sprinkling systems` (27 %). The 2-star hotel did not apply any of these systems, remarkable since it has garden facilities. Low consumption or efficient kitchen appliances were implemented by 45% percent of the sample. With respect to laundry appliances, most hotels had ´low consumption washing machine through mechanic systems´, while not many used ´low consumption washing machine through electronic systems` (Table 6).

Table 6. Implementation of water-saving Reducing strategies in Benidorm hotels (based on Rico et al. (2019)). (Dk= don´t know; na= no answer))

Hotel category	Number hotels	Water meter				General flow reducer			
		Yes	No	Dk	na	Yes	No	Dk	na
2-stars	1	1	0	0	0	1	0	0	0
3-stars	10	7	0	3	0	2	6	2	0
4-stars	9	6	0	3	0	2	5	2	0
5-stars	2	1	0	1	0	0	2	0	0
Total (%)		68	0	32	0	23	59	18	0

Taps

Hotel category	Timer/automatic shut-off/sensor/pedal				Aerator/diffuser				Flow redactor/limiter			
	Yes	No	Dk	na	Yes	No	Dk	na	Yes	No	Dk	na
2-stars	0	0	0	1	0	0	0	1	1	0	0	0
3-stars	5	5	0	0	3	5	0	2	7	3	0	0
4-stars	6	2	1	0	4	5	0	0	6	3	0	0
5-stars	1	1	0	0	2	0	0	0	0	2	0	0
Total (%)	54	36	5	5	41	45	0	14	64	35	0	0

Showers

Hotel category	Timer				Aerator				Flow redactor/limiter				Thermostatic			
	Yes	No	Dk	na	Yes	No	Dk	na	Yes	No	Dk	na	Yes	No	Dk	na
2-stars	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0
3-stars	6	1	0	3	5	5	0	0	5	4	0	1	1	6	0	3
4-stars	0	9	0	0	4	5	0	0	6	3	0	0	1	8	0	0
5-stars	0	2	0	0	1	1	0	0	1	1	0	0	1	1	0	0
Total (%)	27	59	0	14	55	45	0	0	59	36	0	5	14	72	0	14

Toilets

Hotel category	Double flush mechanisms				Flush interruption systems				Counterbalance systems				Fill or flush cistern limiting system			
	Yes	No	Dk	na	Yes	No	Dk	na	Yes	No	Dk	na	Yes	No	Dk	na
2-stars	0	1	0	0	0	1	0	0	0	1	0	0	1	0	0	0
3-stars	3	7	0	0	3	7	0	0	3	7	0	0	4	6	0	0
4-stars	2	7	0	0	2	7	0	0	1	8	0	0	3	5	1	0
5-stars	1	1	0	0	1	1	0	0	0	2	0	0	1	1	0	0
Total (%)	27	73	0	0	27	73	0	0	18	82	0	0	41	54	5	0

Irrigation systems

	Localized systems				Sprinkling systems				Dripping systems			
Hotel category	Yes	No	Dk	na	Yes	No	Dk	na	Yes	No	Dk	na
2-stars	0	1	0	0	0	1	0	0	0	1	0	0
3-stars	5	5	0	0	3	6	0	1	7	3	0	0
4-stars	5	4	0	0	2	7	0	1	5	4	0	0
5-stars	1	1	0	0	1	1	0	0	1	1	0	0
Total (%)	50	50	0	0	27	68	0	5	59	41	0	0

Appliances

	Low consumption dishwasher				Low consumption washing machine (mechanic systems)				Low consumption washing machine (electronic systems)			
Hotel category	Yes	No	Dk	na	Yes	No	Dk	na	Yes	No	Dk	na
2-stars	0	0	0	1	0	1	0	0	0	1	0	0
3-stars	5	5	0	0	6	3	0	1	1	5	0	4
4-stars	5	4	0	0	3	5	0	1	1	6	0	2
5-stars	0	1	1	0	0	1	1	0	0	1	1	0
Total (%)	45	45	5	5	41	45	5	9	9	59	5	27

Innovative Reusing

Reusing variables were three: ´coffee machines with water recirculation systems of continuous brew`, ´greywater systems for irrigation`, and ´harvested rainwater for irrigation`. These systems allow to reuse water for the same purpose (e.g. coffee machines), or for other purpose, for instance, grey water from different sources (e.g. laundry room, kitchen, sinks) for irrigation. Also, taking advantage of rainwater for watering gardens is a way of reusing water.

Four hotels stated that they had ´water circulation in coffee machines´, while eleven hotels stated that they have not introduced that tool, and the rest did not know or did not answer the question. Moreover, only two hotels have introduced ´greywater systems for irrigation`, accounting for a 9% of the sample. These two were a 3-stars and a 5-stars hotel. ´Rainwater harvesting for irrigation` was implemented in three hotels, including two 3-stars hotels, and one 4-star hotel (Table 7).

Table 7. Implementation of water-saving Reusing strategies in Benidorm hotels (based on Rico et al. (2019)).

		Water circulation in coffee machines				**Greywater for irrigation**				**Rainwater for irrigation**			
Hotel category	**Number hotels**	Yes	No	Dk	na	Yes	No	Dk	na	Yes	No	Dk	na
2-stars	1	1	0	0	0	0	1	0	0	0	1	0	0
3-stars	10	1	7	2	0	1	6	1	2	2	6	0	2
4-stars	9	2	3	3	1	0	6	1	2	1	6	0	2
5-stars	2	0	1	1	0	1	1	0	0	0	2	0	0
Total (%)		18	50	27	5	9	64	9	18	14	68	0	18

Innovative Recycling

Recycling measures included one variable: ´closed water treatment for swimming pool`. Though this measure does not "turn very dirty and polluted water to clean drinkable water" (Kasim et al. 2014, p. 1102), closed water treatment systems in swimming pools do treat ´dirty´ water so that it can be recycled into the swimming pool to avoid renovating water. More than three quarters of hotels have introduced this measure into their swimming pool facilities (Table 8).

Table 8. Implementation of water-saving Recycling strategies in Benidorm hotels (based on Rico et al. (2019)).

		Closed water treatment for swimming pool			
Hotel category	**Number hotels**	Yes	No	Dk	na
2-stars	1	1	0	0	0
3-stars	10	8	2	0	0
4-stars	9	8	1	0	0
5-stars	2	1	1	0	0
Total (%)		82	18	0	0

Table 9 summarizes the water-savings measures into the different 4R categories (2014).

Table 9. Water-saving measures classified according the 4R Framework.

Innovative Reaching	- Formalized policies for water management (incl. prevention and control of leaks)	
	- Formalized action plan/program for water-saving or consumption reduction	
	- Standard certification (EMAS, ISO 14001; ecolabel or other)	
	- Signs with information on rational water use the water consumption hotspots	
	- Towel reusing programs	
	- Bedding/linen reusing programs	
	- Staff training and increased awareness to identify and apply good practices and make a good use of water resources.	
	- Promotion of responsible participation of staff in water management	
	- Planting native species in gardens	
Innovative Reducing	- Water meter	Number of meters
	- General flow redactor	
	- Taps	Timer and/or automatic shut-off and/or presence sensor and/or pedal operated Aerators/diffusers Flow reducers/limiters
	- Shower heads	Timer taps Thermostatic taps Flow reducers/limiters Aerators
	- Toilets	Double/dual flush mechanisms Flush interruption systems Cistern counterbalance systems Fill or flush cistern limiting system
	- Washing machines	Low consumption or efficient use through electronic systems Low consumption or efficient use through mechanic systems
	- Irrigation systems	Localized systems Dripping systems Sprinkling systems
Innovative Reusing	- Coffee machines with water recirculation systems continuous brew	
	- Greywater systems for irrigation	
	- Harvested rainwater for irrigation	
Innovative Recycling	- Swimming pool closed loop greywater treatment	

5.2.2. Energy-saving measures

Innovative Reaching

The energy sources have been included in the Reaching category, as the decision to (not) select and use can be related to education (e.g. teaching staff and guests), collaboration (e.g. energy certifications based on energy sources and CO2 emissions, environmental mindedness, relationship with other institutions), and compensation (e.g. taxes, costs, subsidies) in the hotel.

To start with, electricity was used by all hotels in the sample. Some hotels stated that electricity is used mainly for lighting, and general purposes except for water heating. Diesel was used by all hotels that responded to the question (three quarters) to produce HSW. Then, Propane was used by 80% of all hotels, for cooking, laundry, and heating water. Natural gas was used by one third and one respondent stated that it was used for the kitchen, laundry, HSW, and water heater. Butane was used by two four stars hotels in the sample. Moreover, Solar panels have been installed by five hotels which count for one third of the sample, to produce energy for HSW and the swimming pool. Another respondent indicated that solar panels are to support diesel usage. Lastly, none of the hotels answered whether they include photovoltaic as an energy source in their hotels (see Table 10).

In the final comments, one respondent indicated that their hotel used geothermal energy, and on-site wind turbines. The same establishment indicated that actions were being undertaken to create awareness among staff and clients. Another respondent stated in the comments that solar panels were installed, but it was not mentioned again throughout the rest of the questionnaire.

Table 10. Implementation of energy-saving Reaching strategies for freshwater in Benidorm hotels (based on Yoon et al. (2018)).

Energy Source for Freshwater

		Electricity			**Diesel**			**Propane**		
Hotel category	**Number hotels**	Yes	na	Average consumption	Yes	na	Average consumption	Yes	na	Average consumption
3-stars	6	6	0	0	4	2	2	6	0	0
4-stars	9	9	0	0	7	2	2	6	3	0
Total (%)	15	100	0		73	27		80	20	0

	Natural Gas			**Butane**			**Solar panels**		
Hotel category	Yes	na	Average consumption	Yes	na	Average consumption	Yes	na	Average consumption
3-stars	1	5	0	0	6	2	1	5	0
4-stars	4	5	0	2	7	2	4	5	0
Total (%)	33	67		13	87		33	67	0

	Photovoltaic		
Hotel category	Yes	na	Average consumption
3-stars	0	6	0
4-stars	0	9	0
Total (%)	0	100	0

As it was revealed by the previous results, three quarters of the sample used diesel as the energy source to produce HSW, compared to one fifth that used Propane, and one tenth that used Natural Gas. Solar panels were the second used source for HSW possibly to support diesel usage, as one respondent stated before. Butane and photovoltaic energy sources were not used by any of the respondents (Table 11).

Table 11. Implementation of energy-saving Reaching strategies for HSW in Benidorm hotels (based on Yoon et al. (2018)).

Energy Source for Hot Sanitary Water (HSW)

Hotel category	Number hotels	HSW Electricity			HSW Diesel			HSW Propane		
		Yes	na	Average consumption (kWh)	Yes	na	Average consumption	Yes	na	Average consumption
3-stars	6	0	6	1014138	4	2	2	1	5	0
4-stars	9	1	8		7	2	2	2	7	0
Total (%)	15	7	93		73	27		20	80	0

Hotel category	HSW Natural Gas			HSW Butane			HSW Solar panels		
	Yes	na	Average consumptio n	Yes	na	Average consumption	Yes	na	Average consumptio n
3-stars	0	6	0	0	6	2	0	6	0
4-stars	2	7	0	0	9	2	4	5	0
Total (%)	13	87		0	100		27	73	0

HSW Photovoltaic		
Yes	na	Average consumption
0	6	0
0	9	0
0	100	0

Innovative Reducing

Reducing variables included whether a hotel had one or more energy meter. ´Pumps for water distribution on the building` were classified as innovative reducing, as the number of pumps and the pump´s power/efficiency can be adjusted to reduce or increase energy consumption. ´HSW deposits` were also included as more deposits indicate less energy consumption to produce HSW instantaneously.

From the results, ninety percent of hotels had one ´energy meter` and one 4-stars hotel had five energy meters. The results for pumps were very variable. Most hotels had two pumps for freshwater distribution, especially 4-stars hotels, while most 3-stars hotels had 4 pumps. Only one hotel had six pumps for water distribution, which was also the highest establishment. Most hotels had three or four pumps for HSW, though there was a high no answer rate for this question. For ´other water resources´ only four hotels answered, from which two had one pump and two had two pumps. HSW deposits were three or five for most hotels. The rest had either one, two or four, and two hotels had six and seven deposits (Table 12).

In the additional comments, one hotel indicated that ´proximity sensors for lights` were installed in their hotel as an innovative reducing measure. Another hotel indicated that the exterior facade was insulated, to reduce needs for conditioning of the building. One more respondent mentioned the reform of the hotel´s facade, though it was not explicitly mentioned that it was for insulation.

Table 12. Implementation of energy-saving Reducing strategies in Benidorm hotels (based on Yoon et al. (2018)).

Hotel category	Number hotels	Energy meter		Pumps for freshwater distribution			
		One meter	1+ meter	2	3	4	6
3-stars	6	6	0	2	1	3	0
4-stars	9	8	1(5)	4	2	2	1
Total (%)	15	93	7	40	20	33	7

Hotel category	Pumps for HSW distribution						Pumps for other water resources		
	0	1	2	4	6	na	1	2	na
3-stars	0	1	1	3	0	1	2	0	4
4-stars	1	1	3	0	1	2	0	2	7
Total (%)	7	13	27	20	7	20	13	13	74

Hotel category	HSW deposits							
	1	2	3	4	5	6	7	na
3-stars	0	0	3	0	2	0	0	1
4-stars	1	2	2	1	1	1	1	0
Total (%)	7	13	33	7	20	7	7	7

Innovative Reusing

Reusing measures included the installation of solar panels. A detailed analysis was made of the number of installed solar panels, the surface of the solar panels, and the savings for hotels that solar panels have generated in terms of kWh and Euros. Solar panels were installed in six hotels - counting for the respondent that indicated the installation of solar panels in the additional comments –. Four hotels have indicated that the solar panels were used for the production of HSW. On average, the hotels had 124 solar panels installed, with an average surface of 1.83m^2 per panel (Table 13). Moreover, three hotels answered the questions on the savings in kWh, resulting on 23.85% of savings on average (Note: one hotel was excluded from the calculation since the number given was not valid). Again, three hotels responded on the savings that the installation of solar panels have entailed, which was 16,654 EUR on average in a year.

Table 13. Implementation of energy-saving Reusing strategies in Benidorm hotels (based on Yoon et al. (2018)).

Hotel category	Solar panels		HSW Solar panels			Number of solar panels		Surface Solar panels	
	Yes	na	Yes	na		Yes	v	Yes	na
3-stars	1	5	0	6		0	6	0	6
4-stars	4	5	4	7		5	4	5	4
Total (%)	33.33	66.67	13.33	86.67	Average Total	124		1.83m^2	

Hotel category	Savings in kWh		Savings in EUR	
	Yes	na	Yes	na
3-stars	0	6	0	6
4-stars	3	6	3	6
Average Total	23.85%		16654 EUR	

Innovative Recycling

Recycling measures have included the ´pumps for water circulation in swimming pool and SPA facilities`. These pumps allow for the used and treated water to recirculate and renovate the water. Four stars hotels had mainly one or six pumps while, three stars hotels had two or five pumps. One hotel said to have twenty-five pumps, having the largest swimming pool capacity (1200m^3) (Table 14).

Table 14. Implementation of energy-saving Recycling strategies in Benidorm hotels (based on Yoon et al. (2018)).

Hotel category	Pumps for water circulation in swimming pool and SPA						
	1	2	3	5	6	25	na
3-stars	0	2	0	2	0	1	1
4-stars	4	1	1	0	3	0	0
Total (%)	26.67	20	6.67	13.33	20	6.67	6.67

In table 15 below I categorize the energy-savings measures into the different 4R categories adjusted to the framework by Kasim et al. (2014).

Table 15. Energy-saving measures classified according to the 4R Framework (Source: own elaboration)

Innovative Reaching	- Energy sources		- Electric - Diesel - Propane - Natural Gas - Butane - Solar panel - Photovoltaic - Other
	- EMS (ISO 14001 Norm)		
Innovative Reducing	- Energy meter	Number of meters	
	- Pumps	Pumps to distribute freshwater Pumps to distribute HSW Pumps for other water resources	
	- Hot sanitary water (HSW)	Consumption (L) HSW accumulators /storage banks	
	- Solar panels		- Number of collectors

Innovative Reusing	- Surface of collectors - Savings from collectors (kWh) - Savings from collectors (EUR)
Innovative Recycling	- Swimming pool/SPA pumps to recirculate water

5.3. Drivers and barriers for the implementation of water- and energy- saving measures in the hotel sector in Benidorm

In this section the drivers and barriers to implement water- and energy- saving measures. The results derived partly from the survey data, and partly from a literature review. The drivers and barriers are classified according to Kasim et al.´s (2014) 4R framework adjusted for this study.

5.3.1. Drivers for water- and energy-saving measures

Drivers in hotels are derived from the survey of Rico et al. (2019) on the hotel´s motivation to implement water-saving measures. Table 16 below presents the motivational factors according to the category of the hotel. The results show that the factors that were most selected, in general, as drivers to implement water-saving measures were: "Legal compliance on environmental regulations" (63%); the "reduction of operational costs" (59%); "awareness by the hotel" (50%); "awareness and adaption strategies for future climate change" (50%). However, the factors that were considered as ´most important´ from which they could only select one were: "Increased awareness by the users/clients" (18%) of the hotels, the "experienced droughts in the past years" (18%), the "reduction of operational costs" (13%), "legal compliance on environmental regulations" (9%), "environmental awareness/worries by the hotel´ (9.09%) and ´worries and adaption strategies for future climate change" (4%).

Hotels are less driven by the fact that the sector is "adopting these kinds (i.e. environmental) of practices" (86% did not selected this factor as driver), and due to "worries about the market barriers that environmental problems can entail" (86% did not selected this factor as driver). The "competitive advantage" that the hotel may gain by introducing water-saving measures, and the "reduced investment required" to implement those measures, were also not highly considered by the hotels, according to the results (Table 16).

Table 16. Motivational factors to implement water-saving measures in Benidorm hotels (based on Rico et al. 2019)

	Hotel Category	**Important factor**	**Most important factor**	**na**
Legal compliance to environmental regulations	2-stars	0	0	1
	3-stars	4	1	5
	4-stars	8	1	0
	5-stars	2	0	0
	Total	14	2	6
	Total (%)	**63.64**	**9.09**	**27.27**
	2-stars	0	1	0

Reduction of operational costs	3-stars	6	0	4
	4-stars	7	1	1
	5-stars	0	1	1
	Total	14	3	6
	Total (%)	**59.09**	**13.64**	**27.27**
Improvement of the hotel brand image	2-stars	1	0	0
	3-stars	3	0	7
	4-stars	5	0	4
	5-stars	2	0	0
	Total	11	0	11
	Total (%)	**50**	**0**	**50**
The reduced/low required investment to implement the measure	2-stars	0	0	1
	3-stars	3	0	7
	4-stars	4	0	5
	5-stars	0	0	2
	Total	7	0	15
	Total (%)	**31.82**	**0**	**68.18**
Maintain/gain competitive advantage	2-stars	1	0	0
	3-stars	3	0	7
	4-stars	1	0	8
	5-stars	1	0	1
	Total	6	0	16
	Total (%)	**27.27**	**0**	**72.73**
Increased demand/awareness/sensitivity expressed by the clients/users	2-stars	1	0	0
	3-stars	3	2	5
	4-stars	3	2	4
	5-stars	2	0	0
	Total	9	4	9
	Total (%)	**40.91**	**18.18**	**40.91**
Concerns for the market barriers that the environmental issues can entail	2-stars	0	0	1
	3-stars	7	1	2
	4-stars	4	1	4
	5-stars	0	0	2
	Total	11	2	9
	Total (%)	**50**	**9.09**	**40.91**
Because the sector/industry is generally adopting this type of practices	2-stars	0	0	1
	3-stars	3	0	7
	4-stars	0	0	9
	5-stars	0	0	2
	Total	3	0	19
	Total /%)	**13.64**	**0**	**86.36**
Concerns for the market barriers that the environmental issues can entail	2-stars	1	0	0
	3-stars	1	0	9
	4-stars	1	0	8
	5- stars	0	0	2
	Total	3	3	19
	Total (%)	**13.64**	**0**	**86.36**
Experience of droughts events in the past years	2-stars	0	0	1
	3-stars	5	1	4
	4-stars	0	2	7
	5-stars	0	1	1
	Total	5	4	13

	Total (%)	**22.73**	**18.18**	**59.09**
Concerns, awareness, and adaption future climate change projections	2-stars	0	0	1
	3-stars	5	0	5
	4-stars	4	1	4
	5-stars	2	0	0
	Total	11	1	10
	Total (%)	**50**	**4.55**	**45.45**

Based on my literature review of comparable studies, in terms of sample size and location (Tirado et al., 2019; Torres-Bagur et al., 2019). I developed Figure 8 to show the drivers for hotels to implement water and energy measures. The drivers for Reaching and Reducing strategies are similar. Financial investments to introduce Reaching and Reducing do not necessarily need to be large, while they reduce operational costs through energy and water savings almost immediately after its implementation (Torres-Bagur et al., 2019). Moreover, the technology required is often low thus easy to introduce regardless the hotel´s technological capabilities (Kasim et al., 2014; Torres-Bagur et al., 2019). While Reaching strategies require a bit more of monitoring, for instance, to accomplish the requirements for ´EMS or certifications`, Reducing strategies do not require high monitoring.

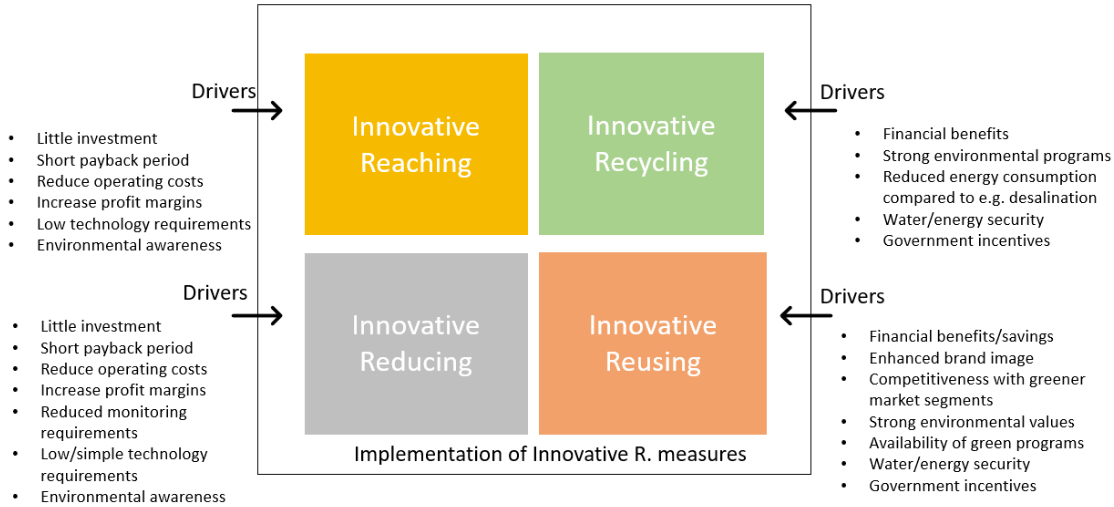

Figure 8. Drivers for water-saving measures according to the 4R Framework categories

Reusing and Recycling drivers are also similar. Both strategies generate financial benefits as they directly reduce the use of freshwater and energy, or indirectly through reducing needs for desalinated water thus decreasing energy consumption. Likewise, both strategies ensure the availability of water and energy even through their production and reduces the dependency on resource availability (Hernández-Sánchez et al., 2017; Yoon et al., 2018). Improving the competitiveness with greener market segments also seems to be a motivational factor according to the literature. The availability of a green program, an appropriate legal framework, and incentives from the government can be a strong determinant for hotels to implement these type measures. From the survey of Yoon et al. (2018), three hotels indicated that they had received grants from the ´Tourism Agency of the Valencian Community Government`; the ´Energy Agency of the Valencian Community Government`; the ´grant for the improvement of conditions and services in the hotel sector`; and the European Regional Development Fund to make reforms, for instance, installing solar panels, new air conditioning systems, and shift from diesel to natural gas.

Drivers for water-saving measures

From the analysis with the fisher´s exact test (see Appendix 5), the water-saving measures did not result to have a significant relationship ($p > 0.05$) with “Legal compliance on environmental regulations”, “Maintain/gain competitive advantage”, “Increased awareness/worries by the users/clients”, “Worries on the market barriers that the environmental problems can entail”, “The experienced droughts in the past years”. The introduction of ´taps with timer and/or automatic shut-off and/or presence sensor and/or pedal operated`, ´taps with aerators/diffusers`, ´shower heads with thermostatic taps`, and with ´signs with information on rational water use the water consumption hotspots` were significantly ($p < 0.05$) related to the motivational factor “Reduction of operational costs”. The implementation of ´taps with timer and/or automatic shut-off and/or presence sensor and/or pedal operated`, ´shower heads with thermostatic taps` ($p < 0.01$), ´Washing machines of low consumption or efficient use through mechanic systems`, ´greywater systems for irrigation` and ´harvested rainwater for irrigation` were significantly ($p < 0.05$) related to the “Improvement of the hotel brand image”.

Moreover, ‘planting native species in gardens` was significantly ($p < 0.05$) related to **“**The reduced/low required investment to implement the measure”. The implementation of ´taps with timer and/or automatic shut-off and/or presence sensor and/or pedal operated` was significantly ($p < 0.05$) related to the “Environmental awareness/worries by the hotel” driver. Then, ´planting native species in gardens` was significantly ($p < 0.01$) related the factor where hotels introduce measures “because the sector/industry is generally adopting this type of practices”. Finally, the implementation of ´general flow redactor`, ´taps with flow reducers/limiters` and to ´harvested rainwater for irrigation` was significantly ($p < 0.05$) related to “Worries and adaptation strategies for future climate change”.

5.3.2. Barriers for water and energy saving measures

The barriers to introduce water and energy saving measures were obtained through the literature review (Chan et al., 2018; Torres-Bagur et al., 2019, etc.) (see Section 2.3). Figure 9 summarizes the main external and internal barriers found for each category of the 4R Framework developed by Kasim et al. (2014).

Reaching strategies require high monitoring of the environmental actions undertaken and to “accomplish the requirements for environmental certifications”. Clients might not welcome measures such as towel and bedding reusing policies, which can lead to client discomfort, and can cause concerns about “hotel image and quality” (i.e. publicity and marketing barriers This was also the case for refusing to introduce native or drought tolerant plants (Torres-Bagur et al., 2019). Thus, the “fit of the water and energy measures in the business operations” and the “company´s corporate culture” are key determinants to implement resource saving measures (Chan et al., 2018). Finally, staff needs to be highly engaged for an effective practical implementation of the saving measures (Razumova et al., 2016; Torres-Bagur et al., 2019).

Barriers for Reducing strategies can be also related to “consumer satisfaction and comfort” in the case of shifting bath to showers, which were related to “marketing and publicity worries”, and “legislation and regulation barriers” according to Torres-Bagur et al. (2019). Moreover, these measures require the installation of simple technological devices, and need to fit within the business operations (Chan et al., 2018). Even, water and energy meters can be perceived as ´sophisticated´ which can also limit its implementation (Torres-Bagur et al., 2019). The general

”lack of environmental awareness” by the hoteliers can further hinder the implementation of these measures, as well as the other categories (Torres-Bagur et al., 2019).

Reusing measures require “high investment costs”, while the “payback period” is longer than for Reaching and Reducing strategies. Furthermore, the “costs for maintenance” are high and entail complex “monitoring techniques” for the good functioning of the water systems or renewable energy technologies (Torres-Bagur et al., 2019). Moreover, the “lack of business models and markets” for reusing systems and technologies, the “limited institutional framework” and the “lack or limited of governmental and/or financial incentives”, can hinder the implementation of measures in this 4R category (Alcalde Sanza & Gawlik, 2014).

