

**Water management in hospitality sector: a literature investigation**

**Gestão hídrica no setor de hospitalidade: uma investigação da literatura**

**Gestión del agua en el sector de la hospitalidad: una investigación de la literatura**

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**Abstract:** Being tourism one of the industries highly dependent on water, it is a necessary resource to ensure the hospitality sector sustainability. Due to this, the research objective is to raise the benefits coming from the international scientific literature to contribute to water resources management in the sector. To achieve this, the present research uses the intervention instrument Knowledge Development Process-Constructivist, aiming to select, identify and analyze literature characteristics. The paper selects a set of 25 articles with scientific recognition, that identified the following results: Spain is the country with the highest representativeness of studies developed; University of the Balearic Islands is the most found authors' home university; Azilah Kasim is prominent author in the area; hotels with more than three stars are the most studied; water consumption in guest rooms are the most analyzed hotels areas; stakeholders' involvement is essential to an efficient water management, especially manager's environmental awareness. Aiming to help hotel managers to elaborate a water management plan and review their water usage, water resources management