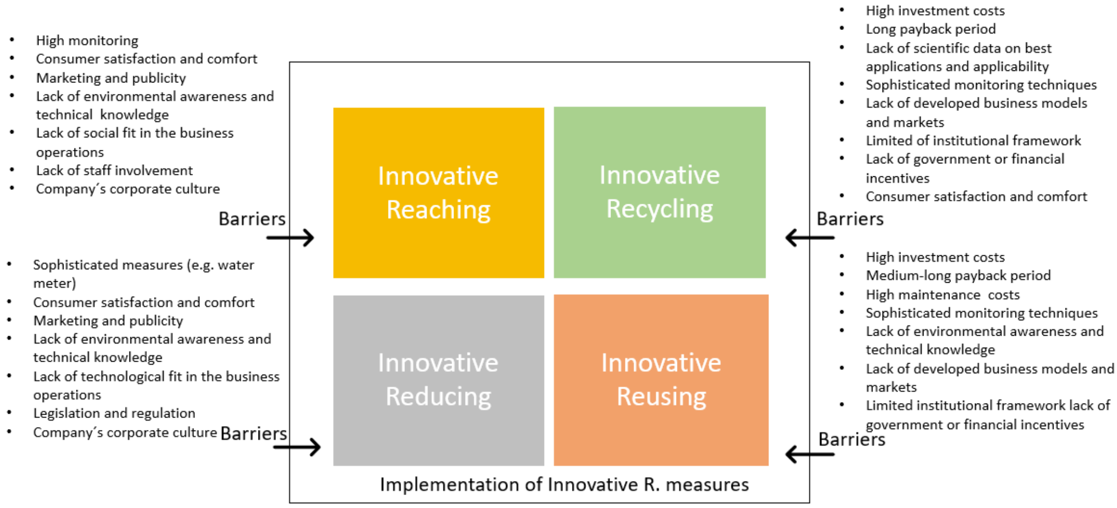

Figure 9. Barriers for water-saving measures according to the 4R Framework categories

Finally, Recycling strategies require hotels to be knowledgeable and have the technological capability to implement these measures. From the sample, the only Recycling measures were ´swimming pool closed loop greywater treatment systems´ and the pumps required for the functioning of the system, which are popular among the hotels. Yet, similar barriers as for Reusing strategies were considered. High investment costs, long payback period, high maintenance costs and sophisticated monitoring costs are often required (Torres-Bagur et al., 2019). Furthermore, government and financial incentives, as well as an appropriate institutional framework for these measures are key determinants. Lastly, the lack of scientific data on the applications and applicability of such complex measures are very relevant.

5.4. Water and energy-saving measures and water and energy consumption in the hotel sector in Benidorm.

5.4.1. ´*Water for water*` and ´*water for energy*` perspective

In this section, the results from the multiple regression analysis to assess the relationship and the relative importance of each water-saving measures and the ´percentage of water consumption/cost over the total operational costs` are presented.

5.4.1.1 Water saving measures and ´percentage of water consumption/cost` over total operational costs.

The analysis for Reaching measures excluded the variables: ´towel reusing policies´, and ´staff participation in water management programs´ due to lack of more than one levels (e.g. all hotels responded "Yes") of observations, or limited observations (i.e. not enough responses to perform the test). For instance, all hotels have stated to have implemented ´staff participation in water management programs`. R output (Figure 10) shows that a model with all the predictors -except for the excluded variables- accounted for 77% percent of the variance in predicting the ´percentage of water consumption/cost` (Adjusted R2 = 0.77) which is not significantly better than the null model (i.e. a model without any predictors) ($F_{7,1}$=4.825 p=.33). Note that the negative signs in the adjusted R2 indicate that the explanation of the outcome is very low or negligible. This can be due to the impact of too many independent variables or due to the low sample size (Field, 2016).

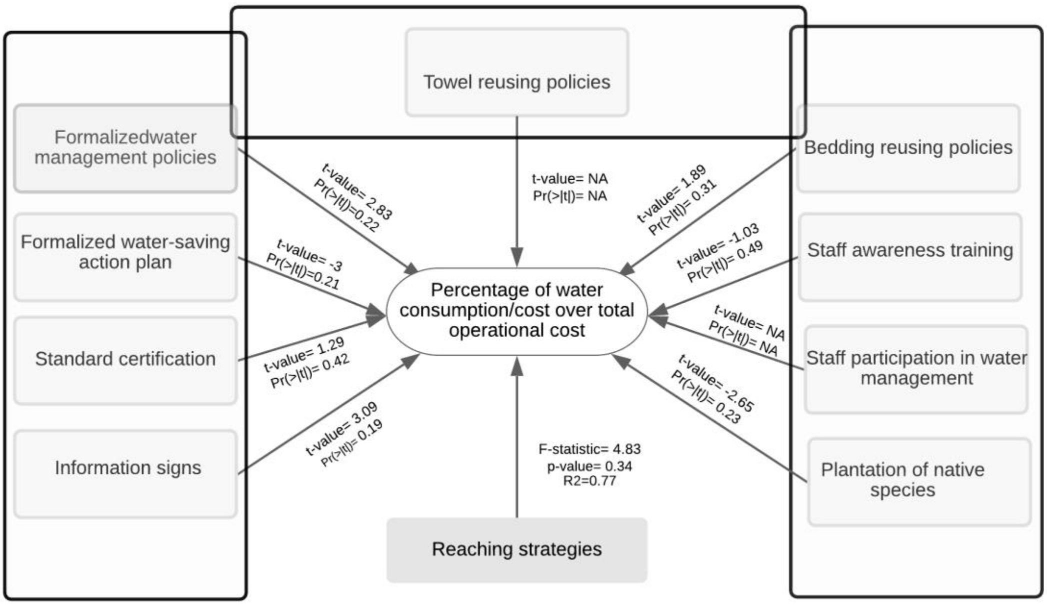

Figure 10. Multiple Regression for Water Innovative Reaching strategies and Percentage of water consumption/cost over total operational costs. Corresponding image for Table 20 Appendix 5 (based on Rico et al. (2019)).

From the B-coefficient (i.e. Beta coefficient) (see Table 20 in Appendix 5) we obtained that with ´percentage of water consumption/cost` has a negative relationship formalized action plans, information signs, towel reusing policies and staff awareness training. This means that, despite the non-significance except for information signs, the implementation of these measures lead to decreases in the dependent variable. The ´percentage of water consumption/cost` had a positive relationship with the remaining set of variables.

The multiple regression analysis for Reducing strategies was performed by several multiple regressions and in clusters of measures for the same devices (i.e. Taps, Toilets, Showers etc.) to avoid having too many independent variables, and negative adjusted R squares. The results from the regressions indicate (see Table 21-27 Appendix 5):

- Water meters accounted for 12% of the variance (R2= 0.1203) for ´percentage of water consumption/cost`, which is not significantly better than the null model (i.e. a model with no predictors) ($F_{1,13}$=1.778 p=0.205). The B-coefficient is negative, indicating a negative relationship with ´percentage of water consumption/cost` (i.e. decreases in ´percentage of water consumption/cost`);

- Overall flow reductors accounted for 19% of variance (R2= 0.196) for ´percentage of water consumption/cost`, which is not significantly better than the null model ($F_{1,13}$=1.471, p=0.09). The B-coefficient is negative, indicating a negative relationship with ´percentage of water consumption/cost` (i.e. decreases in ´percentage of water consumption/cost`);

- Devices applied in taps: Taps with timer and/or automatic shut-off, taps with aerators/diffusers, and taps with flow reducers/limiters accounted for 13% of the variance (Adjusted R2=0.139) ´percentage of water consumption/cost`, which is not significantly better than the null model ($F_{4,10}$=1.564, p=0.258). Taps with aerators/diffusers showed a negative coefficient indicating a negative relationship with ´percentage of water consumption/cost` (i.e. decreases in the ´percentage of water consumption/cost`), whilst the remaining two measures showed a positive B-coefficient (i.e. increases in ´percentage of water consumption/cost`);

- Devices applied in showers: timer taps, thermostatic taps, flow reducers/limiters, and aerators accounted for -2% of the variance (Adjusted R2=-0.02), which is not significantly better than the null model ($F_{3,10}$=0.875, p=0.481). All the shower devices showed a positive B-coefficient indicating a positive relationship with ´percentage of water consumption/cost` (i.e. increases in ´percentage of water consumption/cost`);

- Devices applied in toilets: double/dual flush mechanisms, flush interruption systems, cistern counterbalance systems, fill or flush cistern limiting system. A model with all predictors accounted for 36% of the variance ´percentage of water consumption/cost` (Adjusted R2=0.36), which is not significantly better than the null model ($F_{5,9}$=2.578, p=0.103). Toilets with fill or flush cistern limiting system added to explaining the ´percentage of water consumption/cost` (T=3.205, p=0.011). From the B-coefficient sign, we obtained that ´percentage of water consumption/cost` is positively related to toilets with fill or flush cistern, indicating that ´percentage of water consumption/cost` increases with its implementation. Despite the non-significance, double/dual flush mechanisms, flush interruption systems in toilets showed a negative B-coefficient, indicating a negative relationship with ´percentage of water consumption/cost` (i.e. decreases in ´percentage of water consumption/cost`);

- Devices in kitchen appliances: low consumption dishwasher and water efficiency systems, low consumption or efficient use washing machines through electronic systems, Low consumption or efficient use washing machines through mechanical systems accounted for -18% of the variance (Adjusted R2=-0.187). which is not significantly better than the null model ($F_{3,8}$=0.425, p=0.742). All three measures showed a negative B-coefficient, indicating a negative relationship with ´percentage of water consumption/cost` (i.e. decreases in ´percentage of water consumption/cost`); and

- Devices applied for irrigation systems: localized systems, dripping systems, and sprinkling systems, accounted for 2% of the variance (Adjusted R2=-0.026) in the outcome which is not significantly better than the null model ($F_{3,8}$=, p=0.381). All three measures showed a negative B-coefficient, indicating a negative relationship with ´percentage of water consumption/cost` (i.e. decreases in ´percentage of water consumption/cost`).

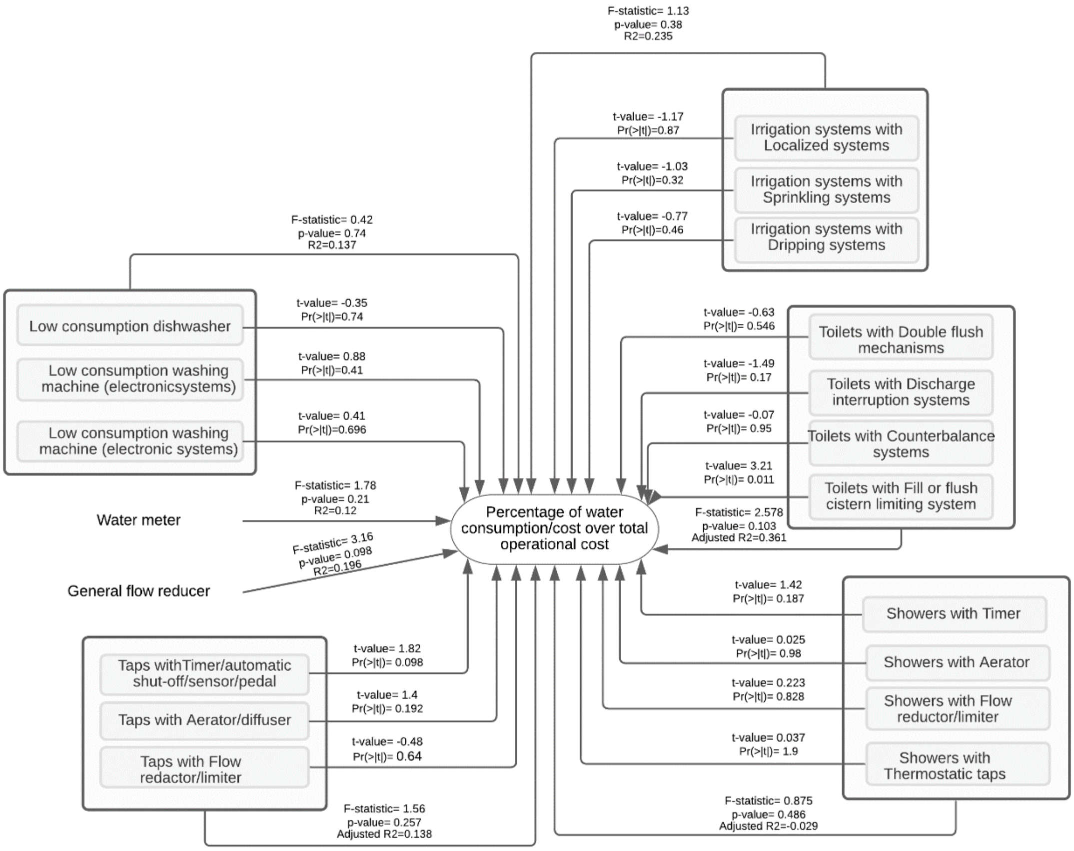

Figure 12. Multiple Regression (Not that analyses for Water meter and General flow reducer are linear regression tests) for Water Innovative Reaching strategies and Percentage of water consumption/cost over total operational costs. Corresponding image for Table 21-Table 27 Appendix 5 (based on Rico et al. (2019)).

The analysis for Reusing strategies was performed for all the three variables in this category. Rainwater for irrigation was excluded from the analyses. A model with the two variables accounted for 9% of the variance (Adjusted R2=0.093) for ´percentage of water consumption/cost`. This is not significantly better than the null model (a model without any predictors). ($F_{2,8}$=1.51, p=0.277). The two variables presented a negative B-coefficient, indicating a negative relationship with ´percentage of water consumption/cost` (i.e. decreases in ´percentage of water consumption/cost`) (see Table 28 Appendix 5).

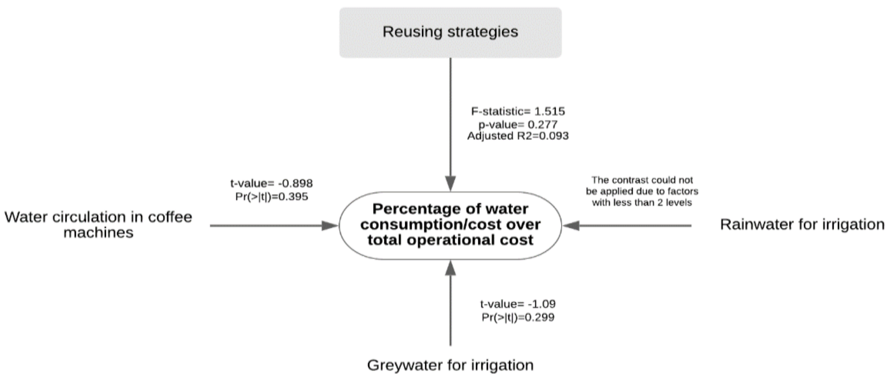

Figure 11. Individual regressions tests for Water Innovative Reusing strategies and Percentage of water consumption/cost over total operational costs. Corresponding image for Table 28 Appendix 5 (Rico et al. (2019)).

The Recycling measure swimming pool closed loop wastewater treatment was analyzed through a simple linear regression. The model with the predictor accounted for 4% of the variance (R2=0.041). This value is not significantly better than the null model ($F_{1,13}$=0.559, p=0.468). The B-coefficient is negative indicating a negative relationship with ´percentage of water consumption/cost` (i.e. decreases in ´percentage of water consumption/cost`) (see Table 29 Appendix 5)

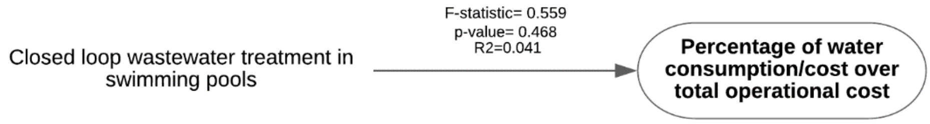

Figure 13. Individual regressions test for Water Innovative Recycling strategies and Percentage of water consumption/cost over total operational costs. Corresponding image for Table 28 Appendix 5 (based on Rico et al. (2019)).

6.4.1.2. Water saving measures and ´hotel water consumption` (2014)

The multiple regression analysis for the Reaching strategies shows that a model with all the predictors - except for ´towel reuse policies´ and ´staff participation in water management´ that were excluded, due to lack of more than two levels of observations, or limited observations- accounted for 32% percent of the variance (Adjusted R2 = 0.32) in predicting hotel´s water consumption, which is not significantly better than the null model (i.e. a model without any predictors) ($F_{7,3}$=1.69 p=0.36). ´hotel water consumption` showed a negative relationship with formalized action plans and staff awareness training as the B-coefficient were negative (i.e. decreases in ´hotel water consumption`) (see Table 30 Appendix 5).

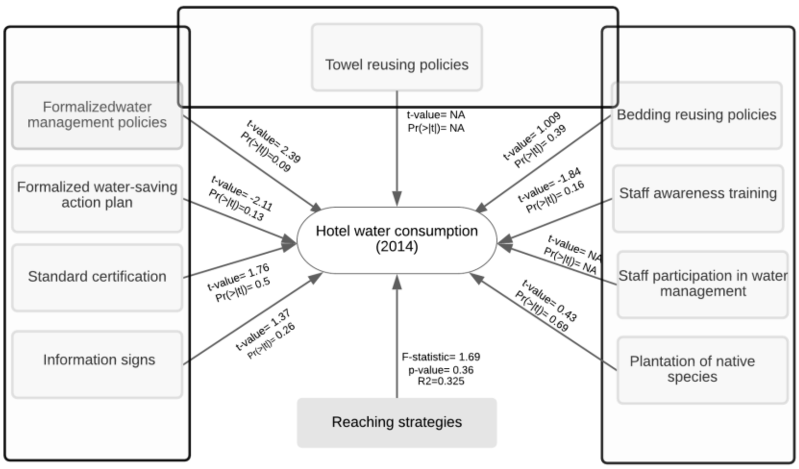

Figure 14. Multiple Regression for Water Innovative Reaching strategies and Hotel water consumption (2014). Corresponding image for Table 30 Appendix 5 (based on Rico et al. (2019) and Hotel annual water consumption Data (2005-2017)).

The multiple regression analysis for Reducing strategies was performed individually and in clusters of measures for the same devices (i.e. Taps, Toilets, Showers etc.) to avoid having too many independent variables, and negative adjusted R squares. The results from the regressions indicated (see Table 31- Table 37 Appendix 5):

- Water meters accounted for 8% of the variance (R2= 0.08) for percentage of water consumption over the hotel´s water consumption, which is not significantly better than the null model ($F_{1,19}$=1.735 p=0.203). The B-coefficient is positive, indicating a positive relationship with ´hotel water consumption` (i.e. increases in ´percentage of water consumption/cost`);

- Overall flow reductors accounted for 2% of variance (R2= 0.027) for percentage of water consumption over the hotel´s water consumption which is not significantly better than the null model ($F_{1,19}$=0.467, p=0.503). The B-coefficient is negative, indicating a negative relationship with ´hotel water consumption` (i.e. decreases in ´percentage of water consumption/cost`);

- Devices in taps: Taps with timer and/or automatic shut-off and/or presence sensor and/or pedal operated, taps with aerators/diffusers, and taps with flow reducers/limiters accounted for 5% of the variance (Adjusted R2=0.05), which is not significantly better than the null model ($F_{4,13}$=1.248, p=0.339). ´hotel water consumption` showed a significant negative B-coefficient with taps with aerator/diffuser indicating decreases in ´hotel water consumption`. The remaining two tap devices showed a positive B-coefficient indicating increases in ´hotel water consumption`;

- Devices in showers: timer taps, thermostatic taps, flow reducers/limiters, and aerators accounted for 3% of the variance (Adjusted R2=0.033), which is not significantly better than the null model ($F_{3,14}$=1.199, p=0.346). For the analysis, the variable Showers with thermostatic taps was excluded from the test. ´hotel water consumption` showed a negative B-coefficient for showers with flow/reductor/limiter indicating decreases in ´hotel water consumption`. The remaining two shower devices showed a positive B-coefficient indicating increases in ´hotel water consumption`;

- Devices in toilets: double/dual flush mechanisms, flush interruption systems, cistern counterbalance systems, fill or flush cistern limiting system. A model with all predictors accounted for -18% of the variance of the outcome (Adjusted R2=-0.182), which is not significantly better than the null model ($F_{4,16}$=0.231, p=0.916). ´hotel water consumption` showed a significant negative B-coefficient for toilets with counterbalance systems, fill or flush cistern limiting system (i.e. decreases in ´hotel water consumption`). The remaining two toilet devices showed a positive B-coefficient indicating increases in ´hotel water consumption`;

- Devices in kitchen appliances: low consumption dishwasher and water efficiency systems, low consumption or efficient use washing machines through electronic systems, Low consumption or efficient use washing machines through mechanical systems accounted for 22% of the variance (Adjusted R2=0.222), which is not significantly better than the null model ($F_{4,9}$=1.927, p=0.19). ´hotel water consumption` showed a negative B-coefficient for low consumption dishwasher (i.e. decreases in ´hotel water consumption`). The remaining two efficient systems in appliances showed a positive B-coefficient indicating increases in ´hotel water consumption`; and

- Devices for irrigation systems: localized systems, dripping systems, and sprinkling systems, accounted for 4% of the variance (Adjusted R2=0.044) in the outcome which is not significantly better than the null model ($F_{3,16}$=1.293, p=0.311). ´hotel water consumption` showed a negative B-coefficient for sprinkling systems (i.e. decreases in ´hotel water consumption`). The remaining two irrigation systems showed a positive B-coefficient indicating increases in ´hotel water consumption`.

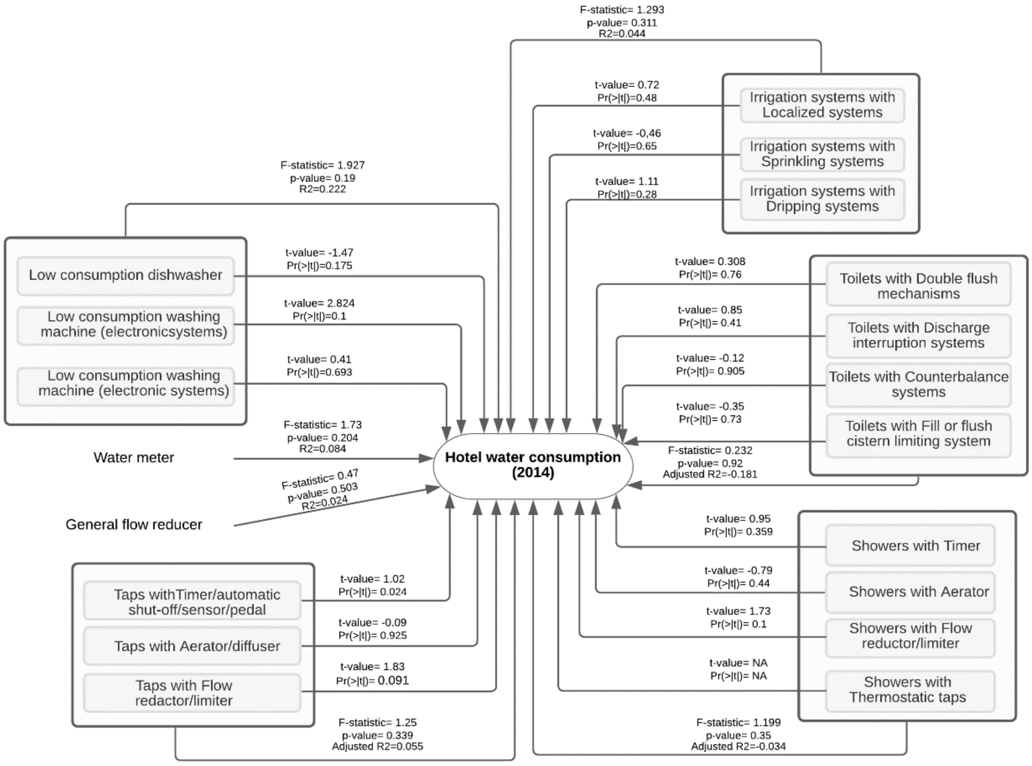

Figure 15. Multiple Regression and individual regressions tests (Water meter and General flow reducer) for Water Innovative Reaching strategies and hotel water consumption (2014). Corresponding image for Table 31- Table 37 Appendix 5 (based on Rico et al. (2019) and Hotel annual water consumption Data (2005-2017)).

The analysis for Reusing strategies was made for all the three variables in this category: ´coffee machines with water recirculation systems continuous brew`, ´greywater systems for irrigation` and ´harvesting rainwater systems for irrigation. A model with all three variables accounted for -2% of the variance (Adjusted R2=-0.239) for ´hotel water consumption`. This is not significantly better than the null model (a model without any predictors) ($F_{5,11}$=0.383, p=0.85). ´hotel water consumption` showed a negative B-coefficient for all three Reusing strategies indicating decreases in ´hotel water consumption` with the implementation of these measures (see Table 38 Appendix 5).

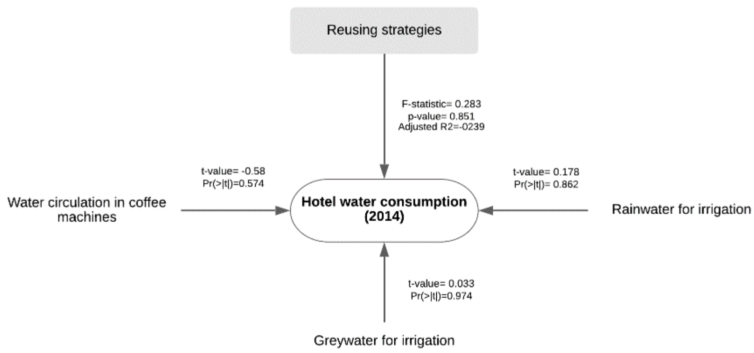

Figure 16. Individual regressions tests for Water Innovative Reusing strategies and Hotel water consumption. Corresponding image for Table 38 Appendix 5 (based on Rico et al. (2019) and Hotel annual water consumption Data (2005-2017)).

The Recycling measure ´swimming pool closed loop wastewater treatment` was analyzed through a simple linear regression. The model with the predictor accounted for 0.04% of the variance (R2=0.0004). This value is not significantly better than the null model ($F_{1,19}$=0.008, p=0.93). ´hotel water consumption` showed a significant negative B-coefficient for closed water treatment systems in swimming pools indicating decreases in ´hotel water consumption` with the implementation of this measure.

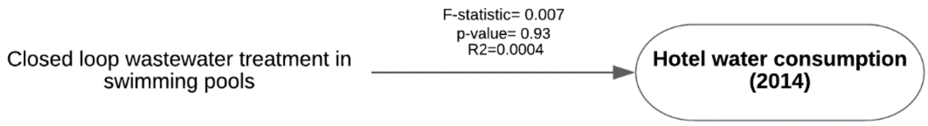

Figure 17. Individual regressions tests for Water Innovative Recycling strategies and Hotel water consumption. Corresponding image for Table 39 Appendix 5 (based on Rico et al. (2019) and Hotel annual water consumption Data (2005-2017)).

6.4.1.3 ´Water for Energy' perspective: Water saving measures and ´percentage of water consumption/cost` over total operational costs

The regression test between Reaching measures excluded several variables from the analysis due to missing values and fewer than two levels in the independent variables (i.e. water-saving measures). Thus, the analysis was done individually (i.e. linear regression) for only one independent variable, ´Bedding Reuse Strategies`. Bedding reuse strategies accounted for 91% of the variance (R2=0.911) of ´percentage of heating and cooling over the total energy consumption/cost`, which is not significantly better than the null model ($F_{1,1}$=10.27 p=0.192). Moreover, accounted for 61% of the variance (R2=0.615) for ´percentage of lighting over the total energy consumption/cost`, which is not significantly better than the null model ($F_{1,1}$=1.599 p=0.426). The B-coefficient in both regressions were positive indicating a positive B-coefficient for both variables (i.e. increases in the percentage of energy consumption/cost) (see Table 40 Appendix 5).

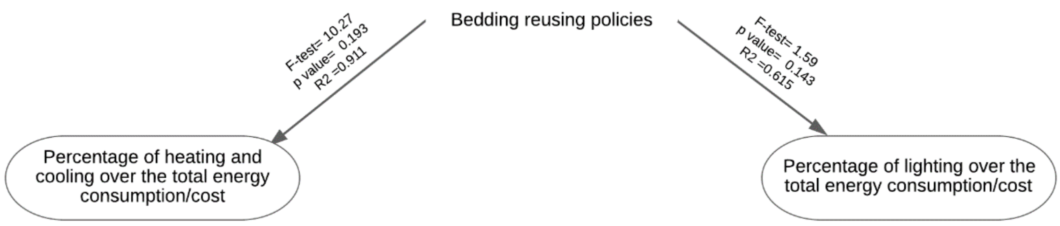

Figure 18. Individual regressions tests for Water Innovative Reaching strategies and Percentage of heating and cooling over the total energy consumption/cost and Percentage of lighting over the total energy consumption/cost Corresponding image for Table 40 Appendix 5 (based on Rico et al. (2019) and Yoon (2018b)).

Predictors from the Reducing measures were excluded in the regression test due to insufficient observations. Thus, the analysis was performed individually to the variables that had more than two response levels (i.e. tap devices, shower devices). The results indicated (see Table 41-Table 45 Appendix 5):

- ´Overall flow reductors` accounted for 45% of variance (R2= 0.459) for the ´percentage of heating and cooling over the total energy consumption/cost` which is not significantly better than the null model ($F_{1,1}$=0.849, p=0.526). The ´percentage of heating and cooling energy consumption/cost` showed a negative B-coefficient for overall flow reducers indicating decreases in ´hotel water consumption`. Moreover, ´overall flow reductors` accounted for 97% of variance (R2= 0.979) for the ´percentage of lighting over the total energy consumption/cost` which is not significantly better than the null model ($F_{1,1}$=46.58, p=0.093) with the implementation of this measure. The ´percentage of lighting over the total energy consumption/cost` showed a negative B-coefficient for ´overall flow reducers` indicating decreases in ´hotel water consumption`;

- From the devices in taps, ´taps with timer and/or automatic shut-off and/or presence sensor and/or pedal operated` was analyzed. The measure accounted for 54% of the variance (R2=0.541) for the ´percentage of heating and cooling over the total energy consumption/cost`, which is not significantly better than the null model ($F_{1,1}$=1.177, p=0.47). The ´percentage of heating and cooling over the total energy consumption/cost` showed a negative B-coefficient for taps with timer indicating decreases in ´hotel water consumption`. Moreover, ´taps with timer and/or automatic shut-off and/or presence sensor and/or pedal`, accounted for 2% of the variance (R2=0.021) for the ´percentage of lighting over the total energy consumption/cost`, which is not significantly better than the null model ($F_{1,1}$=0.022, p=0.907). The ´percentage of lighting over the total energy consumption/cost` showed a positive B-coefficient for ´taps with timer ` indicating increases in ´hotel water consumption`;

- From the devices in showers, ´showerheads aerators` was analyzed. The measure accounted for 91% of the variance (R2=0.911) for the ´percentage of heating and cooling over the total energy consumption/cost`, which is not significantly better than the null model ($F_{1,1}$=10.27, p=0.192). The ´percentage of heating and cooling over the total energy consumption/cost` showed a negative B-coefficient for ´showers with aerators` indicating decreases in ´hotel water consumption`. Moreover, ´showerheads aerators` accounted for 61% of the variance (R2=0.615) for the ´percentage of lighting over the total energy consumption/cost`, which is not significantly better than the null model ($F_{1,1}$=1.599, p=0.426). The ´percentage of lighting over the total energy consumption/cost` showed a negative B-coefficient for ´showerheads aerators` indicating decreases in ´hotel water consumption`;

- From the devices in toilets, ´toilets with double/dual flush mechanisms` was a valid variable. The measure accounted for 4% of the variance (R2=0.048) for the ´percentage of heating and cooling over the total energy consumption/cost`, which is not significantly better than the null model ($F_{1,1}$=0.05, p=0.8592). ´percentage of heating and cooling over the total energy consumption/cost` showed a positive B-coefficient for ´toilets with double/dual flush mechanisms` indicating increases in ´hotel water consumption`. Moreover, ´ toilets with double/dual flush mechanisms ` accounted for 86% of the variance (R2=0.864) for the ´percentage of lighting over the total energy consumption/cost`, which is not significantly better than the null model ($F_{1,1}$=6.338, p=0.2407). The ´percentage of lighting over the total energy consumption/cost` showed a positive B-coefficient for ´ toilets with double/dual flush mechanisms` indicating increases in ´hotel water consumption`;

- None of the measures applied in kitchen appliance had more than two responses, or presented missing values, for which the regression test cannot be computed. Therefore, all four hotels in the sample indicated to have a ´low consumption dishwasher with a water efficient system` and a ´low consumption or efficient use washing machine through electronic systems`. Two did not have ´low consumption or efficient use washing machine through mechanic systems` and the other two did not answer; and

- Among the irrigation systems, ´sprinkling systems` was a valid variable. The measure accounted for 54% of the variance (R2=0.541) for the ´percentage of heating and cooling over the total energy consumption/cost`, which is not significantly better than the null model ($F_{1,1}$=1,177 p=0.471). The ´percentage of heating and cooling over the total energy consumption/cost` showed a negative B-coefficient for ´ sprinkling systems ` indicating decreases in ´hotel water consumption`. Moreover, ´sprinkling systems` for irrigation accounted for 2% of the variance (R2=0.021) for the ´percentage of lighting over the total energy consumption/cost`, which is not significantly better than the null model ($F_{1,1}$=0.021, p=0.907). The ´percentage of lighting over the total energy consumption/cost` showed a positive B-coefficient for ´ sprinkling systems` indicating increases in ´hotel water consumption`.

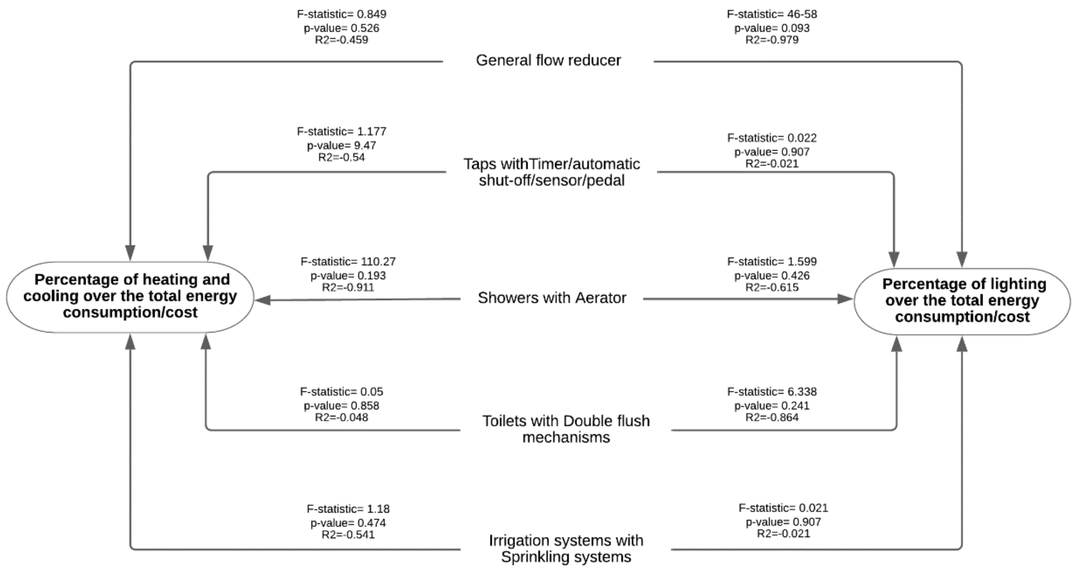

Figure 19. Individual regressions tests for Water Innovative Reducing strategies and Percentage of heating and cooling over the total energy consumption/cost and Percentage of lighting over the total energy consumption/cost Corresponding image for Table 41-Table 45 Appendix 5 (based on Rico et al. (2019) and Yoon (2018b)).

The analysis for Reusing was made for one out of three variables in this category: ´coffee machines with water recirculation systems continuous brew`. A model with this variable as a predictor accounted for 95% of the variance (R2=0.951) for the ´percentage of heating and cooling over the total energy consumption/cost`. This is not significantly better than the null model ($F_{1,1}$=19.79, p=0.141). The ´percentage of heating and cooling over the total energy consumption/cost` showed a negative B-coefficient for ´coffee machines with water recirculation systems continuous brew` indicating decreases in ´hotel water consumption`. Furthermore, ´coffee machines with water recirculation systems continuous brew` accounted for 13% of the variance for the ´percentage of lighting over the total energy consumption/cost`, which is not significantly better than the null model ($F_{1,1}$=0.158, p=0.759). The ´percentage of lighting over the total energy consumption/cost` showed a positive B-coefficient for the independent variable indicating increases in ´hotel water consumption` (see Table 46 Appendix 5).

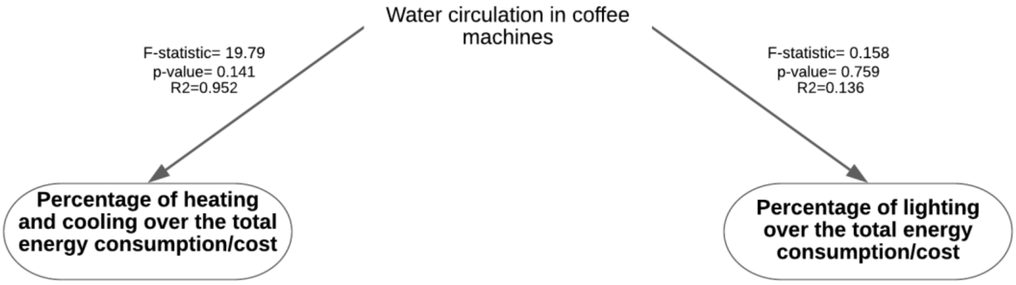

Figure 20. Individual Regression tests for Water Innovative Reusing strategies and Percentage of heating and cooling over the total energy consumption/cost and Percentage of lighting over the total energy consumption/cost. Corresponding image for Table 46 Appendix 5 (based on Rico et al. (2019) and Yoon (2018b)).

The analysis for Recycling measures was not performed since the unique variable, ´swimming pool closed loop wastewater treatment`, presented only one value level. However, the four hotels had implemented the measure in their swimming pool facilities.

5.4.2. ´*Energy for energy*` and ´*energy for water*` perspective

5.4.2.1. Energy saving measures and percentage of energy consumption/cost for the hotels.

The regression test between Reaching energy measures and energy consumption/cost included the variables according to the type of energy sources used by the hotels. The energy sources: ´electricity`, ´propane` and ´photovoltaic` were excluded from the analysis since there were

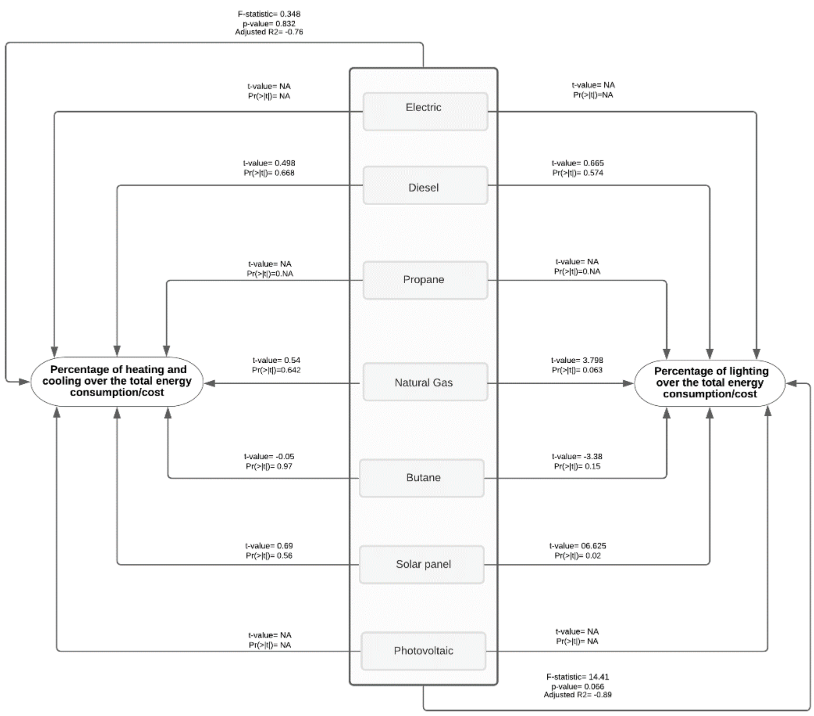

Figure 21. Multiple Regression tests for Energy Innovative Reaching strategies and Percentage of heating and cooling over the total energy consumption/cost and Percentage of lighting over the total energy consumption/cost. Corresponding image for Table 47 & 48 Appendix 5. (based on Yoon (2018b)).

missing values. The model with all predictors accounted for 89% of the variance (Adjusted R2=0.911) for ´percentage of lighting over the total energy consumption/cost`, though is not significantly better than the null model ($F_{4,2}$=14.41, p=0.066). One variable, ´solar panels´ as energy source was significant (p<0.05) as predictor for the ´percentage of lighting over the total energy consumption/cost`. The ´percentage of lighting over the total energy consumption/cost` showed a negative B-coefficient for ´butane` indicating decreases in the ´percentage lighting consumption/cost` with the use of this energy source, whilst the rest of the energy sources presented a positive B-coefficient (i.e. increases of percentage lighting consumption/cost). Moreover, the model with all predictors accounted for -31 % of the variance (Adjusted R2=-0.31) for the ´percentage of heating and cooling over the total energy consumption/cost`, which is not significantly better than the null model ($F_{3,3}$=0.517, p=0.699). The ´percentage of heating and cooling energy consumption/cost` showed a positive B-coefficient for all energy sources indicating increases of the ´percentage heating and cooling consumption/cost` (see Table 48 Appendix 5).

The regression test for Reducing measures included the implementation of ´energy meters` as a saving measure, and the number of pumps in the hotels, to distribute ´freshwater`, ´HSW` and ´other water resources`. The regressions were done separately for the energy meter and the pumps. A model with ´energy meter` as a predictor accounted for 0.07% of the variance (R2=0.007) for the ´percentage of lighting over the total energy consumption/cost`, which is not significantly better than the null model ($F_{1,5}$=0.038, p=0.853). The ´percentage of lighting over the total energy consumption/cost` showed a negative B-coefficient for energy meters indicating decreases in ´percentage of lighting over the total energy consumption/cost`. Furthermore, the introduction of an energy meter accounted for 4% of the variance (R2=0.045) for the ´percentage of heating and cooling over the total energy consumption/cost`, which is not significantly better than the null model ($F_{1,5}$=0.234, p=0.649). The ´percentage of heating and cooling over the total energy consumption/cost` showed a positive B-coefficient for energy meters indicating increases in the ´percentage heating and cooling consumption/cost` (see Table 49 Appendix 5).

The regression analyses for the pumps to distribute freshwater, HSW and other water resources`, were done individually.

- The ´pumps to distribute freshwater` in the building accounted for 34% of the variance (R2=0.3424) for the ´percentage of lighting over the total energy consumption/cost`, which is not significantly better than the null model ($F_{1,5}$=0.167, p=0.167). The ´percentage of lighting over the total energy consumption/cost` showed a positive B-coefficient for ´pumps for freshwater` indicating increases in percentage lighting consumption/cost. Moreover, the freshwater pumps accounted for 0.04% of the variance (R2=0.004) for the ´percentage of heating and cooling over the total energy consumption/cost`, which is not significantly better than the null model ($F_{1,5}$=0.022, p=0.887). The ´percentage of heating and cooling over the total energy consumption/cost` showed a positive B-coefficient for ´pumps for freshwater` indicating increases in the ´percentage heating and cooling consumption/cost` (see Table 50 Appendix 5);

- The ´pumps to distribute HSW` in the building account for 0.7% of the variance (R2=0.007) for the ´percentage of lighting over the total energy consumption/cost`, which is not significantly better than the null model ($F_{1,5}$=0.038, p=0.853). The ´percentage of lighting over the total energy consumption/cost` showed a positive B-coefficient for pumps for HSW indicating increases in percentage lighting consumption/cost. Moreover, ´pumps to distribute HSW` in the building accounted for 95% of the variance (R2=0.967) for the ´percentage of heating and cooling over the total energy consumption/cost`, which is not significantly better than the null model ($F_{3,2}$=14.83, p=0.064). The ´percentage of heating and cooling over the total energy consumption/cost` showed a positive B-coefficient for ´pumps for HSW` indicating increases in the ´percentage heating and cooling consumption/cost` (see Table 51 Appendix 5);

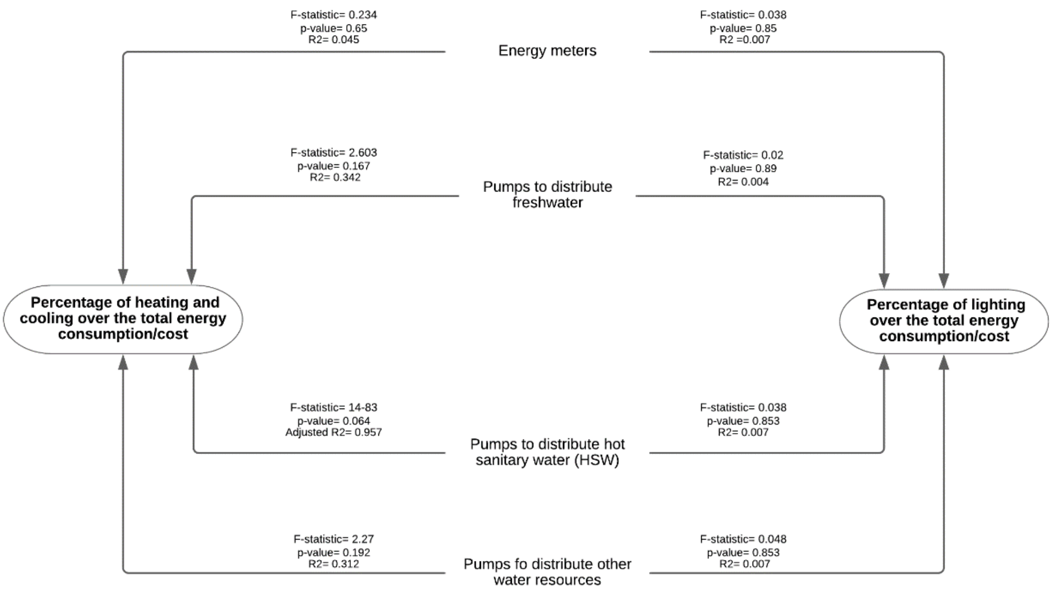

Figure 22. Individual Regression tests for Energy Innovative Reaching strategies and Percentage of heating and cooling over the total energy consumption/cost and Percentage of lighting over the total energy consumption/cost. Corresponding image for Table 50- Table 52 Appendix 5 (based on Yoon (2018b)).

- The ´pumps to distribute freshwater` in the building from other water resources accounted for 0.7% of the variance (R2=0.007) for the ´percentage of lighting over the total energy consumption/cost`, which is not significantly better than the null model ($F_{1,5}$=0.038, p=0.853). The ´percentage of lighting over the total energy consumption/cost` showed a negative B-coefficient for pumps for freshwater indicating decreases in percentage lighting consumption/cost. Moreover, ´pumps to distribute freshwater from other water resources` in the building account for 31% of the variance (R2=0.312) for the ´percentage of heating and cooling over the total energy consumption/cost`, which is not significantly better than the null model ($F_{1,5}$=2.269, p=0.192). The ´percentage of heating and cooling over the total energy consumption/cost` showed a positive B-coefficient for pumps for freshwater indicating increases in the ´percentage heating and cooling consumption/cost` (see Table 52 Appendix 5).

The multiple regression analyses for Reusing strategies were performed between the ´number and the surface of solar collectors` and the ´percentage of lighting over the total energy consumption/cost`; and the number and the surface of solar collectors and the ´percentage of heating and cooling over the total energy consumption/cost`. The results showed that a model with the two predictors accounted for 90% of the variance (Adjusted R2=0.902) for and the ´percentage of lighting over the total energy consumption/cost`, which was significantly better than a model with no predictors ($F_{2,4}$=28.63, p=0.004). Moreover, the model accounted for -17% of the variance (Adjusted R2= -0.17) for the ´percentage of heating and cooling over the total energy consumption/cost`, which was not significantly better than the null model predictors ($F_{2,4}$=0.564, p=0.6085). The ´percentage of lighting over the total energy consumption/cost` showed a negative B-coefficient for solar panel´s number indicating decreases in percentage lighting consumption/cost, while the sign of the B-coefficient was positive for solar panel´s surface, indicating increases in the ´percentage of lighting over the total energy consumption/cost`. Similarly, the ´percentage of lighting over the total energy consumption/cost` showed a negative B-coefficient for solar panel´s number, whilst the sign of the B-coefficient was positive for solar panel´s surface (see Table 53 Appendix 5).

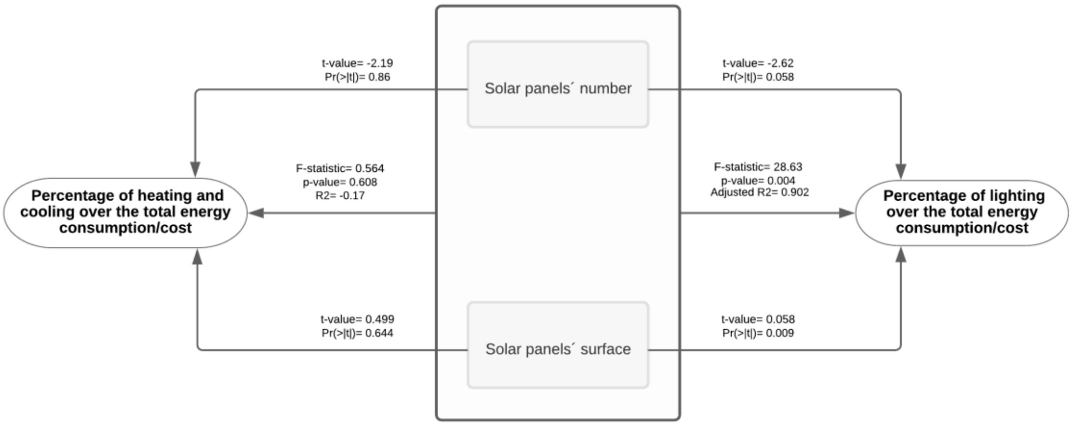

Figure 23. Multiple Regression test for Solar Panels (i.e. Energy Innovative Reusing strategies) and Percentage of heating and cooling over the total energy consumption/cost and Percentage of lighting over the total energy consumption/cost. Corresponding image for Table 53 Appendix 5 (based on Yoon (2018b)).

Additional tests in relation to the introduction of solar panels in hotels were performed with ´solar panel numbers` and ´solar panel surface` as predictors for ´savings in kWh` and ´savings in Euros`. On the one hand, the model with the two predictors accounts for 14% of the variance (Adjusted R2= 0.141) for the ´savings in kWh`, which is not significantly better than a model with no predictors ($F_{2,4}$=0.564, p=0.6085). On the other hand, the model with the two predictors, ´solar panel number`, and ´solar panel surface` account for 50% of the variance (Adjusted R2= 0.509) for ´savings in Euros`, which is significantly better than a model with no predictors ($F_{2,4}$=8.256, p=0.005). This indicates that the number and the surface of the solar panels in the hotels in Benidorm are correlated to the savings in Euros that these may entail. From the B-coefficient we obtained that savings in kWh and Euros increase with the number and surface of solar panels. Many data on solar panel savings in kWh and Euro are missing is missing in the survey. Yet the numbers for savings in kWh oscillate around 17.5KWh and savings in Euros are between 16000EUR and 17500EUR.

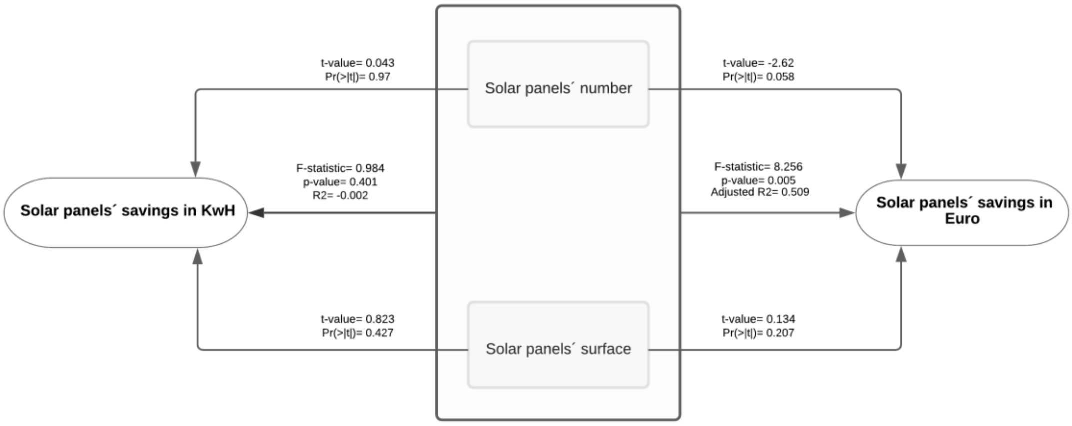

Figure 24. Multiple Regression test for Solar Panels (i.e. Energy Innovative Reusing strategies) and Solar panels´ savings in KhH and Solar panels´ savings in Euros. Corresponding image for Table 54 Appendix 5 (based on Yoon (2018b)).

For the Recycling measures, the ´swimming pool pumps for water circulation` was included in the analysis. The results show that a model with the one predictor accounted for 29% of the variance (R2=0.29) for and the ´percentage of lighting over the total energy consumption/cost`, which was not significantly better than a model with no predictors ($F_{2,4}$=2.042, p=0.212). The ´percentage of lighting over the total energy consumption/cost` showed a positive B-coefficient for ´swimming pool pumps for water circulation`, indicating increases in ´percentage lighting consumption/cost` (see Table 55 Appendix 5).

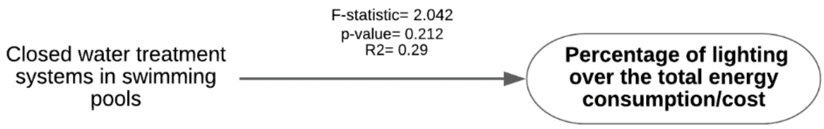

Figure 25. Individual Regression test for Energy Innovative Recycling strategies and Percentage of heating and cooling over the total energy consumption/cost and Percentage of lighting over the total energy consumption/cost. Corresponding image for Table 55 Appendix 5 (based on Yoon (2018b)).

6.4.2.2. ´Energy for water perspective´

Energy saving measures and hotel water consumption (2016)

A multiple regression analysis was performed to assess the relationship and the relative importance of each energy-saving measures and the hotel water consumption of hotels. The hotel water consumption data was taken from the year 2016 (note that in the previous analysis it was taken from 2014), since the survey from Yoon (2018b) was done in that same year.

The regression analyses for Reaching variables that included the type of energy sources used by the hotels were done individually due to missing results in the multiple regression test. The energy sources ´electricity` and ´butane´, were excluded from the analysis for the lack of more than two levels of observations. All hotels responded that they used ´electricity` as energy source for lighting, air conditioning, and other general uses, while none used ´butane`. The regression for ´diesel` showed that it accounted for 15% of the variance (R2=0.07) for ´hotel water consumption`, which is not significantly better than the null model ($F_{1,2}$=0.152, p=0.734). ´Propane` accounted for 4% of the variance (R2=0.04), which is not significantly better than the null model ($F_{1,2}$=0.095, p=0.786). ´Solar panels` accounted for 4% of the variance (R2=0.045) for the output variable, which is not significantly better than the null model ($F_{1,2}$=0.096, p=0.786). Finally, ´natural gas` accounted for 96% of the variance (R2=0.965), which was significantly better than the null model ($F_{1,2}$=54.29, p=0.017). In this case, the hotel with the highest ´hotel water consumption` in 2016 was the only one that used ´natural gas` as an energy source. From the B-coefficient we obtained that Solar panels had a negative sign, indicating decreases in ´hotel water consumption`. The remaining set of variables showed a positive B-coefficient sign which gives an indication of increases in ´hotel water consumption` (see Table 56 Appendix 5).

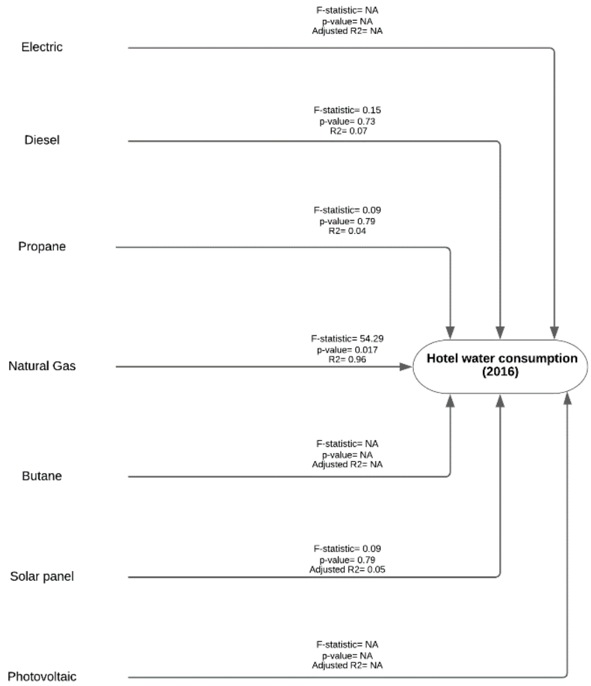

Figure 26. Individual Regression tests for Energy Innovative Reaching strategies and Hotel Water Consumption (2016). Corresponding image for Table 56 Appendix 5 (based on Yoon (2018b) and Hotel annual water consumption Data (2005-2017)).

For the Reducing variables, the regression analysis was also made individual for each variable. For the relationship between ´energy meter´ and ´hotel water consumption`, the regression analysis could not be performed due to lack of more than one level (e.g. all hotels responded "Yes") of observations, or limited observations. For this case, all hotels had one or more ´energy meter`. The ´pumps for HSW` accounted for 13% of the variance for hotel water consumption,

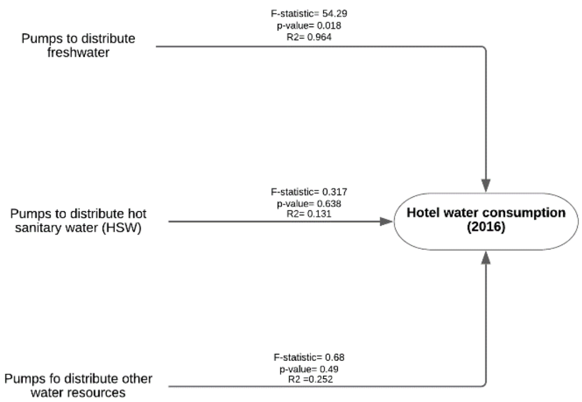

Figure 27. Individual Regression tests for Energy Innovative Reducing strategies and Hotel Water Consumption (2016). Corresponding image for Table 57 Appendix 5 (based on Yoon (2018b) and Hotel annual water consumption Data

which was significantly better than the null model ($F_{1,2}$=0.301, p=0.638). Pumps for freshwater form other water resources pumps accounted for 25% for ´hotel water consumption`, which was not significantly better than the null model ($F_{1,2}$=0.675, p=0.497). The number of pumps in the building for freshwater accounted for a 96% of the variance (R2=0.965) for ´hotel water consumption`, which was significantly better than the null model ($F_{1,2}$=54.29, p=0.018). The B-coefficient signs were positive for pumps distributing freshwater and HSW, whilst the pumps distributing freshwater from other water resources had a negative B-coefficient sign (i.e. decreases in ´hotel water consumption`) (see Table 57 Appendix 5).

The only variable within Recycling was excluded due to one missing value. However, all the three other hotels had two, three and six pumps for water recirculation in swimming pools, with the water consumption increasing with the number of pumps.

5.5. Climate change attitudes and perceptions and the implementation of water- and energy-saving measures in Benidorm.

Simple regression tests were performed to explore the relationship between the water-saving measures and the perceptions and attitudes towards climate change. The analysis also predicted the extent to which perceptions and attitudes towards climate change by each of the water-saving measures implemented in the hotel sector in Benidorm.

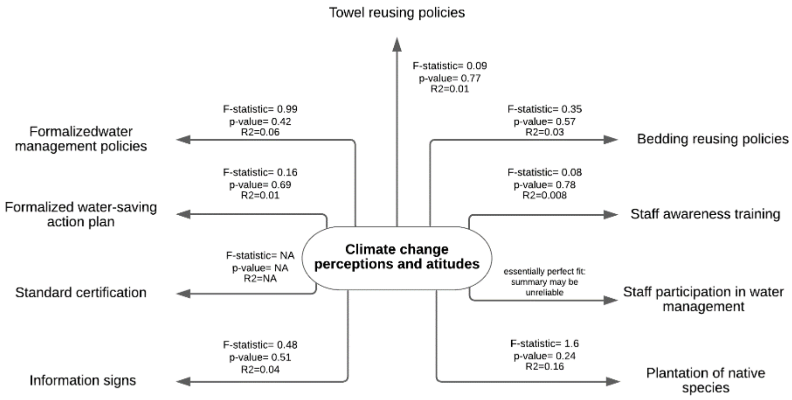

Figure 28. Individual Regression tests for Climate change perceptions and attitudes and Innovative Reaching Strategies. Corresponding image for table 58 Appendix 5 (based on Rico et al. (2019))

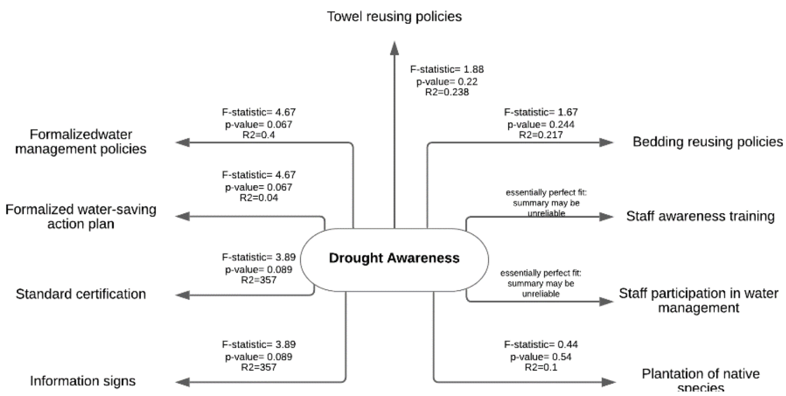

Figure 29. Individual Regression tests for Drought Awareness and Innovative Reaching Strategies. Corresponding image for Table 58 Appendix 5 (based on Rico et al. (2019))

The results showed that ´climate change perceptions and attitudes` and ´drought awareness` did not have any significant relationship with measures in the Reaching category. Thus, indicating that awareness on climate change and on droughts did not determine whether Reaching strategies were implemented in the hotels from the sample.

The regression test indicated that ´climate change perceptions and attitudes` accounted for 64.9% of the variance of for ´general flow reducers`. This was a significant result ($F_{1,10}$=18.52, p<0.01). This means that changes in climate change perceptions and attitudes correlate with shifts in the implementation of general flow reducers. Moreover, ´drought awareness` accounted for 55.5% of the variance for implementing ´showers with thermostatic taps` which was a significant result ($F_{1,6}$=7.5, p=0.033). The ´attitudes and perceptions towards climate

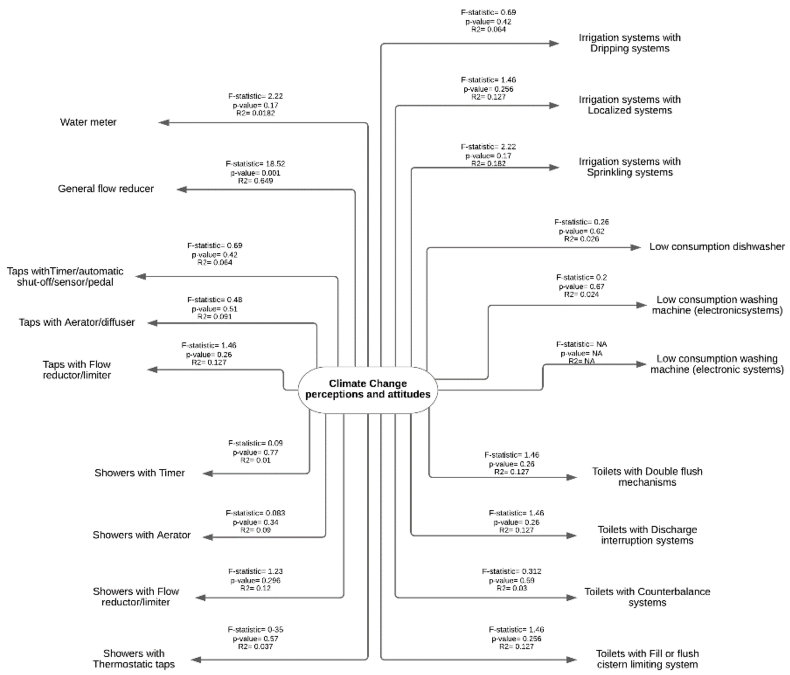

Figure 31. Individual Regression tests for Climate change perceptions and attitudes and Innovative Reducing Strategies. Corresponding image for Table 59 Appendix 5 (based on Rico et al. (2019))

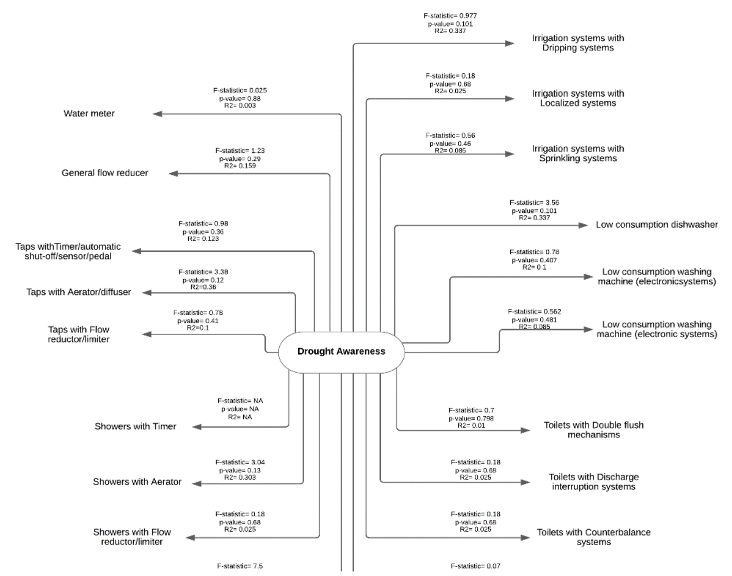

Figure 30. Individual Regression tests for Drought Awareness and Innovative Reaching Strategies. Corresponding image for Table 59 Appendix 5 (based on Rico et al. (2019)).

change` and ´drought awareness` did not have a significant relationship with the rest of the variables in the Reducing category.

The results for Reusing strategies indicated that ´climate change perceptions and attitudes` accounted for 64% of the variance for ´greywater for irrigation` measures which was a significant amount ($F_{1,9}$=16.57, p<0.01). Moreover, the ´awareness on droughts` accounted for 62.5% of the variance for ´water circulation in coffee machines`, which was a significant relationship ($F_{1,9}$=11.67, p<0.011).

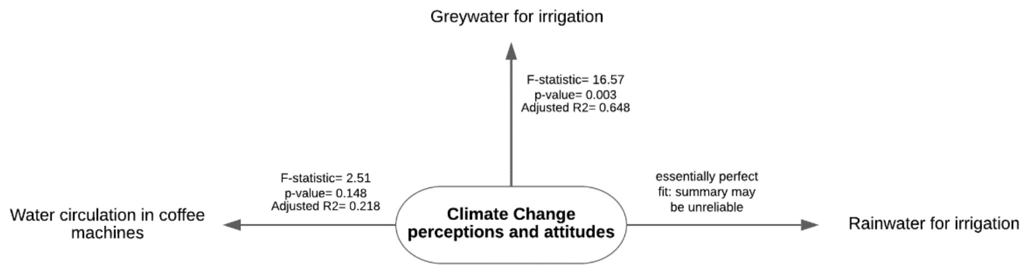

Figure 33. Individual Regression tests for Climate change perceptions and attitudes and Innovative Reusing Strategies. Corresponding image for Table 60 Appendix 5 (based on Rico et al. (2019))

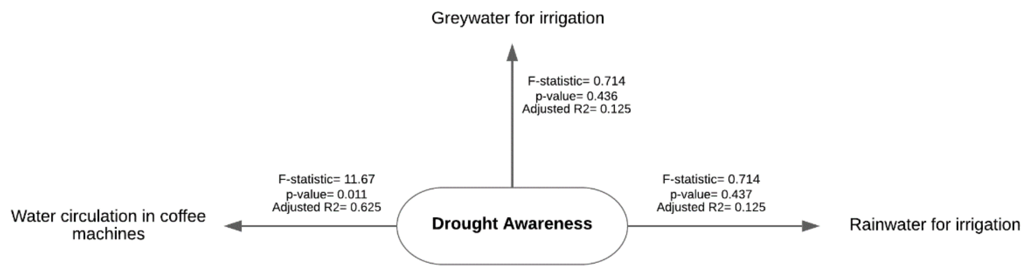

Figure 32. Individual Regression tests for Drought Awareness and Innovative Reusing Strategies. Corresponding image for Table 60 Appendix 5 (based on Rico et al. (2019))

Finally, the results showed that ´climate change perceptions and attitudes` did not have significant relationships with any variable in the Recycling category. Thus, awareness on climate change did not determine whether recycling strategies were implemented in the hotels from the sample. ´Awareness on droughts` could not be tested as the summary turned out unreliable due the perfect fit of the data.

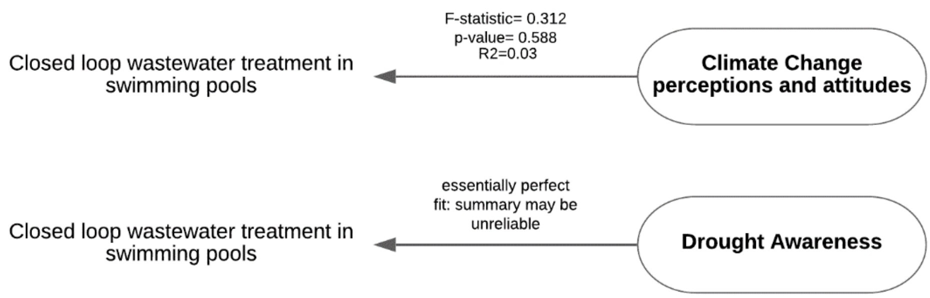

Figure 34. Individual Regression tests for Climate change perceptions and attitudes, and Drought Awareness and Innovative Recycling Strategies. Corresponding image for Table 61 Appendix 5 (based on: Rico et al. (2019))

Chapter 6. Discussion

6.1. The 4Rs Framework

For this thesis, the water management framework developed by Kasim et al. (2014) for accommodation, particularly hotels, is used to analyze and evaluate current water management in the Benidorm´s hotel sector. This 4R framework is used to cluster the water and energy saving measures into four categories: Reaching, Reducing, Reusing and Recycling; based on the hotels´ technological and knowledge capabilities. The four categories are not strictly defined and are not limited to specific measures when applied to a specific case. This allowed me to redefine two Rs, Reducing and Reaching. In my research I considered that Reaching strategies apply for education and information for staff and guests, whereas Reducing strategies include appliances that reduce resource consumption. In my view the classification accords to the definitions as the former does is knowledge intensive, while the latest is not knowledge intensive (i.e. devices are applied and no more actions are required). Moreover, I extended the application to energy management in hotels, by adjusting the energy-conservation measures in the framework.

However, the framework does not recognize other elements, rather than knowledge and technology that determine whether hotels will implement a specific measure. These elements can be, for instance, consumer expectations (Whelan & Fink, 2016), external incentives (Razumova et al., 2015) or economic sustainability (Njoroge et al., 2019). Kasim et al. (2014) probably assumed that hotels are obliged to introduce sustainable practices through an environmental management framework. Other approaches such as the one by (Njoroge et al., 2019) should also be considered, who claim that strategic innovation can be achieved through economic sustainability, instead of a mere obligation. In my research, I have identified drivers and barriers for each of the quadrants to identify the elements to implement measures of each 4R category. This allows to evaluate the benefits and disadvantages of measure application and ensures adherence to sustainable practices.

6.2. The current implementation of resource saving measures in Benidorm´s hotels.

Water-saving measures

The most widely introduced water saving strategies in Benidorm´s hotels correspond to Reaching strategies. All surveyed hotels involved and enhanced the participation of staff in water management, and more than three quarter of all hotels used signs to inform guests on water-saving practices, encouraged guests to use towels more than one day, and trained staff in water management practices. The rest of the measures in this category were also implemented by a more than two quarters of all hotels. These outcomes are common to comparable case studies: Torres-Bagur et al. (2019) revealed that towel and bed linen reuse programs, information signs for guests were very popular among the sampled hotels in Girona. However, staff training on good water practices to help save water and reduce operational costs were less widespread than the other measures (Torres-Bagur et al., 2019), while the percentage was much higher in Benidorm, accounting that the sample size are similar in theirs and my study. Moreover, from my literature review (Dumont et al., 2013; Kelly & Williams, 2007) and my analysis I conclude that the plantation of native species is an effective method to reduce water use in gardens which is also popular in Benidorm´s two-, three- and four-stars hotels.

Implementing Reducing strategies has a wide range of responses with water meters, taps with flow reductors/limiter, showers with flow reductors/limiter and dripping systems for irrigation being the ones most widely implemented in Benidorm. Tirado et al. (2019) showed that low flow fittings in water-devices and efficient irrigation systems are widely spread. However, tap sensors are very little implemented in Majorca compared to my study. Flow reducers and general flow reducers were popular in hotels in Benidorm, Majorca (Tirado et al., 2019), and Girona (Torres-Bagur et al., 2019).

Furthermore, I concur with Tirado et al. (2019) and Torres-Bagur et al. (2019) that low flush toilets and double flush mechanisms in toilets are popular among hotels, whereas flush interruption systems and counterbalance systems are less common. Efficient kitchen appliances were also widespread in our sample particularly low-consumption dishwashers, and most hotels with laundries acquired efficient washing machines. To continue, at least one water meter was introduced in more than half of the hotel´s in Benidorm, and almost a quarter of all hotels have more than two water submeters. These results are similar to those from Tirado et al. (2019), who also observed that efficient kitchen appliances and water meters were popular. In my sample, all five- star hotels have introduced efficient irrigation systems. Yet their gardens still have water-intensive plant species instead of drought-resistant native species, which counteracts the effect of the irrigation systems. Finally, closed water treatment systems for the swimming pool facilities as Recycling strategies were introduced by more than three-quarters of all hotels. This measure is very widespread among hotels to avoid emptying and filling the pool (Rico et al., 2019)

The least implemented water-saving measures in hotels fall under the Reusing category since less than a quarter of surveyed hotels have implemented any of these measures. This is comparable to Tirado et al. (2019) ´s results, who obtained that greywater for irrigation and rainwater harvesting systems were very little implemented, by around a fifth of their sample, respectively. However, these measures can save large amounts of water but involve large technical requirements and high levels of investment and knowledge (Styles et al., 2013; Tirado et al., 2019).

Energy-saving measures

The majority of the hotels in Benidorm used electricity for lighting and other general purposes. From the sample, five out of fifteen hotels produce electricity from solar panels, and one hotel installed wind turbines and geothermal energy systems. Several hotels in Benidorm used clean and sustainably generated sources of energy, including three hotels that use geothermal energy for acclimatization, which is not renewable, but it is inexhaustible as it uses the energy stored in land. Diesel was used mainly to generate hot sanitary water (HSW), whereas Propane and Natural Gas were used specially for kitchen and laundry purposes or HSW. These energy sources are not renewable, being less ´clean` to more ´clean`, in order: Diesel, Butane, Propane and Natural Gas (Nair et al., 2018). In fact, one respondent stated that the hotel has shifted from Diesel and Propane to Natural Gas a source of energy.

Moreover, HOSBEC promotes and emphasizes on energy consumption, as a resource to be considered among the hotels in Benidorm. In fact, HOSBEC provides programs to their associates where they define and update the energy profile of the hotels (e.g. where, how, and how much energy is consumed), they establish energy consumption indicators, and provide guidance for good practices for energy efficiency. In addition, they offer counselling services for the implementation of the norm ISO 50001 for energy management (HOSBEC, n.d.). Thus, according to my review, reaching strategies of collaboration in relation to energy consumption are strong in the hotels in Benidorm.

Among reducing strategies, energy meters to monitor energy consumption were widely popular among hotels in Benidorm (i.e. all hotels implemented this measure). This is an effective energy management system (Agencia Provincial de la Energia de Alicante, 2013; Meliá Hotels International, 2017). Furthermore, hotels implemented up to seven HSW deposits, being the highest buildings the ones with more HSW deposits. Possible reasons for these results are that high hotel buildings need to pump the water up, having a greater need for pumps, therefore energy can be saved by having more HSW deposits to cover peak demands of HSW (Asociación Técnica Española de Climatización y Refrigeración & Instituto para la Diversificación y Ahorro de la Energía, 2010; Cheung et al., 2013). In addition, hotels stated that they have introduced wall thermic isolation, new air conditioning machines and heaters, new boilers, lighting sensors, and have undertaken programs for guest and staff awareness on sustainable and energy-saving practices. Literature analysis indicates that these are common energy Reducing strategies applied in hotels (Agencia Provincial de la Energia de Alicante, 2013; Chan et al., 2013; Mardani et al., 2016; Sucheran & Bob, 2015).

The implementation of solar panels was the most common renewable energy source in Benidorm. My analysis reveals that the installation produced around one quarter of savings in kWh, corresponding to an amount of more than 16,000 euros in savings per year on average. The literature analysis reveals that solar photovoltaic and solar thermal renewable energies can supply up to 63% of the total hotel´s electricity demand (Meschede et al., 2017). Indeed, installing solar panels is a great opportunity for hotels to ameliorate their sustainability approaches and generate savings in operational costs, especially since the increase energy costs in the past decade (Eurostat, 2020). Energy related recycling strategies include pumps for water circulation in swimming pools and SPAs. Hotels had one to six pumps for both facilities, being six for the ones with swimming pools with a capacity of around 900 L/m3. Moreover, one hotel declared to have twenty-five pumps, for a capacity of 1,200 L/m3, and to refresh 60,000L/m3. This is an outstanding number, since another hotel has implemented one pump for a capacity of 267 L/m3 and renovates 1,224,000 L only for the swimming pool(s). The reason for these results can be the misinterpretation by the respondents.

6.3 What motivates Benidorm´s hotels to implement resource conservation measures

Drivers for implementing water- and energy- saving measures are identified based on the literature review and the results obtained by using Rico et al. (2019) ´s survey. From our analysis we obtain that the selection between ´most important` and ´important` factors for hotels in Benidorm to implement water measures did not largely differ. A great number of hotels considered legal compliance to environmental regulations, and reduction of operational costs"as ´important`; while factors on environmental awareness by users and hotels on daily operations, droughts and climate change are widely chosen as ´most important`. The analyses further show that Climate change and Drought awareness were related to the introduction of numerous water conservation measures (see Section 5.5). These results are remarkable, as in a later section of the survey only three hotels admitted having adopted measures to face droughts. In addition, certifications were the least implemented by the hotel sample in Benidorm, while compliance with international norms was considered the ´most important` motivational factor to implement water-saving measures to obtain environmental international certifications, such as ISO14001.

Overall, similar drivers are common to Reaching and Reducing, namely environmental awareness, the reduction of operational costs, hotel brand image and tendencies for adopting resource saving measures in the sector. From the literature analysis, we observe that three- and four- star hotels tend to obtain resource and economic savings or improvements of hotel brand image in sustainability matters (Tirado et al., 2019; Torres-Bagur et al., 2019). The latter was also the case for five-stars hotels (Pinto et al., 2017). Reducing measures require less monitoring than reaching: Reducing are installed and operate automatically, while Reaching need the monitoring to accomplish the requirements for ´EMS` or Standard Certifications. Other drivers are the reduced money and technology requirements which are characteristic to these 4R categories (Kasim et al. 2014).

However, Reaching and Reducing strategies may not be installed to prevent consumer dissatisfaction and discomfort. For instance, research shows flow reductors, information signs and towel or bedding reusing policies could be rejected by guests (Torres-Bagur et al., 2019). In my sample, none of the five-stars hotels in Benidorm had introduced general flow reductors and information signs, while only one had introduced towel and bedding reducing policies, and shower´s taps flow reductors. Reducing strategies can also be hindered by legislation and regulation factors, which can be both internal (e.g. Company´s regulations) or external (e.g. government frameworks). In Benidorm, HOSBEC Hotel Association does provide incentives and a support for implementing water- and energy-saving measures which helps hotels. Reaching measures require high involvement of the hotel staff, and therefore training, for a successful implementation of the saving measures (Christopher Warren & Becken, 2017). The latter does not apply to Benidorm as the majority of hotels offer staff training for resource management, and all hotels involve the staff in water management.

Reusing strategies are likely to be implemented since there are green programs available to implement, for instance rainwater harvesting systems or greywater recycling systems (Alcalde Sanza & Gawlik, 2014; Styles et al., 2013). From my literature analysis, these conservation measures were related to enhanced brand image of the hotels, which coincides with other studies (Higgins et al., 2002). Furthermore, we obtained that rainwater harvesting systems were also related to strong environmental values, such as worries for future climate change. Moreover, recycling strategies for water and energy are a priority for future development and are increasingly receiving support, to ensure water availability in certain areas (Alcalde Sanza & Gawlik, 2014; Styles et al., 2013). Furthermore, hotels may also be keen to implement these Reusing and Recycling measures as it secures the availability of water and energy resources and can create financial benefits and savings as the resources are generated on-site, by solar panels or wind turbines (Styles et al., 2013).

Yet, Reusing and Recycling strategies require high investment costs for its implementation, which can be an important internal barrier, and there is a longer payback period compared. For both types of strategies, the sophisticated monitoring techniques can entail difficulties as high expertise is essential. Important external barriers lack of business models for the implementation of measures, and a limited institutional framework for it (Alcalde Sanza & Gawlik, 2014). Moreover, government or financial incentives may not be available for all hotels (Alcalde Sanza & Gawlik, 2014). For instance, solar energy in Spain is not largely leveraged, and the support through Spanish regulations have been criticized to be very discouraging. Even, in 2008-9 a ´tax on the sun` (Ministerio de Industria Energía y Turismo, 2015) was implemented which charged users per KWh generated.

The analysis reveals that hotels in Benidorm have received incentives innovate their building installations, such as wall insulation systems and solar panels, from the ´Tourism Agency of the Valencian Community Government` (Conselleria de Turismo de la Generalitat Valenciana); ´Energy Agency of the Valencian Community Government` (Conselleria de Energía de la Generalitat Valenciana); the ´grant for the improvement of conditions and services in the hotel sector` (Ayuda a la reforma de mejora de condiciones y servicios de la planta hotelera); and the European Regional Development Fund (Fondo Europeo de Desarrollo Regional) through the Valencian Tourism Agency. Moreover, HOSBEC Hotel Association does provide incentives to Benidorm´s hotels and reinforces the implementation of resource saving measures through energy and water programs. This shows that there is support from political institutions to Benidorm´s hotel sector for energy and water conservation measures.

Finally, the implementation of all 4Rs strategies can be limited by the technological and behavioral mismatch of the new systems (i.e. installation of new water- and energy-saving technological devices) into the business operations. At the moment the lack of sector-specific systems can be a burden to implement innovations at the hotel level. Therefore to overcome this burden it is essential that innovations are developed to be implemented in the hotel sector specifically.

6.4 How the application of water- and energy-saving measures affects resource consumption in Benidorm

Water-saving measures, ´percentage of water consumption/cost over the operational costs and ´hotel water consumption`

My analysis reveals that the ´percentage of water consumption/cost over the operational costs` and ´hotel water consumption` in 2014 (i.e. the year when the survey was performed) was not well significantly related to the adoption of water-saving measures. Only, the percentage of water consumption/cost was strongly related to the implementation of ´fill or flush cistern limiting system` and ´hotel water consumption` was significantly related to ´taps with timer/automatic shut off`. Yet, these measures increase water consumption. These results can be explained by the backfiring effect that encompass the unexpected behavior of guests (i.e. flushing the toilet more than once) (Freire-González, 2019; Rico et al., 2019).

Despite weaknesses of the relationship, several measures decrease in consumption. Reaching strategies including ´formalized water-saving action plans`, information signs`, ´staff training`, and ´native species plantation` reduce the percentage of water/consumption cost in hotels, whilst ´standard certification` and ´staff training` lead to decreases in hotel water consumption (2014). Among the Reducing strategies, the ´implementation of general flow reducers`, ´taps with aerators`, ´toilets with water saving systems`, ´low consumption dishwashers` and ´sprinkling systems for efficient irrigation` reduce both percentage of water consumption/cost and hotel water consumption.

The remaining set of measures carried increases in hotel´s water consumption. We note the tension with the expansion of water intensive facilities in hotels. This trend is known as the ´Jevons Paradox` by which the gains from efficient devices are offset by increasing resource intensive activities (Dumont et al., 2013; Sears et al., 2018). In Benidorm, this is the case for four- and five-stars hotels, which have applied large and water intensive facilities, such as big gardens, swimming pools, SPAs etc. while they have also implemented conservation measures in other areas. For instance, five-stars hotels have implemented efficient irrigation systems, while low water intensive (i.e. native) species have not been introduced.

Moreover, the three Reusing strategies and the Recycling strategy resulted in decreases in percentages of water/consumption cost and water consumption in hotels. Possible explanations can be that there is reduced energy or water demand since these are generated on-site, or resources are reused for other purposes (i.e. irrigation). Thus, there are economic benefits associated with these practices, even though there is a longer payback period (Styles et al., 2013). However, reusing measures were the least implemented by hotels, which could have affected the results of the analyses.

Energy-saving measures and ´percentage of energy consumption/cost over the operational costs`

The analyses from my research showed a strong relationship between the ´percentage of lighting over the total energy consumption/cost` and solar panels´ number and surface. The percentage of lighting consumption/cost decreased with the increase of number of solar panels, while the percentage of lighting consumption/cost increases with the increase in surface of solar panels. This is a remarkable result, which can be explained due the small response rate on these questions. Yet, from my analysis we obtained that a large number and surface of solar panels entail significant savings in kWh (on average 17.5kWh) and Euros (between 16000EUR and 17500EUR) for the hotels in Benidorm, which have been sustained in other studies on renewable energies for the hotel industry (Becken, 2013).

The ´percentage of lighting and cooling and heating consumption/cost over the total operational costs` did not show a strong relationship with the remaining energy-saving measures. Yet, there are measures that lead to the reduction of the percentage of energy consumption/cost over the total operational costs. For instance introduction of butane (i.e. Reaching) as energy source relationship ´percentage of lighting consumption/cost`, which is outstanding, but it can also tend to increase the percentage due to increases in energy cost. Energy meters, as for Reducing strategies, significantly reduced the ´percentage of lighting consumption/cost`.

The remaining set of measures did not show any significant nor a negative relationship with the percentage of energy consumption/cost. Instead, they increase energy consumption. For instance, pumps may increase energy intensity, in particular lighting consumption/cost. As a solution, pumps for water circulation in swimming pools can be more efficient by installing variable speed pumps (Styles et al., 2013). For the distribution pumps, the use of variable speed pumps and heat pumps significantly reduce energy consumption (Styles et al., 2013).

From my literature analysis, equipment efficiency (e.g. efficient kitchen and laundry devices) appeared to be an efficient measure in reducing energy consumptions in buildings; while specific measures such as active space cooling or shading of rooms for reducing cooling demands, building isolation, standard certifications and lighting controls were specific measures that seemed to reduce energy consumption in hotels (Mardani et al., 2016; Styles et al., 2013). Moreover, key card system, that restrict the energy use in rooms only when they are occupied, have been identified to be very efficient in energy saving, particularly for guests that leave the room for long periods (Chan et al., 2017; Mardani et al., 2016; Sucheran & Bob, 2015). In that sense, Benidorm can be very strong, as hotels receive support on energy monitoring and management through the HOSBEC Hotel Association.

Even though these relationships were not strong due to the size of the sample, the analyses show that water and energy consumption decreases with the implementation of resource-saving measures. However, the effect of the saving measures can be counteracted by the implementation of resource intensive amenities in other areas of the hotels, or by the mischievous behavior of guests. Therefore, the results of this research, despite its weaknesses may not be devalued and provides insights of the relationships between several water and energy saving measures and resource consumption.

6.5 The Water-Energy Nexus: demand management in Benidorm

In Benidorm's hotel sector, facilities and utilities that involve the use of water and energy simultaneously are implemented. Indeed, the consumption of both resources is interlinked, and increased or decreased consumption of one resource may increase or decrease the consumption of the other resource. Examples in Benidorm are: improved air conditioning and building insolation; the use of water and energy meters and submeters; general and device´s flow reductors; water- and energy-low consumption washing machines and dishwasher with full loads and water temperature adjustments ; efficient irrigation systems as they´d optimizes water for irrigate and energy to make the system function; HSW accumulators as these can reduce the time for hot water to come out when showering; formalized policies; towel and bedding reuse programs to optimize laundry loads; and staff training and staff participation can save both water and energy.

From the ´*energy for water*` perspective, my analysis showed water consumption in Benidorm has a significant relationship with Natural Gas, that implied an increase in hotel water consumption. In fact, Yoon (2018b) showed that Natural Gas has low to medium level *energy for water* intensity (p.78). Furthermore, the water consumption increases with the number of pumps present in the building. The explanation can be that hotels with more water consumption also need to pump more water along the hotel building. The implementation of solar panels led to decreases in water consumption, which coincides with the results of other studies on the trend (Chan et al., 2013; Meschede et al., 2017).

To continue, Yoon (2018b) observed that hotels with laundry services, regardless the kitchen size, have high ´*energy for water*` consumption patterns. Therefore, not only the investment in efficient washing and dry machines is essential, but also the use of kitchen and laundry appliances with full loads and the optimization of water temperature in washing machines can have an influence energy consumption (Agencia Provincial de la Energia de Alicante, 2013). For that, the training and participation of the staff may be indispensable (Becken et al., 2014; Pace, 2016). The consumption patterns are influenced by Jervon´s paradox, where hotels undertake conservation measures but implement other water- and energy- intensive for instance. For instance, in many cases laundry is externalized, but hotels may have other intensive facilities such as SPA´s.

The ´*water for energy*` perspective, did not show any significant relationship between water-saving measures and energy consumption/cost. Despite the weaknesses, ´general flow reducers` ´showers with aerator`, and ´taps with timer` ´sprinkling systems` and ´water circulation in coffee machines` lead to decreases in energy consumption/cost. Reasons are, for instance, that as reducing the flow would also reduce the need for pumping water and the water that needs to be heated up, thus decreasing energy consumption. Faucet aerators and timers reduce the water flow coming from the faucet, and in the same duration of flow, the use of water is reduced and so does the need for heating or cooling.

My results can be compared to other cases. Pinto et al. (2017) in their study on four- and five-stars hotels, concluded that the installation of efficient devices (e.g. reducers) in showers entail decreases both of water consumption and of energy as for its heating and distribution. Yet, the effect was conditional to the extent of the reduction of the flow rate, as if falling below 5 l/min, guests may stay longer under the shower which may ´backfire` the effect (i.e. leading to increase water consumption, reversing the effect of the flow reducers) (Freire-González, 2019; Pinto et al., 2017).

Even though results should be looked with attention, this study reveals how energy intensity for water and water intensity for energy is influenced by water and energy consumption, therefore showing the complexity for measuring the water and energy nexus at the micro scale, in this case, the hotel scale. Hotels in Benidorm are key actors to address the WEN from a demand side perspective and are already taking a step forward by having introduced both technological and management measures.

6.6 Research limitations

Limitations related to my methodological process have been identified for my thesis. First, I had no control over COVID-19 pandemic and this limited my on-site data gathering. Therefore, data from the studies of Rico et al. (2019) and Yoon (2018b) was reviewed an analyzed. These data were gathered in 2014 and 2017 respectively, thus the current situation may not be fully reflected in this paper. Although my initial objective was to extend these data sets, my final sample size was limited. Yet, my study was able to combine and use both surveys, obtaining obtained a sample that represents a quarter of all hotels in Benidorm, which corresponds with over a third of total beds in Benidorm. In the end sample size is comparable or even larger than other studies on the same field. Thus the results of my thesis are highly valuable.

In terms of survey content, data from the questionnaires did not fully include the issues that I intended to analyze. The survey by Rico et al. (2019) gathered several water-saving measures, motivational factors to be implemented, and the ´percentage of water consumption/cost` over the total` operational costs. Yet, the barriers to implement the water- saving measures were ignored thus I extrapolated them from the literature and discussed them for Benidorm´s case. Further, the energy focused survey did not gather energy-specific measures, which was also an initial objective from the on-site data gathering. In addition to the survey data, interviews would also be valuable to assess the fit of the innovative measures to the hotel´s operations. However, by merging both surveys I also ended with one-hundred and eight questionnaire items for four hotels from both studies combined.

To continue, the data was merged from surveys performed in different time periods (i.e. 2014 and 2016). If the data on water and energy were gathered in the same year, comparison results likely are reliable. However, the interviewed hotels probably did not make changes in water- and energy- aspects in such period of time, thus not affecting the results.

Finally, the use of percentages of total consumption/cost over the total operational costs are difficult to interpret. Decreases in the percentage can be due to either decreases in consumption or increases in the total cost. Therefore, gathering data of total consumption would be relevant for future studies.

Despite the limitations, I believe that the data shows meaningful result representing the complexity of the water and energy consumption Benidorm´s hotels. Besides, to my knowledge, this is one of the first studies that simultaneously address water- and energy-saving measures and water and energy consumption for a large sample of hotels. This water-energy nexus approach is unique in tourism studies. Therefore, my gained insights likely guide further research for sustainable development in the sector.

6.7 Further research

The case of Benidorm offers relevant insights into relationships between water, energy and tourism and moving towards more sustainable options. Nevertheless, there are important challenges that can be overcome for future research. First, taking a larger sample size would produce more and meaningful results. This can be done by surveying a larger number of hotels in the same area or in other areas, also to compare results among different regions. Second, different analytical tests may be performed to explore other type of relationships, for instance moderation analyses to observe the effect of other variables.

Third, concerning the content of the surveys, future studies can include questions on hotel-specific energy measures, and measures concerning the nexus. Drivers and barriers to implement both water and energy measures may be also addressed. Fourth, it would be relevant to study obtain water and energy consumption data in monetary terms to assess saving potentials, in order to improve motivation for hotels to make savings. A survey including these elements was developed for this study to be potentially conducted (see Appendix 5).

The study approaches respondents that belong to the hotel sector. It would be relevant to investigate resource consumption and resource conservation measures in other accommodation establishments. Even, it would be relevant to include suppliers of these measures, to better understand possible improvements for resource saving in the accommodation sector. In sum, data collection in the water and energy matters in other case studies than the presented one, will strengthen the interactions, usability, and quality of all stakeholders to improve their operations and enhance sustainability in the tourism sector.

Chapter 7. Conclusion

My study provides an assessment on the implementation of water- and energy-saving measures in the hotel sector. For that, I use the example of Benidorm as a mature tourism destination, and one of the most popular holiday resorts in the Mediterranean. My study builds on two surveys gathered by Rico et al. (2019) and Yoon (2018b), from which I obtained a total of thirty-three responses, that account for more than a third of the total hotel beds in Benidorm. Moreover, a literature review on comparable case studies was performed to obtain additional data. Therefore, my thesis provides evidence on the current of water and energy saving measures adopted in hotels, the motivations and discouragement to do so, and the links between adoption of conservation measures and resource consumption.

For the purpose of the study, the 4Rs framework developed by Kasim et al. (2014) was adjusted and used as a building block for the analyses. My results show that the great majority of hotels in Benidorm currently undertake resource saving actions through the implementation of water- and energy- conservation measures. In general, hotels from all categories have mainly implemented measures belonging to the Reaching category, followed by Reducing, Reusing and Recycling categories. The reasons for this are clear: the former two categories require simple technologies and little understanding, whilst the two latter categories demand more complex technologies and knowledge. In addition, I provide evidence that hotels in Benidorm are mainly driven to apply resource conservation measures for the compliance to environmental regulations and the reduction of operational costs. From my literature review, it becomes clear that the non-implementation of resource saving measures can be due to internal barriers that are specific to each organization and will be overcome individually. For instance, investment required in terms of capital and technology, consumer comfort and satisfaction, the involvement of the staff and the practical implementation. By contrast, external barriers are not fully on the stake of the organization, such as legal frameworks and financial support for implementing sustainable and/or environmental measures.

My thesis paper further examines the relationship between the resource conservation measures and water and energy consumption, respectively. Numerous water conservation measures lead to decreases in water consumption and ´percentage of water consumption/cost over the total operational costs`, particularly those that require guest and staff involvement but are not so technology and knowledge intensive. The installation solar panels notably increased savings in kWh and Euros for the hotels in Benidorm and reduced the ´percentage of energy consumption/cost over the total operational costs`. Yet, other measures were associated with increases in consumption. We note that as hotels in Benidorm may have implemented conservation measures in one area (e.g. efficient irrigation systems), while other areas continue being resource intensive (i.e. water demanding species), which may push resource consumptions upwards. This tension has been identified as the Jevon´s paradox. Also, unexpected behaviors of guests can have a ´backfiring` effect on devices such as flushing cisterns with limiting systems multiple times or pressing taps with timer/automatic shut off more than necessary.

Studies on resource conservation actions rarely considered the water and energy nexus, and how the effects of introducing one action have on the other resource. The study found that the use of Natural Gas and the installation of solar panels were related to low water consumption; whilst low energy consumption was related to the application of flow reducers, shower aerators, taps with automatic timer and efficient sprinkler systems in gardens. Though the results must be interpreted with care, the study addresses synergies within the water and energy nexus, including both *´water for energy`* and *´energy for water`* perspectives.

Benidorm´s hotel is aware of the impacts that climate change can entail. However, Benidorm needs to be prepared for the many and important challenges for the foreseeable changes in the climate. First, the increasing risks for drought events in Mediterranean destinations can be overcome by Benidorm´s solid water supply system. However, the supply perspective entails the risk of increasing resource consumption, as water supply is secured through non-conventional resources, and makes Benidorm increasingly dependent on energy for wastewater treatment, groundwater pumping, water transbasin projects, and especially, desalination processes. Second, the expected increases in temperatures can lead to tourist discomfort which could entail increases water and energy uses, and the following expansion of resource intensive amenities such as air conditioning or swimming pools. Third, the trends for mass tourism and luxury tourism may also push for higher resource consumption. In this project, relevance has been given to resource demand management of water and energy resources, as contrast to increasing supply. It is extremely relevant to implement demand management strategies to hamper water scarcity events, that can shift to future energy scarcity events. A new concept of conservation measures could then be identified as ´water- and energy-saving measures` or ´WEN measures` in the hotel sector, which builds on the synergies between both resources.

Hotels in Benidorm have started and are increasingly applying water- and energy-saving measures, particularly supported by HOSBEC Hotel Association. For achieving my main objective: “to propose mechanisms to better implement water-saving and energy-saving measures and policies to assist strategic management for climate change adaptation in the hotel sector in Benidorm”, I propose three mechanisms. First, it is relevant to jointly apply resource saving measures to avoid and overcome the backfiring effect and Jevon´s paradox. Second, there are increasing needs for these water- and energy- measures or systems to be tailored-specific for the hotel sector. This will help to have a better fit of the new sustainable schemes or technologies onto the existing hotel´s organizational and operational structures, just as the transfer of knowledge between the guests, hotels and the technology suppliers need to be strengthened. Third, I encourage suppliers and institutions to support Benidorm´s hotel sector in the introduction and application of resource saving measures with a long-term perspective towards future climate change challenges. Overall, my study contributes advances in water and energy related research and addresses demand management for future resource scarcity in order to assist the tourism and the hotel sector in climate change adaptation.

Implications of the study and recommendations

This study contributes to the current research on the assessment and effectiveness of water-saving measures and energy-saving measures, and how their implementation is related to hotel resource consumption. This research has produced meaningful results on the synergies and trade-offs of the effect of applying specific measures and advances on the understanding of the water-energy nexus in the tourism field, particularly the hotel sector. In addition, improving the understanding of current issues on water and energy may assist hotels and the tourism industry to better mitigate and adapt to the prospective Climate change.

Results emphasized that there is great potential to decrease water and energy consumption from tourism by the implementation of integrated conservation measures. Hotels play a key role in the application of those measures. A main conclusion is that technologies should aim to be sector-specific in order to have a better fit with specific operations of different establishments. Reaching and Reducing strategies seem to have a better fit with the hotel´s operations. Thus, hotels should leverage from these technologies, improve monitoring systems, and assess their effectiveness within their operations. For instance, ´complex` measures such as water recycling in swimming pools can be replaced for more ´simple` measures such as saltwater conversion or pool covers.

Developments for resource saving in the accommodation sector have occurred in the past years. For instance, Q-ton System from Mitsubishi Heavy Industries, Ltd. (MHI) is an innovative air-source system heat pump for the production of Hot Sanitary Water (HSW) and for heating through aerothermal energy and with a CO2 compressor (Lumelco, n.d.[6]). Several hotels in Spain - RIU Hotel Plaza de España (Madrid), NH Collection Valencia Colón (Valencia) or Hotel Albit Playa (Alicante) have implemented the system and have reported a 35% of energy saving cost associated to HSW.

In addition, there is great potential in Benidorm for on-site greywater measures, the pilot project in the Samba Hotel in Lloret del Mar -established by the European project, demEAUmed[7] -, has shown positive results in terms of water and energy saving, particularly MBR greywater reuse systems or the Development of the Innovative Wastewater Recycling Process for Hotels and/or Large Commercial Buildings (HOTER) in Malta and the Mediterranean region. Yet, there is need for more scientific data on best applications at the hotel and other accommodation level.

This study has aimed to improve knowledge on the strategic management and decision making on the demand side of the water and energy sector and its nexus. In addition, I want to encourage the hotel sector to innovate and apply resource conservation measures to make their daily operations more sustainable. Every effort count, no matter how small, for the tourism sector to contribute the mitigation and adaptation to climate change.

[6] https://www.lumelco.es/

[7] http://www.demeaumed.eu/index.php

Acknowledgments

I would like to thank Dr. Bas Amelung for his patience and guidance throughout the project. Many thanks to the Universidad de Alicante´s team, specially to Antonio Rico and Hyerim Yoon, for giving me the opportunity to work with their data. Without their insights I would not have been able to start and finish this project. Special thanks to Sandra, for her constant support and valuable input. I would also like to acknowledge all the hotels that have *indirectly* participated in this project, I hope for better times to come for the sector. Thank you to my family and friends that have encouraged me throughout the process. Finally, I want to thank all the women that have fought and worked for us to have the opportunity to study and do research. Yet not all women in every country have the right or chance to receive an education, a fair pay, and equal opportunities. We will keep fighting for equality and progress.

References

Agencia Provincial de la Energia de Alicante. (2013). *Guía de ahorro y eficiencia energética en establecimientos hoteleros de la Provincia de Alicante*.

Agencia Provincial de la Energia de Alicante. (2020). *Guía de buenas prácticas en ahorro y eficiencia energética para trabajadores del sector turístico.*

Alcalde Sanza, L., & Gawlik, B. M. (2014). Water Reuse in Europe: Relevant guidelines, needs for and barriers to innovation. In *JRC Science and Policy Reports*.

Arahuetes, A., Hernández, M., & Rico, A. M. (2018). Adaptation strategies of the hydrosocial cycles in the Mediterranean region. *Water (Switzerland)*, *10*, 790.

Asociación Técnica Española de Climatización y Refrigeración, & Instituto para la Diversificación y Ahorro de la Energía. (2010). *Guía técnica. Agua caliente sanitaria central. Ahorro y Eficiencia Energética en Climatización.*

Atanasova, N., Dalmau, M., Comas, J., Poch, M., Rodriguez-Roda, I., & Buttiglieri, G. (2017). Optimized MBR for greywater reuse systems in hotel facilities. *Journal of Environmental Management*, *193*, 503–511.

Baños, C. J., Hernández, M., Rico, A. M., & Olcina, J. (2019). The hydrosocial cycle in coastal tourist destinations in Alicante, Spain: Increasing resilience to drought. *Sustainability (Switzerland)*, *11*, 1–20.

Barberán, R., Egea, P., Gracia-de-Rentería, P., & Salvador, M. (2013). Evaluation of water saving measures in hotels: A Spanish case study. *International Journal of Hospitality Management*, *34*, 181–191.

Beccali, M., Finocchiaro, P., Ippolito, M. G., Leone, G., Panno, D., & Zizzo, G. (2018). Analysis of some renewable energy uses and demand side measures for hotels on small Mediterranean islands: A case study. *Energy*, *157*, 106–114.

Beccali, M., La Gennusa, M., Lo Coco, L., & Rizzo, G. (2009). An empirical approach for ranking environmental and energy saving measures in the hotel sector. *Renewable Energy*, *34*, 82–90.

Becken, & McLennan, C. lee. (2017). Evidence of the water-energy nexus in tourist accommodation. *Journal of Cleaner Production*, *144*, 415–425.

Becken, S, Garofano, N., McLennan, C., Moore, S., Rajan, R., & Watt, M. (2014). *March 14 2 nd White Paper Tourism and Water: From Challenges to Solutions Providing the business case EarthCheck Research Institute About EC3 Global*.

Becken, Susanne. (2013). Operators' Perceptions of Energy Use and Actual Saving Opportunities for Tourism Accommodation. *Asia Pacific Journal of Tourism Research*, *18*, 1–2.

Bianco, V., Righi, D., Scarpa, F., & Tagliafico, L. A. (2017). Modeling energy consumption and efficiency measures in the Italian hotel sector. *Energy and Buildings*, *149*, 329–338.

Bohdanowicz, P., & Martinac, I. (2007). Determinants and benchmarking of resource consumption in hotels-Case study of Hilton International and Scandic in Europe. *Energy and Buildings*, *39*, 82–95.

Buonomano, A., De Luca, G., Damian Figaj, R., & Vanoli, L. (2015). Dynamic simulation and thermo-economic analysis of a PhotoVoltaic/ Thermal collector heating system for an indoor-outdoor swimming pool. *Energy Conversion and Management*, *99*, 176–192.

Chan, E., Okumus, F., & Chan, W. (2017). The Applications of Environmental Technologies in Hotels. *Journal of Hospitality Marketing and Management*, *26*, 23–47.

Chan, Okumus, F., & Chan, W. (2018). Barriers to Environmental Technology Adoption in Hotels. *Journal of Hospitality and Tourism Research*, *42*, 829–852.

Chan, Okumus, F., & Chan, W. (2020). What hinders hotels' adoption of environmental technologies: A quantitative study. *International Journal of Hospitality Management*, *84*.

Chan, W., Li, D., Mak, B., & Liu, L. (2013). Evaluating the application of solar energy for hot water provision: An action research of independent hotel. *International Journal of Hospitality Management*, *33*, 76–84.

Cheung, C. T., Mui, K. W., & Wong, L. T. (2013). Energy efficiency of elevated water supply tanks for high-rise buildings. *Applied Energy*, *103*, 685–691.

Coles, T., Dinan, C., & Warren, N. (2016). Energy practices among small- and medium-sized tourism enterprises: A case of misdirected effort? *Journal of Cleaner Production*, *111*, 399–408.

Dascalaki, E., & Balaras, C. A. (2004). XENIOS-a methodology for assessing refurbishment scenarios and the potential of application of RES and RUE in hotels. *Energy and Buildings*, *36*, 1091–1105.

Deng, S. M., & Burnett, J. (2000). Study of energy performance of hotel buildings in Hong Kong. *Energy and Buildings*, *31*, 7–12.

Dhirasasna, N. N., Becken, S., & Sahin, O. (2020). A systems approach to examining the drivers and barriers of renewable energy technology adoption in the hotel sector in Queensland, Australia. *Journal of Hospitality and Tourism Management*, *42*, 153–172.

Dumont, A., Mayor, B., & López-Gunn, E. (2013). Is the Rebound Effect or Jevons Paradox a Useful Concept for better Management of Water Resources? Insights from the Irrigation Modernisation Process in Spain. *Aquatic Procedia*, *1*, 64–76.

Eurostat. (2020). *Eurostat - Data Explorer*.

Field, A. (2016). *Discovering Statistics Using IBM SPSS Statistics*.

Freire-González, J. (2019). Does Water Efficiency Reduce Water Consumption? The Economy-Wide Water Rebound Effect. *Water Resources Management*, *33*, 2191–2202.

Gabarda-Mallorquí, A., Fraguell, R., & Ribas, A. (2018). Exploring Environmental Awareness and Behavior among Guests at Hotels That Apply Water-Saving Measures. *Sustainability*, *10*, 1305.

Gabarda-Mallorquí, A., Garcia, X., & Ribas, A. (2017). Mass tourism and water efficiency in the hotel industry: A case study. *International Journal of Hospitality Management*, *61*, 82–93.

Gabarda-Mallorqui, A., & Palom, A. R. (2018). Exploring hotel typologies according to water saving measures application through a cluster analysis. The case of Lloret de Mar (Costa Brava). *Cuadernos de Turismo*, 665–668.

Gössling, S., Peeters, P., Hall, C. M., Ceron, J. P., Dubois, G., Lehmann, L. V., & Scott, D. (2012). Tourism and water use: Supply, demand, and security. An international review. In *Tourism Management* (pp. 1–15). Pergamon.

Gual, M., Moià, A., & March, J. G. (2008). Monitoring of an indoor pilot plant for osmosis rejection and greywater reuse to flush toilets in a hotel. *Elsevier*, *219*, 81–88.

Hardy, L., Garrido, A., & Juana, L. (2012). Evaluation of Spain's water-energy nexus. *International Journal of Water Resources Development*, *28*, 151–170.

Hernández-Sánchez, J. C., Boluda-Botella, N., & Sánchez-Lizaso, J. L. (2017). The role of desalination in water management in southeast Spain. *Desalination and Water Treatment*, *76*, 71–76.

Ibrahim, D., & Altunc, M. (2012). Using Solar Energy in the Cleaning of Swimming Pools in North Cyprus. In *Journal of Sustainable Energy & Environment*.

Kasim, A., Gursoy, D., Okumus, F., & Wong, A. (2014). The importance of water management in hotels: A framework for sustainability through innovation. *Journal of Sustainable Tourism*, *22*, 1090–1107.

Katircioglu, S., Gokmenoglu, K. K., & Eren, B. M. (2019). The role of tourism growth in generating additional energy consumption: empirical evidence from major tourist destinations. *Environmental and Ecological Statistics*, *26*, 303–323.

Katircioglu, S., Korhan, ·, Gokmenoglu, K., Baris, ·, & Eren, M. (2019). The role of tourism growth in generating additional energy consumption: empirical evidence from major tourist destinations. *Environmental and Ecological Statistics*, *26*, 303–323.

Kelly, J., & Williams, P. (2007). Tourism destination water management strategies: An eco-efficiency modelling approach. *Leisure/ Loisir*, *31*, 427–452.

Klontza, E. E., Kampragkou, E., Ververidis, K., Papadopoulou, M. P., & Lekkas, D. F. (2016). Evaluation of water saving measures for mid-sized tourist lodging units: the case of Samos Island, Greece. *EUROPEAN JOURNAL OF ENVIRONMENTAL SCIENCES*, *6*, 37–42.

Krizaj, D., Brodnik, A., & Bukovec, B. (2014). A Tool For Measurement of Innovation Newness and Adoption in Tourism Firms. *International Journal of Tourism Research*, *16*, 113–125.

March, H. (2015). The politics, geography, and economics of desalination: a critical review. *Wiley Interdisciplinary Reviews: Water*, *2*, 231–243.

March, H., Saurí, D., & Rico-Amorós, A. M. (2014). The end of scarcity? Water desalination as the new cornucopia for Mediterranean Spain. *Journal of Hydrology*, *519*, 2642–2651.

Mardani, A., Zavadskas, E. K., Streimikiene, D., Jusoh, A., Nor, K. M. D., & Khoshnoudi, M. (2016). Using fuzzy multiple criteria decision making approaches for evaluating energy saving technologies and solutions in five star hotels: A new hierarchical framework. *Energy*, *117*, 131–148.

Matos, C., Pereira, S., Amorim, E. V., Bentes, I., & Briga-Sá, A. (2014). Wastewater and greywater reuse on irrigation in centralized and decentralized systems - An integrated approach on water quality, energy consumption and CO 2 emissions. *Science of the Total Environment*, *493*, 463–471.

Mclennan, C. J., Becken, S., & Stinson, K. (2017). A Water-Use Model For The Tourism Industry In The Asia-Pacific Region: The Impact Of Water-Saving Measures On Water Use. *Journal of Hospitality & Tourism Research*, *41*, 746–767.

Meliá Hotels International. (2017). Integrated annual report. *Integrated Annual Report 2017*, *March*, 1–146.

Meschede, H., Dunkelberg, H., Stöhr, F., Peesel, R. H., & Hesselbach, J. (2017). Assessment of probabilistic distributed factors influencing renewable energy supply for hotels using Monte-Carlo methods. *Energy*, *128*, 86–100.

Michopoulos, A., Ziogou, I., Kerimis, M., & Zachariadis, T. (2017). A study on hot-water production of hotels in Cyprus: Energy and environmental considerations. *Energy and Buildings*, *150*, 1–12.

Ministerio de Industria Energía y Turismo. (2015). *BOE-A-2015-10927*.

Morote, Á. F., Olcina, J., & Hernández, M. (2019). The use of non-conventional water resources as a means of adaptation to drought and climate change in semi-arid regions: South-eastern Spain. *Water (Switzerland)*, *11*.

Nair, S., Hashim, H., Hannon, L., & Clifford, E. (2018). End use level water and energy interactions: A large non-residential building case study. *Water (Switzerland)*, *10*, 810.

Nikolaou, I. E., Vitouladitis, H., & Tsagarakis, K. P. (2012). The willingness of hoteliers to adopt proactive management practices to face energy issues. *Renewable and Sustainable Energy Reviews*, *16*, 2988–2993.

Njoroge, M., Anderson, W., & Mbura, O. (2019). Innovation strategy and economic sustainability in the hospitality industry. *Bottom Line*, *32*, 253–268.

Olcina-Cantos, J., & Vera-Rebollo, J. F. (2016). *Cambio Climático y Política Turística en España: Diagnostico Litoral Mediterráneo Español*. *38*, 323–335.

Olcina Cantos, J., Baños Castiñeira, C. J., & Rico Amorós, A. M. (2016). Medidas de adaptación al riesgo de sequía en el sector hotelero de Benidorm (Alicante, España). *Revista de Geografía Norte Grande*, *153*, 129–153.

Olcina Cantos, J., & Miró Pérez, J. J. (2017). Actividad turística y cambio climático en la Comunidad Valenciana. In *Actividad turística y cambio climático en la Comunidad Valenciana*.

Olcina Cantos, J., & Vera-Rebollo, J. F. (2016). Adaptación del sector turístico al cambio climático en España. La importancia de las acciones a escala local y en empresas turísticas. *Anales de Geografía de La Universidad Complutense*, *36*, 321–352.

Olcina, J., Saurí, D., & Vera-Rebollo, J. F. (2016). Libro jubilar en homenaje al profesor Antonio Gil Olcina. *Universidad de Alicante*.

Orr, M., Qian, X., Schneider, I., Heyn, M., & Simmons, P. (2019). Perceptions vs. practice: A longitudinal analysis of energy-efficient and energy conservation practices in Minnesota'S tourism industry. *Sustainability (Switzerland)*, *11*, 6741.

Pace, L. A. (2016). How do tourism firms innovate for sustainable energy consumption? A capabilities perspective on the adoption of energy efficiency in tourism accommodation establishments. *Journal of Cleaner Production*, *111*, 409–420.

Pinto, A., Afonso, A. S., Santos, A. S., Pimentel-Rodrigues, C., & Rodrigues, F. (2017). Nexus Water Energy for Hotel Sector Efficiency. *Energy Procedia*, *111*, 215–225.

Razumova, M., Ibáñez, J. L., & Palmer, J. R. M. (2015). Drivers of environmental innovation in Majorcan hotels. *Journal of Sustainable Tourism*, *23*, 1529–1549.

Razumova, M., Rey-Maquieira, J., & Lozano, J. (2016). The role of water tariffs as a determinant of water saving innovations in the hotel sector. *International Journal of*

Hospitality Management, *52*, 78–86.

Renwick, D. W. S., Redman, T., & Maguire, S. (2013). Green Human Resource Management: A Review and Research Agenda. *International Journal of Management Reviews*, *15*, 1–14.

Ricart, S., Arahuetes, A., Villar, R., Rico, A. M., & Berenguer, J. (2019). More water exchange, less water scarcity? Driving factors from conventional and reclaimed water swap between agricultural and urban – tourism activities in Alicante , Spain. *Urban Water Journal*, *16(10):*, 677-686.

Rico-Amoros, A. M., Sauri, D., Olcina-Cantos, J., & Vera-Rebollo, J. F. (2013). Beyond Megaprojects?. Water Alternatives for Mass Tourism in Coastal Mediterranean Spain. *Water Resources Management*, *27*, 553–565.

Rico, A., Olcina, J., Baños, C., Garcia, X., & Sauri, D. (2019). Declining water consumption in the hotel industry of mass tourism resorts: contrasting evidence for Benidorm, Spain. *Current Issues in Tourism*, *0*, 1–14.

Rosselló -Batle, B., Moià, A., Cladera, A., & Martínez, V. (2010). Energy use, CO 2 emissions and waste throughout the life cycle of a sample of hotels in the Balearic Islands. *Energy and Buildings*, *42*, 547–558.

Sanyé-Mengual, E., Romanos, H., Molina, C., Oliver, M. A., Ruiz, N., Pérez, M., Carreras, D., Boada, M., Garcia-Orellana, J., Duch, J., & Rieradevall, J. (2014). Environmental and self-sufficiency assessment of the energy metabolism of tourist hubs on Mediterranean Islands: The case of menorca (Spain). *Energy Policy*, *65*, 377–387.

Saurí, D., Olcina, J., Fernando Vera, J., Martín-Vide, J., March, H., Serra-Llobet, A., & Padilla, E. (2013). Tourism, Climate Change and Water Resources: Coastal Mediterranean Spain as an Example. In *European Climate Vulnerabilities and Adaptation* 231–252.

Sinha, A., Driha, O., & Balsalobre-Lorente, D. (2020). Tourism and inequality in per capita water availability: is the linkage sustainable? *Environmental Science and Pollution Research*, *27*, 10129–10134.

Styles, D., Schonberger, H., & Galvez Martos, J. L. (2013). *Best Environmental Management Practice in the Tourism Sector*.

Sucheran, R., & Bob, U. (2015). Energy conservation measures in the hotel sector in Kwa-Zulu Natal, South Africa. *African Journal of Hospitality, Tourism and Leisure*, *4*, 1–17.

Tarjuelo, J. M., Rodriguez-Diaz, J. A., Abadía, R., Camacho, E., Rocamora, C., & Moreno, M. A. (2015). Efficient water and energy use in irrigation modernization: Lessons from Spanish case studies. *Agricultural Water Management*, *162*, 67–77.

Tirado, D., Nilsson, W., Deyà-Tortella, B., & García, C. (2019). Implementation of water-saving measures in hotels in Mallorca. *Sustainability (Switzerland)*, *11*, 1–13.

Torres-Bagur, M., Ribas, A., & Vila-Subirós, J. (2019). Incentives and barriers to water-saving measures in hotels in the Mediterranean: A case study of the Muga river basin (Girona, Spain). *Sustainability (Switzerland)*, *11*.

Villar-Navascués, R., Ricart, S., Gil-Guirado, S., Rico-Amorós, A. M., & Arahuetes, A. (2020). Why (Not) Desalination? Exploring Driving Factors from Irrigation Communities' Perception in South-East Spain. *Water*, *12*, 2408.

Warren, C., Becken, S., & Coghlan, A. (2017). Using persuasive communication to co-create behavioural change–engaging with guests to save resources at tourist accommodation facilities. *Journal of Sustainable Tourism*, *25*, 935–954.

Warren, Christopher, & Becken, S. (2017). Saving energy and water in tourist accommodation: A systematic literature review (1987–2015). *International Journal of Tourism Research*, *19*, 289–303.

Whelan, T., & Fink, C. (2016). *The Comprehensive Business Case for Sustainability*.

Williams, J., Bouzarovski, S., & Swyngedouw, E. (2014). *Politicising the nexus: Nexus technologies, urban circulation, and the coproduction of water-energy*.

Williams, N., Rayner, J. P., & Raynor, K. J. (2010). Green roofs for a wide brown land: Opportunities and barriers for rooftop greening in Australia. *Urban Forestry and Urban Greening*, *9*, 245–251.

Wyngaard, A. T., & De Lange, R. (2013). The effectiveness of implementing eco initiatives to recycle water and food waste in selected Cape Town hotels. *International Journal of Hospitality Management*, *34*, 309–316.

Yoon, H. (2018a). A review on water-energy nexus and directions for future studies: From supply to demand end. *Documents d'Analisi Geografica*, *64*, 365–395.

Yoon, H. (2018b). *Exploring the Water-Energy Nexus in Urban and Tourist Areas of the Western Mediterranean: Empirical findings from Beniform and Barcelona*.

Yoon, H., Sauri, D., & Amorós, A. M. R. (2018). Shifting scarcities? The energy intensity of water supply alternatives in the mass tourist resort of Benidorm, Spain. *Sustainability (Switzerland)*, *10*, 1–17.

Zografakis, N., Gillas, K., Pollaki, A., Profylienou, M., Bounialetou, F., & Tsagarakis, K. P. (2011). Assessment of practices and technologies of energy saving and renewable energy sources in hotels in Crete. *Renewable Energy*, *36*, 1323–1328.

Appendix

Appendix 1. Water-saving measures

Table 17. Water conservation measures applied in hotels for reducing water-saving measures based on a literature review.

Areas of use	*Items*	*Source*
Hotel Energy Management	EMS (Energy Management System) that includes: - Measurements and monitoring of energy consumption and costs - Energy indicators development - Identification and implementation of energy measures - Measurement and monitoring of implemented energy measures - Communication and awareness to employees and clients. - Improved maintenance and regulation of energy system	(Agencia Provincial de la Energia de Alicante, 2013)
Air conditioning and heating control	➢ [Solar] heat pump. ➢ Heat recovery technology. ➢ Low-voltage power-saving technology. ➢ Heating and cooling distribution circuits with variable flow pump ➢ Harnessing of residual energy from cooling and heating, and free- cooling. ➢ Establishing maximum and minimum temperatures. ➢ Limitation of cooling and heating timing.	(Meliá Hotels International, 2017) (Agencia Provincial de la Energia de Alicante, 2013)
Lighting	➢ Light-emitting diode (LED) lights ➢ Light sensors or key-card system ➢ Substitutions of electromagnetic equipment for electronic equipment ➢ Maintenance of lighting systems ➢ Limitation and optimization of lighting time (i.e. with sensors) ➢ Harnessing of natural lighting ➢ Space zoning for efficient lighting	(Agencia Provincial de la Energia de Alicante, 2013)
Kitchen and restaurant	➢ Energy efficient equipment (e.g. microwave-ovens) ➢ Good practices from employees ➢ Efficient lighting and conditioning	(Agencia Provincial de la Energia de Alicante, 2013)
Laundries and cleaning	➢ Use of washing machines and driers with full loads ➢ Optimize the water temperature in washing-machines ➢ Harnessing warm air from driers and hot water from washing machines in heat recuperators	(Agencia Provincial de la Energia de Alicante, 2013)

Swimming pools	➢ Heating swimming pools with residual energy	(Meliá Hotels International, 2017)
Building-energy control	➢ Wall insulation materials ➢ Glass laminating materials ➢ Air infiltration monitoring	(Agencia Provincial de la Energia de Alicante, 2013)
Auto consumption and net balance	➢ Solar photovoltaic ➢ Cogeneration ➢ Wind energy ➢ Hydraulic energy	(Agencia Provincial de la Energia de Alicante, 2013) (Beccali et al., 2018)
Hotel Energy Certifications	An Energy Efficiency Certification must be obtained by all buildings with an installed nominal potential of more 400kW. This obliges hotels to obtain a certification. (ISO 50.001) and UNE-ISO 14001:2015	(Agencia Provincial de la Energia de Alicante, 2013)

Appendix 2. Energy-saving measures

Table 18. Energy conservation measures applied in hotels for reducing energy-saving measures based on a literature review.

Areas of use	*Items*	*Source*
Hotel Water Management	➢ Installation of meters and sub-meters ➢ Overall reduction of water pressures (i.e. pressure reducers) ➢ Leak detection and periodic revision ➢ Communication and awareness to employees and clients.	(Tirado et al., 2019) (Meliá Hotels International, 2017) (C. Warren et al., 2017)
Bathroom control	➢ Low-flow showerheads and taps and flow regulators ➢ Infrared taps (with LED) ➢ Low-flash/Dual-flash toilet	(Tirado et al., 2019) (Agencia Provincial de la Energia de Alicante, 2013)
Kitchens and restaurants	➢ Lower-flow taps ➢ Use of washing machines and driers with full loads ➢ Low-consumption and efficient dishwasher ➢ Waterless steamers ➢ Pre-rinse spray valves ➢ Coffee machines with water recirculation systems continuous brew	(Tirado et al., 2019) (Agencia Provincial de la Energia de Alicante, 2013)
Laundries and cleaning	➢ Low-consumption and efficient washing machines by electronic systems ➢ Low-consumption and efficient washing machines by mechanic systems ➢ Reusing bedding and towels programs	(Agencia Provincial de la Energia de Alicante, 2013) (Kasim et al., 2014)
Swimming pools	➢ Filling with sea water ➢ Installation of closed water treatment systems	(Meliá Hotels International, 2017) (Agencia Provincial de la Energia de Alicante, 2013)
Gardens	➢ Installation of timers or programming systems for irrigation ➢ Planting native species ➢ Wastewater for irrigation (reuse greywater from baths and sinks) ➢ Rainwater harvesting for irrigation	(Klontza et al., 2016) (Tirado et al., 2019) (Barberán et al., 2013) (Wyngaard & De Lange, 2013)
Hotel Water Certifications	E.g. UNE-ISO 14001:2015	(Rico et al., 2019)

Appendix 3. Drivers and barriers for implementing resource saving measures

Table 19. Drivers and internal and external barriers for conservation measures implementation in hotels based on a literature review.

Drivers	Internal barriers	External barriers
Reduction of operational and maintenance costs	Lack of awareness on EMS	Insufficient external motivation and framework to implement EMS
Environmental concerns and awareness	Lack of knowledge on EMS	Limited evidence o financial benefits (i.e. financial and environmental) of EMS
Customer loyalty	Lack of financial resources and budget	Limited scientific data to evaluate applicability of EMS
Improvement of marketing of the hotel	Lack of human resources and staff involvement	Limited transfer of knowledge by suppliers or experts / Lack of professional advise
Legal requirements (compliance with international standard norms)	Length of planning and implementation process	Technological behavioral fit of new systems into existing systems
Tour operator requirements	Problems with practical implementation of EMS	Lack of sector-specific EMS or measures tailored to specific hotel typologies
Chain requirements	Management commitment and attitudes	Subjective and costly certification systems
Adaptation to climate change.	Difficulties to quantify environmental benefits	

Appendix 4. Interview template

Encuesta agua y energía en el Sector Hotelero de Benidorm

Estimado Sr/Sra:

Quisiera agradecerle, también en nombre de la Universidad de Wageningen, su participación en el proyecto de investigación sobre ´Agua y Energía´, así como su tiempo y dedicación en responder a esta encuesta. En esta entrevista se harán preguntas sobre las medidas de ahorro de agua y energía de su hotel, y del consumo de estos recursos.

La duración estimada para completar la encuesta es de **20-30 minutos**. La encuesta es totalmente **ANONIMA**, para proteger la identidad de los datos que nos facilite. Por tanto, le animo a responder la encuesta lo mas precisa y real posible para poder capturar la situación mas fidedigna y ajustada a la realidad existente.

Le agradezco remita esta encuesta, una vez completada, a la atención de C. Espejo Valle-Inclán a: claudia.espejovalle-inclan@wur.nl.

Una vez más, muchas gracias por su participación.

A. Aspectos generales. Tipología – Caracterización del establecimiento

1. ¿Cuál es la categoría del hotel?
2. ¿Cuál fue el año de construcción del hotel?
3. ¿Ha vivido el hotel alguna reforma en sus instalaciones en los últimos 10 años?
    a. En caso afirmativo, ¿cuáles?
4. ¿Cuál es la superficie total del edificio?
5. Indicar si el establecimiento pertenece a una cadena hotelera o es independiente
6. Indicar el número total de habitaciones del hotel
7. Indicar el número total de plazas hoteleras (camas) del hotel
8. ¿Cuántas personas, aproximadamente, integran la plantilla del hotel?
9. (para plantilla total se entiende contratos fijos más eventuales)
10. Indicar aproximadamente la estancia media del hotel por cliente

B. Aspectos operacionales. Caracterización de las unidades productivas y servicios del que dispone/ofrece el hotel y que están vinculados al consumo/uso de agua y energía

1. ¿Dónde realiza el hotel su colada/servicio de lavanderia? (Se incluye aquí tanto la colada generada por el funcionamiento del propio hotel, como el servicio de lavandería ofrecido a los clientes del hotel)
    a. El 100% de la carga de la colada se realiza en las instalaciones del mismo
    b. Solo un porcentaje de la carga total de la colada se realiza en instalaciones propias. Por favor indique el porcentaje aproximado que se realiza en el hotel
    c. La colada del hotel es una unidad/servicio que tenemos 100% externalizado
2. ¿Dispone el hotel de servicio de restauración?
    a. Si
    b. No

3. ¿Quién puede hacer use del servicio de restauración del hotel?
    a. El servicio de restauración es sólo de acceso a los clientes del hotel
    b. El servicio de restauración es tanto para los clientes del hotel como para el público en general
4. Indique el numero de restaurantes que dispone el hotel (se incluyen tanto los restaurantes, cafeterías y bares)
5. Indicar el número de cocinas que tiene el hotel
6. Indicar el numero de lavaplatos que tiene el hotel
7. El hotel dispone de:
    a. SPA o centro de Wellness (servicios de masaje y tratamiento, hidromasaje, sauna etc.)
    b. Piscina
        i. ¿Cuál es la capacidad de la/s piscina/s?
        ii.
    c. Gimnasio o sala de fitness
8. ¿El hotel dispone de un sistema de aire acondicionado?
    a. Si, centralizado
    b. Si, descentralizado
    c. No
9. ¿El hotel tiene jardín?
    a. Si la superficie es de menos de $500m^2$
    b. Si, la superficie del jardín es de entre $501m^2$ y $2500m^2$
    c. Si, la superficie del jardín es de más de $2500m^2$
    d. No

C. Consumo y medidas de ahorro de agua en el hotel

1. ¿De qué tipo de contador de agua dispone el hotel?
    a. El hotel dispone de un único contador para todos los usos del hotel
    b. El hotel dispone de varios contadores diferenciados por sector (en este caso, indicar el número de contadores que dispone el hotel:
    c. No tiene ningún contador
2. ¿Cuál es porcentaje que ha representado el consumo/coste del agua sobre el total de gastos/costes operativos del hotel en último año (2019)?
3. ¿Cuál es el consumo total de agua fría y agua caliente sanitario (ACS) en el último año (2019)?
4. ¿De cuántos acumuladores de ACS dispone el hotel?
5. ¿Cuál es el caudal del grifo en la habitación? L/min

Medidas de ahorro adoptadas por el hotel

A continuación, se especifican distintas tipologías de medidas de conservación y ahorro de agua. Le pedimos que, por favor, nos indique cuál o cuáles de ellas han sido adoptadas por su hotel.

(para todos: 1. Si. 2. No. 3. No sé)

Gestión y políticas

1. ¿El hotel dispone de una política formalizada/escrita de gestión de agua?
2. El hotel dispone de un plan de acción/programa formalizado de ahorro /reducción del consumo de agua?
3. ¿El hotel dispone de un plan de detección de fugas y de revisiones periódicas?
4. El hotel dispone/ha optado algún standard de reconomimiento internacional (EMAS, ISO14001, Ecolabel u otra etiqueta)? ¿Cuál?

5. Otras/as (por favor especificar respuesta)

Tecnologías – sistema de uso eficiente y dispositivos economizadores de agua

- Reducción de la presión de la red principal

- Grifos con temporizador y/o cierre autonómico y/o sensor de presencia
- Grifos con aireadores
- Grifos con reductores y/o limitadores de caudal

- Cabezales de ducha con grifos con temporizador
- Cabezales de ducha con grifo termostático
- Cabezales de ducha con reductores/limitadores de caudal
- Cabezales de ducha con aireadores

- Inodoros con mecanismos de doble descarga/pulsador
- Inodoros con sistemas de interrupción de descarga
- Inodoros con sistema de contrapeso para cisterna
- Inodoros con sistema limitador de llenado o descarga de la cisterna

- Lavavajillas de bajo consumo y eficientes
- Cafeteras con sistemas de recirculación de agua o erogación continua

- Lavadoras de bajo consumo y eficientes mediante sistemas electrónicos/mecánicos
- Secadoras de bajo consumo y eficientes mediante sistemas electrónicos/mecánicos

- Piscinas de agua salada
- Piscinas que disponen de un circuito cerrado de depuración de aguas
- Utilización de cubiertas de piscinas cuando la piscina no está en funcionamiento

- Aplicación de sistemas de riego localizados
- Uso de sistemas de goteo para el riego del jardín
- Uso de sistemas de aspersión/difusión para el riego del jardín
- Uso de aguas depuradas para el riego de jardín
- Uso de agua de lluvia almacenada para el riego de jardín
- Plantación de especies autóctonas en los jardines

- Instalación de sistemas de depuración de aguas en el propio hotel
- Instalación de sistemas de almacenamiento de agua de lluvia en el otro hotel

- Otros/as (por favor especificar)

Acciones y programas de sensibilización

- Disposición de carteles o adhesivos con información específica/consejos para el uso racional y correcto de agua
- El hotel, ¿anima a sus clientes a utilizar las toallas durante más de un día?
- El hotel, ¿anima a sus clientes a prolongar el uso de las sábanas a más de un día?

- El hotel, ¿trabaja en la sensibilización de sus trabajadores para la identificación de buenas prácticas y hacer un uso correcto a la hora de realizar sus actividades?

- El hotel, ¿promociona la participación responsable de los trabajadores en la gestión de agua? (p.ej. cerrar grifos, dosificar los productos sanitarios, no tirar desperdicios por los sanitarios etc.)

- Otras/as

- ¿Cómo evalúa el impacto de las medidas de ahorro de agua adoptadas sobre el consumo total de agua del hotel? (efectivas/no)

- Que usted considere, hay alguna medida que destaque en cuanto a conservación/ahorro de agua?

Factores que han motivado la adopción de prácticas/medidas de conservación/ahorro de agua. (select 5)

1. Cumplimiento de la legislación/regulación medioambiental
2. En caso de pertenecer a una cadena hotelera, por el cumplimiento de los requisitos de la cadena
3. Reducción de los costes operativos
4. Mejora de la imagen de marca del hotel
5. Importe de la inversión requerida para adoptar la medida reducida/baja
6. Mantener/ganar ventaja competitiva
7. Demanda/preocupación/sensibilidad hacia temas medioambientales
8. Porqué el sector, la industria está adoptando de manera generalizada estas practicas
9. Preocupación ante las barreras de mercado que los temas medioambientales pueden suponer
10. La sequía vivida en los últimos años
11. Preocupación y adaptarse a las previsiones del futuro del cambio climático

Factores que han frenado la adopción de prácticas/medidas de conservación/ahorro de agua (select 5)

1. Desconocimiento de prácticas/medidas de conservación de ahorro de agua
2. Falta de recursos económicos y/o presupuestos
3. Falta de recursos humanos y/o participación del personal
4. Falta de ajuste entre el proceso de planificación y de implementación de las prácticas/medidas
5. Dificultades prácticas con la implementación de las prácticas/medidas
6. Dificultad para cuantificar los beneficios económicos
7. Dificultad para cuantificar los beneficios ambientales
8. Falta de evidencia científica en la evaluación de la aplicabilidad de prácticas/medidas
9. Falta de prácticas/medidas específicas para el sector hotelero o tipologías de hotel
10. La subjetividad y el alto coste de los sistemas de certificación

<u>D. Consumo y medidas de ahorro de energía en el hotel</u>

¿De qué tipo de contador de electricidad dispone el hotel?

a. El hotel dispone de un único contador para todos los usos del hotel

b. El hotel dispone de varios contadores diferenciados por sector (en este caso, indicar el número de contadores que dispone el hotel:
c. No tiene ningún contador

6. ¿Cuál es porcentaje que ha representado el consumo/coste de energía sobre el total de gastos/costes operativos del hotel en último año (2019)?
7. ¿Cuál es porcentaje que ha representado el consumo/coste de la iluminación sobre el total de gastos/costes operativos del hotel en último año (2019)?
8. ¿Cuál es porcentaje que ha representado el consumo/coste de la calefacción y la refrigeración sobre el total de gastos/costes operativos del hotel en último año (2019)?

Medidas de ahorro de energía adoptadas por el hotel

A continuación, se especifican distintas tipologías de medidas de conservación y ahorro de energía. Le pedimos que, por favor, nos indique cuál o cuáles de ellas han sido adoptadas por su hotel.

<u>Gestión y políticas</u>

1. ¿El hotel dispone de una política formalizada/escrita de gestión de energía?
2. El hotel dispone de un plan de acción/programa formalizado de ahorro /reducción del consumo de energía?
3. ¿El hotel dispone de un plan revisiones periódicas de aparatos?
4. El hotel dispone/ha optado algún standard de reconocimiento internacional de eficiencia energética (EMAS, ISO50.001, ISO14001, u otra etiqueta)? ¿Cuál?

<u>Tecnologías – sistema de uso eficiente y dispositivos economizadores de energía</u>

- Sustitución de los equipos de producción térmica por otros actuales y eficientes
- Tecnologías de recuperación térmica
- Distribución sectorizada
- Utilización de variadores de velocidad en las bombas de recirculación de los circuitos de distribución térmica
- Aprovechamiento de las energías residuales de procesos de enfriamiento o calentamiento y de enfriamiento gratuito
- Políticas de temperaturas máximas y mínimas
- Limitación de los tiempos de encendido de climatización y calefacción

- Sustitución de lámparas y bombillas por otras más eficientes (p.ej. LED)
- Sensores de luz
- Limpieza de lámparas y luminarias
- Optimización de los niveles de intensidad lumínica
- Limitación y optimización de los tiempos de encendido
- Aprovechamiento de la luz natural

- Equipos de cocina (p.ej. microondas, hornos etc.) energéticamente eficientes

- Uso de lavadoras y secadoras a carga nominal, nunca a media carga
- Optimización de temperatura de agua en los lavados
- Sistemas de aprovechamiento de aire caliente de las secadoras y agua caliente de las lavadoras en recuperadores de calor

- ACS!

- Medidas de mejora del aislamiento de la fachada
- Implantación de dispositivos de sombra
- Sistemas de vigilancia de las infiltraciones de aire y movimiento de aire

- Uso de cubiertas térmicas para mantener la temperatura
- Sistemas de calentamiento de piscinas con energía residual

Energías renovables (Autoconsumo)

- Energía Solar Fotovoltaica
- Energía Mini-Eólica
- Energía Mini-Hidráulica
- Cogeneración

Acciones y programas de sensibilización

- Disposición de carteles o adhesivos con información específica/consejos para el uso racional y correcto de la energía
- El hotel, ¿dispone de un sistema de tarjetas por el cuál el cliente enciende los sistemas electrónicos únicamente cuando esta en la habitación?

- El hotel, ¿trabaja en la sensibilización de sus trabajadores para la identificación de buenas prácticas y hacer un uso correcto a la hora de realizar sus actividades?
- El hotel, ¿promociona la participación responsable de los trabajadores en la gestión de energía? (p.ej. cerrar cortinas, abrir ventanas, no abrir excesivamente los frigoríficos, controlar temperaturas etc.)
- ¿Cómo evalúa el impacto de las medidas de ahorro de energía adoptadas sobre el consumo total de agua del hotel? (efectivas/no)

- Que usted considere, ¿hay alguna medida que destaque en cuanto a conservación/ahorro de energía?

Appendix 5. Results

Drivers and barriers: Fisher´s exact test

	[,1]
Formalized/written_policies	0.3309942
Comment_Formalized/written_policies	0.32751
Actionplan_program_watersaving	0.3191434
Comment_ActionPlan	0.5375801
StandardCertification	0.4710305
StandardCertification_Name	0.4244989
Overall_pressurereduction	0.06408177
Taps_timer_ automaticclosing_sensor	0.1191705
Taps_aerators	0.3287363
Taps_flowreductors_flow limiters	0.3081871
Showerheads_timers	0.6392344
Showersheads_termosthatic taps	0.4460456
Showerheads_flowreducers_limiters	0.5107671
Showerheads_aerators	0.6550199
Toilets_doubleflushsystems	1
Toilets_dischargeinterruptionsystems	1
Toilets_counterbalanced_systems	0.07177033
Toilets _limitingcisterns	0.5003096
Dishwasher_low consumption_waterefficentsystems	0.8198705
Washingmachines_electronicsystems	1
Washingmachines_mechanicystems	0.149672
Coffeemachines_waterrecirculationsystems_continuousbrew	0.57235
Closedwatertreatment_systems	0.3655502
Taps_aerators	0.3287363
Taps_flowreductors_flow limiters	0.3081871
Showerheads_timers	0.6392344
Showersheads_termosthatic taps	0.4460456
Showerheads_flowreducers_limiters	0.5107671
Showerheads_aerators	0.6550199
Toilets_doubleflushsystems	1
Toilets_dischargeinterruptionsystems	1
Toilets_counterbalanced_systems	0.07177033
Toilets _limitingcisterns	0.5003096
Dishwasher_low consumption_waterefficentsystems	0.8198705
Washingmachines_electronicsystems	1
Washingmachines_mechanicystems	0.149672
Coffeemachines_waterrecirculationsystems_continuousbrew	0.57235
Closedwatertreatment_systems	0.3655502
Localizedirrigation_systems	0.8053958
Drippingirragation_systems	0.6578947
Sprinkler_Sprayirrigation_systems	0.5824303
Greywater_irrigation	0.125609
Rainwaterharvesting_irrigation	0.08518857
Plantingnative_localplantspecies	0.2339807

*Figure 37. Fisher´s exact test (p-values) between **"Legal compliance on environmental regulations"** and water saving measures.*

	[,1]
Formalized/written_policies	0.3588162
Comment_Formalized/written_policies	0.7514374
Actionplan_program_watersaving	0.8868034
Comment_ActionPlan	0.2180505
StandardCertification	0.3839641
StandardCertification_Name	0.3330385
Overall_pressurereduction	0.3021545
Taps_timer_ automaticclosing_sensor	0.03113667
Taps_aerators	0.02349222
Taps_flowreductors_flow limiters	0.2004128
Showerheads_timers	0.1585099
Showersheads_termosthatic taps	0.00527254
Showerheads_flowreducers_limiters	0.896506
Showerheads_aerators	0.08491818
Toilets_doubleflushsystems	0.4825299
Toilets_dischargeinterruptionsystems	0.5112782
Toilets_counterbalanced_systems	1
Toilets _limitingcisterns	0.4260725
Dishwasher_low consumption_waterefficentsystems	0.1090226
Washingmachines_electronicsystems	0.1568011
Washingmachines_mechanicystems	0.6105626
Coffeemachines_waterrecirculationsystems_continuousbrew	0.1317843
Closedwatertreatment_systems	0.01079973
Taps_aerators	0.02349222
Taps_flowreductors_flow limiters	0.2004128
Showerheads_timers	0.1585099
Showersheads_termosthatic taps	0.00527254
Showerheads_flowreducers_limiters	0.896506
Showerheads_aerators	0.08491818
Toilets_doubleflushsystems	0.4825299
Toilets_dischargeinterruptionsystems	0.5112782
Toilets_counterbalanced_systems	1
Toilets _limitingcisterns	0.4260725
Dishwasher_low consumption_waterefficentsystems	0.1090226
Washingmachines_electronicsystems	0.1568011
Washingmachines_mechanicystems	0.6105626
Coffeemachines_waterrecirculationsystems_continuousbrew	0.1317843
Closedwatertreatment_systems	0.01079973
Localizedirrigation_systems	0.7080938
Drippingirragation_systems	1
Sprinkler_Sprayirrigation_systems	0.7143134
Greywater_irrigation	0.4525358
Rainwaterharvesting_irrigation	0.2877598
Plantingnative_localplantspecies	0.3985767

*Figure 36. Figure 2. Fisher´s exact test (p-values) between **"Reduction of operational costs"** and water saving measures.*

	[,1]
Formalized/written_policies	1
Comment_Formalized/written_policies	0.6699214
Actionplan_program_watersaving	1
Comment_ActionPlan	0.5651346
StandardCertification	0.2580716
StandardCertification_Name	0.1031992
Overall_pressurereduction	0.1607696
Taps_timer_ automaticclosing_sensor	0.02373581
Taps_aerators	0.09121219
Taps_flowreductors_flow limiters	0.6594427
Showerheads_timers	0.2142857
Showersheads_termosthatic taps	0.04887218
Showerheads_flowreducers_limiters	1
Showerheads_aerators	1
Toilets_doubleflushsystems	0.1983806
Toilets_dischargeinterruptionsystems	1
Toilets_counterbalanced_systems	1
Toilets _limitingcisterns	0.1983806
Dishwasher_low consumption_waterefficentsystems	0.8199571
Washingmachines_electronicsystems	0.5698976
Washingmachines_mechanicystems	0.0123839
Coffeemachines_waterrecirculationsystems_continuousbrew	1
Closedwatertreatment_systems	0.5864662
Taps_aerators	0.09121219
Taps_flowreductors_flow limiters	0.6594427
Showerheads_timers	0.2142857
Showersheads_termosthatic taps	0.04887218
Showerheads_flowreducers_limiters	1
Showerheads_aerators	1
Toilets_doubleflushsystems	0.1983806
Toilets_dischargeinterruptionsystems	1
Toilets_counterbalanced_systems	1
Toilets _limitingcisterns	0.1983806
Dishwasher_low consumption_waterefficentsystems	0.8199571
Washingmachines_electronicsystems	0.5698976
Washingmachines_mechanicystems	0.0123839
Coffeemachines_waterrecirculationsystems_continuousbrew	1
Closedwatertreatment_systems	0.5864662
Localizedirrigation_systems	1
Drippingirragation_systems	1
Sprinkler_Sprayirrigation_systems	0.3614551
Greywater_irrigation	0.02373581
Rainwaterharvesting_irrigation	0.003869969
Plantingnative_localplantspecies	0.4165277
Signs_information_advises	0.3107769
Towelreuse_strategies	0.2142857
Beddingreuse_strategies	0.1983806

*Figure 35. Fisher´s exact test (p-values) between **"Improvement of the hotel brand image"** and water saving measures.*

	[,1]
Formalized/written_policies	0.5539216
Comment_Formalized/written_policies	0.9458204
Actionplan_program_watersaving	0.753483
Comment_ActionPlan	0.9458204
StandardCertification	0.8323013
StandardCertification_Name	0.634112
Overall_pressurereduction	0.05539919
Taps_timer_ automaticclosing_sensor	0.2667699
Taps_aerators	0.2021883
Taps_flowreductors_flow limiters	1
Showerheads_timers	1
Showersheads_termosthatic taps	0.7694906
Showerheads_flowreducers_limiters	0.7652219
Showerheads_aerators	1
Toilets_doubleflushsystems	0.6517028
Toilets_dischargeinterruptionsystems	1
Toilets_counterbalanced_systems	0.2631579
Toilets _limitingcisterns	0.3181115
Dishwasher_low consumption_waterefficentsystems	1
Washingmachines_electronicsystems	1
Washingmachines_mechanicystems	0.6704721
Coffeemachines_waterrecirculationsystems_continuousbrew	0.2203302
Closedwatertreatment_systems	1
Taps_aerators	0.2021883
Taps_flowreductors_flow limiters	1
Showerheads_timers	1
Showersheads_termosthatic taps	0.7694906
Showerheads_flowreducers_limiters	0.7652219
Showerheads_aerators	1
Toilets_doubleflushsystems	0.6517028
Toilets_dischargeinterruptionsystems	1
Toilets_counterbalanced_systems	0.2631579
Toilets _limitingcisterns	0.3181115
Dishwasher_low consumption_waterefficentsystems	1
Washingmachines_electronicsystems	1
Washingmachines_mechanicystems	0.6704721
Coffeemachines_waterrecirculationsystems_continuousbrew	0.2203302
Closedwatertreatment_systems	1
Localizedirrigation_systems	0.3614551
Drippingirragation_systems	0.6478328

*Figure 38. Fisher´s exact test (p-values) between **"The reduced/low required investment to implement the measure"** and water saving measures.*

	[,1]
Formalized/written_policies	0.1950464
Comment_Formalized/written_policies	0.8814684
Actionplan_program_watersaving	0.5304438
Comment_ActionPlan	0.8140539
StandardCertification	1
StandardCertification_Name	0.7755887
Overall_pressurereduction	0.4441987
Taps_timer_ automaticclosing_sensor	0.5642046
Taps_aerators	0.2207792
Taps_flowreductors_flow limiters	0.624355
Showerheads_timers	0.1606288
Showersheads_termosthatic taps	0.7804672
Showerheads_flowreducers_limiters	0.7316821
Showerheads_aerators	1
Toilets_doubleflushsystems	1
Toilets_dischargeinterruptionsystems	0.2828596
Toilets_counterbalanced_systems	1
Toilets _limitingcisterns	0.5134896
Dishwasher_low consumption_waterefficentsystems	0.1966547
Washingmachines_electronicsystems	0.7491054
Washingmachines_mechanicystems	0.177449
Coffeemachines_waterrecirculationsystems_continuousbrew	0.1984373
Closedwatertreatment_systems	0.291866
Taps_aerators	0.2207792
Taps_flowreductors_flow limiters	0.624355
Showerheads_timers	0.1606288
Showersheads_termosthatic taps	0.7804672
Showerheads_flowreducers_limiters	0.7316821
Showerheads_aerators	1
Toilets_doubleflushsystems	1
Toilets_dischargeinterruptionsystems	0.2828596
Toilets_counterbalanced_systems	1
Toilets _limitingcisterns	0.5134896
Dishwasher_low consumption_waterefficentsystems	0.1966547
Washingmachines_electronicsystems	0.7491054
Washingmachines_mechanicystems	0.177449
Coffeemachines_waterrecirculationsystems_continuousbrew	0.1984373
Closedwatertreatment_systems	0.291866
Localizedirrigation_systems	1
Drippingirragation_systems	1
Sprinkler_Sprayirrigation_systems	0.725584
Greywater_irrigation	0.402383
Rainwaterharvesting_irrigation	0.2060231
Plantingnative_localplantspecies	0.8423867
Signs_information_advises	1
Towelreuse_strategies	1
Beddingreuse_strategies	0.752322
Staff_Awarenessprograms_training	1

*Figure 40. Fisher´s exact test (p-values) between **"Maintain/gain competitive advantage"** and water saving measures.*

	[,1]
Formalized/written_policies	0.7730369
Comment_Formalized/written_policies	0.5117019
Actionplan_program_watersaving	0.6690121
Comment_ActionPlan	0.8669813
StandardCertification	0.229464
StandardCertification_Name	0.08767641
Overall_pressurereduction	0.5680753
Taps_timer_ automaticclosing_sensor	0.2221265
Taps_aerators	0.704938
Taps_flowreductors_flow limiters	1
Showerheads_timers	0.4906357
Showersheads_termosthatic taps	0.6057095
Showerheads_flowreducers_limiters	1
Showerheads_aerators	1
Toilets_doubleflushsystems	0.8526922
Toilets_dischargeinterruptionsystems	1
Toilets_counterbalanced_systems	1
Toilets _limitingcisterns	0.4140423
Dishwasher_low consumption_waterefficentsystems	0.7835022
Washingmachines_electronicsystems	0.459425
Washingmachines_mechanicystems	0.5549033
Coffeemachines_waterrecirculationsystems_continuousbrew	0.3989218
Closedwatertreatment_systems	1
Taps_aerators	0.704938
Taps_flowreductors_flow limiters	1
Showerheads_timers	0.4906357
Showersheads_termosthatic taps	0.6057095
Showerheads_flowreducers_limiters	1
Showerheads_aerators	1
Toilets_doubleflushsystems	0.8526922
Toilets_dischargeinterruptionsystems	1
Toilets_counterbalanced_systems	1
Toilets _limitingcisterns	0.4140423
Dishwasher_low consumption_waterefficentsystems	0.7835022
Washingmachines_electronicsystems	0.459425
Washingmachines_mechanicystems	0.5549033
Coffeemachines_waterrecirculationsystems_continuousbrew	0.3989218
Closedwatertreatment_systems	1
Localizedirrigation_systems	1
Drippingirragation_systems	1
Sprinkler_Sprayirrigation_systems	0.392063
Greywater_irrigation	0.6695525
Rainwaterharvesting_irrigation	0.7264284
Plantingnative_localplantspecies	0.9107225
Signs_information_advises	0.8031442
Towelreuse_strategies	1
Beddingreuse_strategies	0.05652861
Staff_Awarenessprograms_training	0.3688312

*Figure 39. Fisher´s exact test (p-values) between **"Increased awareness/worries by the users/clients"** and water saving measures.*

	[,1]
Formalized/written_policies	0.2904025
Comment_Formalized/written_policies	0.9099786
Actionplan_program_watersaving	0.2198142
Comment_ActionPlan	0.9771374
StandardCertification	0.05347192
StandardCertification_Name	0.5497567
Overall_pressurereduction	0.6072534
Taps_timer_ automaticclosing_sensor	0.03143606
Taps_aerators	0.3807811
Taps_flowreductors_flow limiters	0.2241486
Showerheads_timers	0.8477444
Showersheads_termosthatic taps	0.2967713
Showerheads_flowreducers_limiters	0.9133127
Showerheads_aerators	0.2669683
Toilets_doubleflushsystems	1
Toilets_dischargeinterruptionsystems	0.4957983
Toilets_counterbalanced_systems	0.7293233
Toilets _limitingcisterns	0.2095261
Dishwasher_low consumption_waterefficentsystems	0.8363247
Washingmachines_electronicsystems	0.3892572
Washingmachines_mechanicystems	0.7399381
Coffeemachines_waterrecirculationsystems_continuousbrew	0.2855034
Closedwatertreatment_systems	1
Taps_aerators	0.3807811
Taps_flowreductors_flow limiters	0.2241486
Showerheads_timers	0.8477444
Showersheads_termosthatic taps	0.2967713
Showerheads_flowreducers_limiters	0.9133127
Showerheads_aerators	0.2669683
Toilets_doubleflushsystems	1
Toilets_dischargeinterruptionsystems	0.4957983
Toilets_counterbalanced_systems	0.7293233
Toilets _limitingcisterns	0.2095261
Dishwasher_low consumption_waterefficentsystems	0.8363247
Washingmachines_electronicsystems	0.3892572
Washingmachines_mechanicystems	0.7399381
Coffeemachines_waterrecirculationsystems_continuousbrew	0.2855034
Closedwatertreatment_systems	1
Localizedirrigation_systems	1
Drippingirragation_systems	1
Sprinkler_Sprayirrigation_systems	1
Greywater_irrigation	0.5139319
Rainwaterharvesting_irrigation	0.3554843
Plantingnative_localplantspecies	0.07906644
Signs_information_advises	0.2230576
Towelreuse_strategies	0.7857143
Beddingreuse_strategies	0.3741367
Staff_Awarenessprograms_training	0.4214286

*Figure 42. Fisher´s exact test (p-values) between **"Environmental awareness/worries by the hotel"** and water saving measures.*

	[,1]
Formalized/written_policies	0.5948052
Comment_Formalized/written_policies	0.8571429
Actionplan_program_watersaving	1
Comment_ActionPlan	0.5844156
StandardCertification	0.5441558
StandardCertification_Name	1
Overall_pressurereduction	1
Taps_timer_ automaticclosing_sensor	0.6571429
Taps_aerators	0.2402597
Taps_flowreductors_flow limiters	0.2727273
Showerheads_timers	1
Showersheads_termosthatic taps	1
Showerheads_flowreducers_limiters	1
Showerheads_aerators	0.2207792
Toilets_doubleflushsystems	0.07792208
Toilets_dischargeinterruptionsystems	1
Toilets_counterbalanced_systems	1
Toilets _limitingcisterns	1
Dishwasher_low consumption_waterefficentsystems	1
Washingmachines_electronicsystems	0.737013
Washingmachines_mechanicystems	1
Coffeemachines_waterrecirculationsystems_continuousbrew	0.4714286
Closedwatertreatment_systems	1
Taps_aerators	0.2402597
Taps_flowreductors_flow limiters	0.2727273
Showerheads_timers	1
Showersheads_termosthatic taps	1
Showerheads_flowreducers_limiters	1
Showerheads_aerators	0.2207792
Toilets_doubleflushsystems	0.07792208
Toilets_dischargeinterruptionsystems	1
Toilets_counterbalanced_systems	1
Toilets _limitingcisterns	1
Dishwasher_low consumption_waterefficentsystems	1
Washingmachines_electronicsystems	0.737013
Washingmachines_mechanicystems	1
Coffeemachines_waterrecirculationsystems_continuousbrew	0.4714286
Closedwatertreatment_systems	1
Localizedirrigation_systems	1
Drippingirragation_systems	1
Sprinkler_Sprayirrigation_systems	1
Greywater_irrigation	0.1454545
Rainwaterharvesting_irrigation	0.1103896
Plantingnative_localplantspecies	0.006493506
Signs_information_advises	1
Towelreuse_strategies	1
Beddingreuse_strategies	0.3337662
Staff_Awarenessprograms_training	1

*Figure 41. Fisher´s exact test (p-values) between **"Because the sector/industry is generally adopting this type of practices"** and water saving measures.*

	[,1]
Formalized/written_policies	0.5948052
Comment_Formalized/written_policies	0.8571429
Actionplan_program_watersaving	0.35
Comment_ActionPlan	0.9272727
StandardCertification	1
StandardCertification_Name	0.4805195
Overall_pressurereduction	0.1896104
Taps_timer_ automaticclosing_sensor	0.2961039
Taps_aerators	0.3279221
Taps_flowreductors_flow limiters	0.2727273
Showerheads_timers	1
Showersheads_termosthatic taps	1
Showerheads_flowreducers_limiters	0.3584416
Showerheads_aerators	0.2207792
Toilets_doubleflushsystems	0.5714286
Toilets_dischargeinterruptionsystems	1
Toilets_counterbalanced_systems	1
Toilets _limitingcisterns	1
Dishwasher_low consumption_waterefficentsystems	0.1298701
Washingmachines_electronicsystems	1
Washingmachines_mechanicystems	0.3837662
Coffeemachines_waterrecirculationsystems_continuousbrew	0.2571429
Closedwatertreatment_systems	1
Taps_aerators	0.3279221
Taps_flowreductors_flow limiters	0.2727273
Showerheads_timers	1
Showersheads_termosthatic taps	1
Showerheads_flowreducers_limiters	0.3584416
Showerheads_aerators	0.2207792
Toilets_doubleflushsystems	0.5714286
Toilets_dischargeinterruptionsystems	1
Toilets_counterbalanced_systems	1
Toilets _limitingcisterns	1
Dishwasher_low consumption_waterefficentsystems	0.1298701
Washingmachines_electronicsystems	1
Washingmachines_mechanicystems	0.3837662
Coffeemachines_waterrecirculationsystems_continuousbrew	0.2571429
Closedwatertreatment_systems	1
Localizedirrigation_systems	1
Drippingirragation_systems	1
Sprinkler_Sprayirrigation_systems	0.5909091
Greywater_irrigation	1
Rainwaterharvesting_irrigation	0.7045455
Plantingnative_localplantspecies	0.2077922
Signs_information_advises	1
Towelreuse_strategies	1
Beddingreuse_strategies	1
Staff_Awarenessprograms_training	1

*Figure 45. Fisher´s exact test (p-values) between **"Worries on the market barriers that the environmental problems can entail"** and water saving measures.*

	[,1]
Formalized/written_policies	0.3592314
Comment_Formalized/written_policies	0.4296771
Actionplan_program_watersaving	0.4203216
Comment_ActionPlan	0.3090681
StandardCertification	0.200317
StandardCertification_Name	0.391174
Overall_pressurereduction	0.9069101
Taps_timer_ automaticclosing_sensor	0.8602388
Taps_aerators	0.2790398
Taps_flowreductors_flow limiters	0.7048504
Showerheads_timers	0.8533835
Showersheads_termosthatic taps	0.1352847
Showerheads_flowreducers_limiters	1
Showerheads_aerators	0.3498452
Toilets_doubleflushsystems	0.8407784
Toilets_dischargeinterruptionsystems	0.8083444
Toilets_counterbalanced_systems	0.2304853
Toilets _limitingcisterns	0.766475
Dishwasher_low consumption_waterefficentsystems	0.3759801
Washingmachines_electronicsystems	0.4862691
Washingmachines_mechanicystems	0.7166235
Coffeemachines_waterrecirculationsystems_continuousbrew	0.08270677
Closedwatertreatment_systems	0.3282297
Taps_aerators	0.2790398
Taps_flowreductors_flow limiters	0.7048504
Showerheads_timers	0.8533835
Showersheads_termosthatic taps	0.1352847
Showerheads_flowreducers_limiters	1
Showerheads_aerators	0.3498452
Toilets_doubleflushsystems	0.8407784
Toilets_dischargeinterruptionsystems	0.8083444
Toilets_counterbalanced_systems	0.2304853
Toilets _limitingcisterns	0.766475
Dishwasher_low consumption_waterefficentsystems	0.3759801
Washingmachines_electronicsystems	0.4862691
Washingmachines_mechanicystems	0.7166235
Coffeemachines_waterrecirculationsystems_continuousbrew	0.08270677
Closedwatertreatment_systems	0.3282297
Localizedirrigation_systems	0.5134896
Drippingirragation_systems	0.3445378
Sprinkler_Sprayirrigation_systems	0.2707504
Greywater_irrigation	0.6991007
Rainwaterharvesting_irrigation	0.6540616
Plantingnative_localplantspecies	0.03610631
Signs_information_advises	0.222488
Towelreuse_strategies	0.1333333
Beddingreuse_strategies	0.2910217
Staff_Awarenessprograms_training	0.5441558

*Figure 43. Fisher´s exact test (p-values) between **"The experienced droughts in the past years"** and water saving measures.*

	[,1]
Formalized/written_policies	0.3592314
Comment_Formalized/written_policies	0.4296771
Actionplan_program_watersaving	0.4203216
Comment_ActionPlan	0.3090681
StandardCertification	0.200317
StandardCertification_Name	0.391174
Overall_pressurereduction	0.9069101
Taps_timer_ automaticclosing_sensor	0.8602388
Taps_aerators	0.2790398
Taps_flowreductors_flow limiters	0.7048504
Showerheads_timers	0.8533835
Showersheads_termosthatic taps	0.1352847
Showerheads_flowreducers_limiters	1
Showerheads_aerators	0.3498452
Toilets_doubleflushsystems	0.8407784
Toilets_dischargeinterruptionsystems	0.8083444
Toilets_counterbalanced_systems	0.2304853
Toilets _limitingcisterns	0.766475
Dishwasher_low consumption_waterefficentsystems	0.3759801
Washingmachines_electronicsystems	0.4862691
Washingmachines_mechanicystems	0.7166235
Coffeemachines_waterrecirculationsystems_continuousbrew	0.08270677
Closedwatertreatment_systems	0.3282297
Taps_aerators	0.2790398
Taps_flowreductors_flow limiters	0.7048504
Showerheads_timers	0.8533835
Showersheads_termosthatic taps	0.1352847
Showerheads_flowreducers_limiters	1
Showerheads_aerators	0.3498452
Toilets_doubleflushsystems	0.8407784
Toilets_dischargeinterruptionsystems	0.8083444
Toilets_counterbalanced_systems	0.2304853
Toilets _limitingcisterns	0.766475
Dishwasher_low consumption_waterefficentsystems	0.3759801
Washingmachines_electronicsystems	0.4862691
Washingmachines_mechanicystems	0.7166235
Coffeemachines_waterrecirculationsystems_continuousbrew	0.08270677
Closedwatertreatment_systems	0.3282297
Localizedirrigation_systems	0.5134896
Drippingirragation_systems	0.3445378
Sprinkler_Sprayirrigation_systems	0.2707504
Greywater_irrigation	0.6991007
Rainwaterharvesting_irrigation	0.6540616
Plantingnative_localplantspecies	0.03610631
Signs_information_advises	0.222488
Towelreuse_strategies	0.1333333
Beddingreuse_strategies	0.2910217
Staff_Awarenessprograms_training	0.5441558

*Figure 44. Fisher´s exact test (p-values) between **"Worries and adaptation strategies for future climate change"** and water saving measures.*

´Water for water`

´percentage of water consumption/cost` over total operational costs

Table 20. Multiple Regression test for Water Innovative Reaching strategies and ´percentage of water consumption/cost` over total operational costs (Data source: Rico et al. (2019)).

	Model Summary					
	Residual standard error	R2	Adjusted R square	df	F statistic	p-value
Innovative Reaching ~ ´percentage of water consumption/cost` over total operational costs	1.414	0.9712	0.77	7,1	4.825	0.337

	ANOVA			
	St. Error	t-value	Pr(>|t|)	B coefficient
Formalized water management policies	2.828	2.828	0.216	1.645
Formalized water-saving action plan	2	-3	0.205	-1.282
Standard certification	17.08	1.297	0.418	1.678
Information signs	3.873	3.098	0.199	-0.034
Towel reusing policies	NA	NA	NA	-0.524
Bedding reusing policies	2.646	1.89	0.31	0.837
Staff awareness training	8.82	-1.029	0.488	-0.757
Staff participation in water management	NA	NA	NA	0.000
Plantation of native species	2.646	-2.646	0.23	-1.281

Table 21. Individual Regression test for Water meter (i.e. Water Innovative Reducing strategies) and ´percentage of water consumption/cost` over total operational costs (Data source: Rico et al. (2019)).

	Model Summary					
	St. Error	R2	df	F	p-value	B coefficient
Water meter ~ ´percentage of water consumption/cost` over total operational cost	5.23	0.12	1, 13	1.778	0.2053	-0.347

Table 22. Individual Regression test for General flow reducer (i.e. Water Innovative Reducing strategies) and ´percentage of water consumption/cost` over total operational costs (Data source: Rico et al. (2019)).

	Model Summary					
	St. Error	R2	df	F	p-value	B coefficient
General flow reducer ~ ´percentage of water consumption/cost` over total operational cost	5.001	0.196	1, 13	3.161	0.098	-0.442

Table 23. Multiple Regression test for Taps (i.e. Water Innovative Reducing strategies) and ´percentage of water consumption/cost` over total operational costs (Data source: Rico et al. (2019)).

Model Summary

	Residual standard error	R2	Adjusted R square	df	F statistic	p-value
Taps ~ ´percentage of water consumption/cost` over total operational cost	4.986	0.389	0.138	4, 10	1.564	0.257

	ANOVA			
	St. Error	T value	Pr(>|t|)	B coefficient
Taps with Timer/automatic shut-off/sensor/pedal	2.665	1.820	0.098	0.571
Taps with Aerator/diffuser	3.724	1.400	0.192	-0.287
Taps with Flow redactor/limiter	2.714	-0.483	0.639	0.358

Table 24. Multiple Regression test for Showers (i.e. Water Innovative Reducing strategies) and ´percentage of water consumption/cost` over total operational costs (Data source: Rico et al. (2019)).

	Model Summary					
	Residual standard error	R2	Adjusted R square	df	F statistic	p-value
Showers ~ ´percentage of water consumption/cost` over total operational cost	5.548	0.207	-0.029	3, 10	0.875	0.486

	ANOVA			
	St. Error	T value	Pr(>|t|)	B coefficient
Showers with Timer	6.735	1.416	0.187	0.466
Showers with Aerator	3.688	0.025	0.980	0.066
Showers with Flow reductor/limiter	0.694	0.223	0.828	0.008
Showers with Thermostatic taps	0.483	0.037	1,9	

Table 25. Multiple Regression test for Toilets (i.e. Water Innovative Reducing strategies) and ´percentage of water consumption/cost` over total operational costs (Data source: Rico et al. (2019)).

	Model Summary					
	Residual standard error	R2	Adjusted R square	df	F statistic	p-value
Toilets ~ ´percentage of water consumption/cost` over total operational cost	4.297	0.588	0.361	5, 9	2.578	0.103

	ANOVA			
	St. Error	T value	Pr(>|t|)	B coefficient
Toilets with Double flush mechanisms	2.605	-0.627	0.546	-0.276
Toilets with Discharge interruption systems	2.857	-1.486	0.171	-0.247
Toilets with Counterbalance systems	2.575	-0.067	0.948	0.262
Toilets with Fill or flush cistern limiting system	3.857	3.205	0.011	0.356

Table 26. Multiple Regression test for Kitchen appliances (i.e. Water Innovative Reducing strategies) and ´percentage of water consumption/cost` over total operational costs (Data source: Rico et al. (2019)).

	Model Summary					
	Residual standard error	R2	Adjusted R square	df	F statistic	p-value
Kitchen appliances ~ ´percentage of water consumption/cost` over total operational cost	6.178	0.137	-0.187	3, 8	0.422	0.742

ANOVA	St. Error	T value	Pr(>|t|)	B Coefficient
Low consumption dishwasher	4.832	-0.346	0.739	-0.054
Low consumption washing machine (electronic systems)	4.343	0.876	0.407	-0.313
Low consumption washing machine (electronic systems)	5.191	0.406	0.696	-0.234

Table 27. Multiple Regression test for Water Irrigation systems (i.e. Innovative Reducing strategies) and ´percentage of water consumption/cost` over total operational costs (Data source: Rico et al. (2019)).

	Model Summary				
	Residual standard error	R2	Adjusted R square	df	F statistic
Irrigation systems ~ ´percentage of water consumption/cost` over total operational cost	5.302	0.235	0.026	3, 11	1.126

ANOVA	St. Error	T value	Pr(>|t|)	B coefficient
Irrigation systems with Localized systems	3.344	-1.167	0.87	-0.054
Irrigation systems with Sprinkling systems	2l244	-1.031	0.324	-0.234
Irrigation systems with Dripping systems	3.929	-0.772	0.456	-0.0313

Table 28. Multiple Regression test for Water Innovative Reusing strategies and ´percentage of water consumption/cost` over total operational costs (Data source: Rico et al. (2019)).

	Model Summary					
	Residual standard error	R2	Adjusted R square	df	F statistic	p-value
Innovative Reusing ~ ´percentage of water consumption/cost` over total operational cost	5.519	0.275	0.093	2, 8	1.515	0.277

ANOVA	St. Error	T value	Pr(>|t|)	B coefficient
Water circulation in coffee machines	4.683	-0.898	0.395	-0.481
Greywater for irrigation	4.683	-1.109	0.299	-0.548
Rainwater for irrigation	The contrast could not be applied due to factors with less than 2 l evels			

Table 29. Multiple Regression test for Water Innovative Recycling strategies and ´percentage of water consumption/cost` over total operational costs (Data source: Rico et al. (2019)).

	Model Summary					
	St. Error	R2	df	F	p-value	B coefficient
Closed loop wastewater treatment in swimming pools ~ ´percentage of water consumption/cost` over total operational cost	5.46	0.041	1, 13	0.559	0.468	-0.203

´hotel water consumption` (2014)

Table 30. Multiple Regression test for Water Innovative Reaching strategies and ´hotel water consumption`/cost (2014 (Data source: Rico et al. (2019) and Hotel annual water consumption Data (2005-2017)).

	Model summary					
	Residual standard error	R2	Adjusted R square	df	F statistic	p-value
Innovative Reaching ~ Water consumption	1.39	0.797	0.3257	7, 3	1.69	0.36

	ANOVA			
	St. Error	t-value	Pr(>|t|)	B coefficient
Formalized water management policies	2.448	2.397	0.096	1.618
Formalized water-saving action plan	1.966	-2.11	0.125	-1.236
Standard certification	1.916	0.76	0.502	0.348
Information signs	1.39	1.366	0.265	0.454
Towel reusing policies	2.12	0.793	0.438	0.183
Bedding reusing policies	2.014	1.009	0.387	0.627
Staff awareness training	1.916	-1.841	0.163	-0.843
Staff participation in water management	NA	NA	NA	NA
Plantation of native species	1.077	0.425	0.699	0.141

Table 31. Individual Regression test for Water meter (i.e. Water Innovative Reducing strategies) and ´hotel water consumption` (2014) (Data source: Rico et al. (2019) and Hotel annual water consumption Data (2005-2017)).

	Model Summary					
	St. Error	R2	df	F	p-value	B coefficient
Water meter ~ Water consumption	2.033	0.084	1, 19	1.735	0.204	0.289

Table 32. Individual Regression test for General flow reducer (i.e. Water Innovative Reducing strategies) and ´hotel water consumption` (2014) (Data source: Rico et al. (2019) and Hotel annual water consumption Data (2005-2017)).

	Model summary					
	St. Error	R2	df	F	p-value	B coefficient
General flow reducer ~ Water consumption	3.098	0.0239	1, 19	0.467	0.503	-0.155

Table 33. Multiple Regression test for Taps (i.e. Water Innovative Reducing strategies) and ´hotel water consumption` (2014) (Data source: Rico et al. (2019) and Hotel annual water consumption Data (2005-2017)).

Model Summary	St. error	R2	Adjusted R square	df	F statistic	p-value
Taps ~ Water consumption	2.105	0.277	0.055	4, 13	1.248	0.339

ANOVA	St. Error	T value	Pr(>|t|)	B coefficient
Taps with Timer/automatic shut-off/sensor/pedal	1.039	1.012	0.0239	0.08
Taps with Aerator/diffuser	1.136	-0.096	0.925	-0.025
Taps with Flow redactor/limiter	2.076	1.827	0.091	0.583

Table 34. Multiple Regression test for Showers (i.e. Water Innovative Reducing strategies) and ´hotel water consumption` (2014) (Data source: Rico et al. (2019) and Hotel annual water consumption Data (2005-2017)).

Model Summary	Residual standard error	R2	Adjusted R square	df	F statistic	p-value
Showers ~ Water consumption	2.196	0.2044	0.034	3, 14	1.199	0.346

ANOVA	St. Error	T value	Pr(>|t|)	B coefficient
Showers with Timer	2.486	0.947	0.3596	0.248
Showers with Aerator	1.115	-0.794	0.441	0.432
Showers with Flow reductor/limiter	1.115	1.729	0.101	-0.198
Showers with Thermostatic taps	NA	NA	NA	NA

Table 35. Multiple Regression test for Toilets (i.e. Water Innovative Reducing strategies) and ´hotel water consumption` (2014) (Data source: Rico et al. (2019) and Hotel annual water consumption Data (2005-2017)).

Model Summary	St. error	R2	Adjusted R square	df	F statistic	p-value
Toilets ~ Water consumption	2.25	0.055	-0.181	4, 16	0.232	0.916

ANOVA	St. Error	T value	Pr(>|t|)	B coefficient
Toilets with Double flush mechanisms	1.121	0.308	0.762	0.085
Toilets with Discharge interruption systems	1.127	0.847	0.409	0.213
Toilets with Counterbalance systems	1.436	-0.121	0.905	-0.034
Toilets with Fill or flush cistern limiting system	8.636	-0.353	0.728	-0.089

Table 36. Multiple Regression test for Kitchen appliances (i.e. Water Innovative Reducing strategies) and ´hotel water consumption`(2014) (Data source: Rico et al. (2019) and Hotel annual water consumption Data (2005-2017)).

	Model Summary					
	Residual standard error	R2	Adjusted R square	df	F statistic	p-value
Kitchen Appliances ~ Water consumption	1.987	0.461	0.222	4, 9	1.927	0.19

	ANOVA			
	St. Error	T value	Pr(>|t|)	B coefficient
Low consumption dishwasher	2.134	-1.473	0.175	-0.907
Low consumption washing machine (electronic systems)	1.369	1.824	0.101	0.678
Low consumption washing machine (mechanic systems)	1.667	0.408	0.693	0.195

Table 37. Multiple Regression test for Water Irrigation systems (i.e. Innovative Reducing strategies) and ´hotel water consumption`(2014) (Data source: Rico et al. (2019) and Hotel annual water consumption Data (2005-2017)).

	Model Summary					
	Residual standard error	R2	Adjusted R square	df	F statistic	p-value
Irrigation systems ~ Water consumption	2.083	0.195	0.044	3, 16	1.293	0.311

	ANOVA			
	St. Error	T value	Pr(>|t|)	B coefficient
Irrigation systems with Localized systems	1.276	0.719	0.482	0.221
Irrigation systems with Sprinkling systems	1.176	-0.460	0.651	-0.12
Irrigation systems with Dripping systems	1.188	1.109	0.284	0.317

Table 38. Multiple Regression test for Water Innovative Reusing strategies and ´hotel water consumption`(2014) (Data source: Rico et al. (2019) and Hotel annual water consumption Data (2005-2017)).

	Residual standard error	R2	Adjusted R square	df	F statistic	p-value
Innovative Reusing ~ Water consumption	2.338	0.148	-0.239	5, 11	0.283	0.851

	ANOVA			
	St. Error	T value	Pr(>|t|)	B coefficient
Water circulation in coffee machines	1.63	-0.579	0.574	-0.58
Greywater for irrigation	1.882	0.033	0.974	-0.15
Rainwater for irrigation	2.699	0.178	0.862	-0.12

Table 39. Regression test for Water Innovative Recycling strategies and ´hotel water consumption` (2014) (Data source: Rico et al. (2019) and Hotel annual water consumption Data (2005-2017)).

	Model Summary					
	St. Error	R2	df	F	p-value	B coefficient
Closed water treatment systems in swimming pools ~ Water consumption	2.123	0.0004	1, 19	0.007	0.93	-0.02

´Water for energy`

Table 40. Regression test for Water Innovative Reaching and ´percentage of heating and cooling over the total energy consumption/cost` and ´percentage of lighting over the total energy consumption/cost` (Data source: Rico et al. (2019) and Yoon (2018b)).

	Model summary for ´percentage of heating and cooling over the total energy consumption/cost`						Model summary for ´percentage of lighting over the total energy consumption/cost`					
	St. Error	R2	df	F	p-value	B coefficient	St. Error	R2	df	F	p-value	B coefficient
Bedding reusing policies	15.76	0.911	1, 1	10.27	0.193	0.955	5.275	0.615	1, 1	1.599	0.426	0.784

Table 41. Regression test for General flow reducer (i.e. Water Innovative Reducing strategies) and ´percentage of heating and cooling over the total energy consumption/cost` and ´percentage of lighting over the total energy consumption/cost` (Data source: Rico et al. (2019) and Yoon (2018b)).

	Model summary for ´percentage of heating and cooling over the total energy consumption/cost`						Model summary for ´percentage of lighting over the total energy consumption/cost`					
	St. Error	R2	df	F	p-value	B coefficient	St. Error	R2	df	F	p-value	B coefficient
General flow reducer	38.9	0.459	1, 1	0.849	0.526	-0.677	1.233	0.979	1, 1	46.58	0.093	-0.989

Table 42. Regression test for Taps (i.e. Water Innovative Reducing strategies) and ´percentage of heating and cooling over the total energy consumption/cost` and´percentage of lighting over the total energy consumption/cost` (Data source: Rico et al. (2019) and Yoon (2018b)).

	Model summary for ´percentage of heating and cooling over the total energy consumption/cost`						Model summary for´percentage of lighting over the total energy consumption/cost`					
	St. Error	R2	df	F	p-value	B coefficient	St. Error	R2	df	F	p-value	B coefficient
Taps with Timer/automatic shut-off/sensor/pedal	25.86	0.54	1, 1	1.177	9.474	-0.735	8.415	0.021	1, 1	5	0.907	0.144

Table 43. Regression test for Showers (i.e. Water Innovative Reducing strategies) and ´percentage of heating and cooling over the total energy consumption/cost` and´percentage of lighting over the total energy consumption/cost` (Data source: Rico et al. (2019) and Yoon (2018b)).

	Model summary for ´percentage of heating and cooling over the total energy consumption/cost`						Model summary for ´percentage of lighting over the total energy consumption/cost`					
	St. Error	R2	df	F	p-value	B coefficient	St. Error	R2	df	F	p-value	B coefficient
Showers with Aerator	15.76	0.911	1, 1	10.27	0.1926	-0.955	5.275	0.615	1, 1	1.599	0.426	-0.784

Table 44. Regression test for Toilets (i.e. Water Innovative Reducing strategies) and ´percentage of heating and cooling over the total energy consumption/cost` and ´percentage of lighting over the total energy consumption/cost` (Data source: Rico et al. (2019) and Yoon (2018b)).

	Model summary for ´percentage of heating and cooling over the total energy consumption/cost`						Model summary for ´percentage of lighting over the total energy consumption/cost`					
	St. Error	R2	df	F	p-value	B coefficient	St. Error	R2	df	F	p-value	B coefficient
Toilets with Double flush mechanisms	51.62	0.048	1, 1	0.05	0.858	0.219	3.14	0.864	1, 1	1. 338	0.241	0.929

Table 45. Regression test for Water Irrigation systems (i.e. Innovative Reducing strategies) and ´percentage of heating and cooling over the total energy consumption/cost` and ´percentage of lighting over the total energy consumption/cost` (Data source: Rico et al. (2019) and Yoon (2018b)).

	Model summary for ´percentage of heating and cooling over the total energy consumption/cost`						Model summary for ´percentage of lighting over the total energy consumption/cost`					
	St. Error	R2	df	F	p-value	B coefficient	St. Error	R2	df	F	p-value	B coefficient
Irrigation systems with Sprinkling systems	35.86	0.541	1, 1	1.177	0.474	-0.735	8.415	0.021	1, 1	0.021	0.907	0.144

Table 46. Regression tests for Water Innovative Reusing strategies and ´percentage of heating and cooling over the total energy consumption/cost` and ´percentage of lighting over the total energy consumption/cost` (Data source: Rico et al. (2019) and Yoon (2018b)).

	Model summary for ´percentage of heating and cooling over the total energy consumption/cost`						Model summary for ´percentage of lighting over the total energy consumption/cost`					
	St. Error	R2	df	F	p-value	B coefficient	St. Error	R2	df	F	p-value	B coefficient
Water circulation in coffee machines	11.6	0.952	1, 1	19.79	0.141	-0.976	7.904	0.136	1, 1	0.158	0.759	0.369

´Energy for energy´

Percentage of energy consumption/cost for the hotels.

Table 47. Multiple Regression test for Energy Innovative Reaching strategies and ´percentage of heating and cooling over the total energy consumption/cost` and ´percentage of lighting over the total energy consumption/cost` (Data source: Yoon (2018b)).

	Model Summary					
	Residual standard error	R2	Adjusted R square	df	F statistic	p-value
Innovative Reaching ~´percentage of lighting over the total energy consumption/cost`	2.309	0.966	0.89	4, 2	14.41	0.066

	ANOVA			
	St. Error	T value	Pr(>|t|)	B coefficient
Electricity	NA	NA	NA	NA
Diesel	2.667	0.665	0.574	0.092
Propane	NA	NA	NA	NA
Natural Gas	2.667	3.798	0.063	0.678
Butane	3.266	-3.384	0.149	-0.387
Solar panels	2.667	6.625	0.022	0.917

Table 48. Multiple Regression test for Energy Innovative Reaching strategies and ´percentage of heating and cooling over the total energy consumption/cost` and ´percentage of lighting over the total energy consumption/cost` (Data source: Yoon (2018b)).

	Model Summary					
	Residual standard error	R2	Adjusted R square	df	F statistic	p-value
Innovative Reaching ~ Percentage heating and cooling over the total energy consumption/cost	36.45	0.34	-0.31	3, 3	0.517	0.699

	ANOVA			
	St. Error	T value	Pr(>|t|)	B Coefficient
Electricity HSW	40.75	0.503	0.649	0.244
Diesel HSW	40.75	0.741	0.512	0.359
Propane HSW	34.32	-0.362	0.732	0.427
Natural Gas HSW	NA	NA	NA	NA
Butane HSW	NA	NA	NA	NA
Solar panels HSW	40.75	0.682	0.544	0.244

Table 49. Regression test for Energy meters (i.e. Energy Innovative Reducing strategies) and ´percentage of heating and cooling over the total energy consumption/cost` and ´percentage of lighting over the total energy consumption/cost` (Data source: Yoon (2018b)).

	Model summary for ´percentage of lighting over the total energy consumption/cost`						Model summary for ´percentage of lighting over the total energy consumption/cost`					
	St. Error	R2	df	F	p-value	B coefficient	St. Error	R2	df	F	p-value	B coefficient
Energy meter	7.945	0.007	1,5	0.038	0.853	-0.087	33.98	0.045	1, 5	1. 338	0.649	0.211

Table 50. Regression test for Pumps for distributing freshwater in the building (i.e. Energy Innovative Reducing strategies) and ´percentage of heating and cooling over the total energy consumption/cost` and ´percentage of lighting over the total energy consumption/cost` (Data source: Yoon (2018b)).

	Model summary for ´percentage of lighting over the total energy consumption/cost`						Model summary for ´percentage of lighting over the total energy consumption/cost`					
	St. Error	R2	df	F	p-value	B coefficient	St. Error	R2	df	F	p-value	B coefficient
Pumps building (freshwater)	6.467	0.342	1, 5	2.603	0.167	0.585	34.69	0.004	1,5	0.022	0.887	0.066

Table 51. Regression test for Pumps for distributing Hot Sanitary Water in the building (i.e. Energy Innovative Reducing strategies) and ´percentage of heating and cooling over the total energy consumption/cost` and ´percentage of lighting over the total energy consumption/cost` (Data source: Yoon (2018b)).

	Model summary for ´percentage of lighting over the total energy consumption/cost`						Model summary for ´percentage of lighting over the total energy consumption/cost`					
	St. Error	R2	df	F	p-value	B coefficient	St. Error	R2	df	F	p-value	B coefficient
Pumps building (HSW)	3.73	0.779	3, 2	6.895	0.129	1.887	11.14	0.957	3, 2	14.83	0.064	3.339

Table 52. Regression test for Pumps for distributing freshwater from other water resources in the building (i.e. Energy Innovative Reducing strategies) and ´percentage of heating and cooling over the total energy consumption/cost` and´percentage of lighting over the total energy consumption/cost` (Data source: Yoon (2018b)).

	Model summary for ´percentage of lighting over the total energy consumption/cost`						Model summary for ´percentage of lighting over the total energy consumption/cost`					
	St. Error	R2	df	F	p-value	B coefficient	St. Error	R2	df	F	p-value	B coefficient
Pumps other water resources (freshwater)	7.945	0.007	1,5	0.038	0.853	-0.087	28.84	0.312	1, 5	2.269	0.192	0.559

Table 53. Multiple Regression test for Solar Panels (i.e Energy Innovative Reusing strategies) and ´percentage of heating and cooling over the total energy consumption/cost` and´percentage of lighting over the total energy consumption/cost` (Data source: Yoon (2018b)).

	Model summary					
	St. Error	R2	Adjusted R2	df	F	p-value

Percentage lighting over the total energy consumption/cost	7.945	0.935	0.902	2, 4	28.63	0.004
Percentage heating/cooling over the total energy consumption/cost	34.33	0.21	-0.17	2, 4	0.564	0.608

	ANOVA							
	Percentage lighting over the total energy consumption/cost				Percentage heating/cooling over the total energy consumption/cost			
	St. Error	T value	Pr(>|t|)	B coefficient	St. Error	T value	Pr(>|t|)	B coefficient
Solar panels Number	0.042	-2.624	0.058	- 1.109	0.62	-0.192	0.857	-0.28
Solar panels surface	3.255	4.648	0.009	1.964	49.05	0.499	0.644	0.72

Table 54. Multiple Regression test for Solar Panels (i.e Energy Innovative Reusing strategies) and Solar panels´ savings in KhH and Solar panels´ savings in Euros (Data source: Yoon (2018b)).

	Model summary					
	St. Error	R2	Adjusted R2	df	F	p-value
Solar panel savings in KWh	44.85	0.141	-0.002	2, 12	0.984	0.401
Solar panel savings in Euros	48.35	0.579	0.509	2, 12	8.256	0.005

	ANOVA							
	Solar panel savings in KWh				Solar panel savings in Euro			
	St. Error	T value	Pr(>|t|)	B coefficient	St. Error	T value	Pr(>|t|)	B coefficient
Solar panels Number	29.29	0.043	0.967	0.019	31.58	1.287	0.222	0.394
Solar panels surface	20.99	0.823	0.427	0.36	22.63	1.335	0.207	0.409

Table 55. Regression test for Energy Innovative Recycling strategies and ´percentage of heating and cooling over the total energy consumption/cost` and´percentage of lighting over the total energy consumption/cost` (Data source: Yoon (2018b)).

	Model Summary					
	St. Error	R2	df	F	p-value	B coefficient
Closed water treatment systems in swimming pools ~´percentage of lighting over the total energy consumption/cost`	6.72	0.29	1, 5	2.042	0.212	0.538

´Energy for water`

*Table 56. Individual Regression test for Energy Innovative Reaching strategies and ´hotel water consumption` (2016). (Data source: Yoon (2018b) and Hotel annual water consumption Data (2005-2017)). *Note that they are individual tests*

	Model Summary (~ Water consumption) *					
	St. Error	R2	df	F	p-value	B coefficient
Electricity	NA	NA	NA	NA	NA	NA
Diesel	25.29	0.07	1, 2	0.15	0.734	0.266
Butane	NA	NA	NA	NA	NA	0.214

Natural Gas	4.925	0.96	1, 2	54.29	0.017	0.982
Propane	25.53	0.04	1, 2	0.095	0.786	
Solar panels	25.53	0.045	1, 2	0.095	0.786	-0.214

*Table 57. Individual Regression test for Energy Innovative Reducing strategies and ´hotel water consumption` (2016). (Data source: Yoon (2018b) and Hotel annual water consumption Data (2005-2017)). *Note that they are individual tests*

	Model Summary (~ Water consumption) *					
	St. Error	R2	df	F	p-value	B coefficient
Pumps building (freshwater)	4.925	0.964	1, 2	54.29	0.018	0.982
Pumps building (HSW)	24.36	0.131	1, 2	0.317	0.638	0.362
Pumps building (other water resources)	22-59	0.252	1, 2	0.675	0.497	-0.502

Climate change attitudes and drought awareness and perceptions and the implementation of water- and energy-saving measures in Benidorm

Table 58. Regression test for Climate change perceptions and attitudes and drought awareness and Reaching water-saving measures implementation (Data source: Rico et al. (2019))

	Climate change perceptions and attitudes						**Drought awareness**					
	St.Error	R2	df	F	p-value	B coefficient	St.Error	R2	df	F	p-value	B coefficient
Formalized water management policies	0.522	0.06	1,10	0.694	0.424	0.255	0.414	0.4	1, 7	4.667	0.0675	0.632
Formalized water-saving action plan	0.646	0.01	1,10	0.163	0.695	0.127	0.414	0.4	1, 7	4.667	0.0675	0.632
Standard certification	NA	NA	NA	NA	NA	NA	0.378	0.357	1, 7	3.889	0.089	0.598
Information signs	0.504	0.04	1,10	0.476	0.505	0.213	0.378	0.357	1, 7	3.889	0.089	-0.597
Towel reusing policies	0.316	0.01	1,9	0.09	0.769	0.194	0.333	0.238	1, 6	1.875	0.22	-0.488
Bedding reusing policies	0.483	0.03	1,9	0.35	0.568	0.1	0.494	0.217	1, 6	1.67	0.244	-4.667
Staff awareness training	0.301	0.008	1,10	0.083	0.778	0.091	essentially perfect fit: summary may be unreliable					
Staff participation in water management	essentially perfect fit: summary may be unreliable						essentially perfect fit: summary may be unreliable					
Plantation of native species	0.5	0.16	1,9	1.6	0.241	0.401	0.433	0.1	1, 4	0.444	0.541	0.316

Table 59. Regression test for Climate change perceptions and attitudes and drough awareness and Reducing water-saving measures implementation (Data source: Rico et al. (2019))

	Climate change perceptions and attitudes						**Drought awareness**					
	St.Error	R2	df	F	p-value	B coefficient	St.Error	R2	df	F	p-value	B coefficient
Water meter	0.467	0.182	1,10	2.222	0.167	0.426	0.471	0.003	1, 7	0.025	0.878	0.059
General flow reducer	0.304	0.649	1,10	18.52	0.001	0.806	0.712	0.159	1, 7	1.326	0.287	0.399
Taps with Timer/automatic shut-off/sensor/pedal	0.522	0.064	1,10	0.694	0.424	0.255	0.528	0.123	1, 7	0.977	0.356	0.35
Taps with Aerator/diffuser	0.522	0.091	1,10	0.476	0.505	-0.302	0.447	0.36	1, 7	3.375	0.116	0.6
Taps with Flow reductor/limiter	0.504	0.127	1,10	1.458	0.255	0.357	0.507	0.1	1, 6	0.778	0.407	-0.316
Showers with Timer	0.316	0.01	1,9	0.09	0.769	-0.1	NA	NA	NA	NA	NA	NA
Showers with Aerator	0.522	0.090	1,10	0.083	0.34	0.302	0.471	0.303	1,7	3.36	0.125	0.55

Showers with Flow reductor/limiter	0.516	0.12	1,9	1.227	0.296	0.346	0.528	0.025	1, 7	0.179	0.684	0.158
Showers with Thermostatic taps	0.483	0.037	1,9	0.35	0.568	-0.194	0.333	0.555	1, 6	7.5	0.033	0.745
Toilets with Double flush mechanisms	0.50	0.127	1,10	1.458	0.255	-0.357	0.561	0.01	1,7	0.7	0.798	0.1
Toilets with Discharge interruption systems	0.504	0.127	1,10	1.458	0.255	0.357	0.528	0.025	1, 7	0.179	0.684	-0.158
Toilets with Counterbalance systems	0.467	0.03	1, 10	0.312	0.588	-0.174	0.527	0.025	1, 7	0.179	0.684	-0.158
Toilets with Fill or flush cistern limiting system	0.504	0.127	1, 10	1.458	0.255	0.357	0.561	0.01	1, 7	0.07	0.798	-0.1
Irrigations systems with Localized systems	0.504	0.127	1, 10	1.458	0.255	0.357	0.528	0.025	1, 7	0.179	0.684	-0.158
Irrigations systems with Sprinkling systems	0.467	0.182	1, 10	2.222	0.167	0.426	0.365	0.085	1, 6	0.562	0.462	-0.29
Irrigations systems with Dripping systems	0.522	0.064	1, 10	0.6944	0.424	0.255	0.528	0.123	1, 7	0.977	0.356	-0.35
Low consumption dishwasher	0.674	0.026	1,10	0.266	0.617	0.161	0.632	0.337	1, 7	3.556	0.101	0.58
Low consumption washing machine (electronic systems)	0.707	0.024	1, 8	0.2	0.666	0.156	0.676	0.1	1, 7	0.778	0.407	0.316
Low consumption washing machine (electronic systems)	Not able to apply the test						0.365	0.085	1, 6	0.562	0.481	-0.293

Table 60. Regression test for Climate change perceptions and attitudes and drough awareness and Reusing water-saving measures implementation (Data source: Rico et al. (2019))

	Climate change perceptions and attitudes						**Drought awareness**					
	St.Error	R2	df	F	p-value	B coefficient	St.Error	R2	df	F	p-value	B coefficient
Water circulation in coffee machines	0.843	0.218	1,9	2.506	0.148	0.467	0.654	0.625	1, 7	11.67	0.011	0.791
Greywater for irrigation	0.421	0.648	1,9	16.57	0.003	0.805	0.774	0.125	1, 5	0.714	0.436	0.354
Rainwater for irrigation	essentially perfect fit: summary may be unreliable						0.383	0.125	1, 5	0.714	0.4366	0.354

Table 61. Regression test for Climate change perceptions and attitudes and drough awareness and Reaching water-saving measures implementation (Data source: Rico et al. (2019))

	Climate change perceptions and attitudes						**Drought awareness**					
	St.Error	R2	df	F	p-value	B coefficient	St.Error	R2	df	F	p-value	B coefficient
Closed loop wastewater treatment in swimming pools	0.467	0.03	1, 10	0.312	0.588	0.174	essentially perfect fit: summary may be unreliable					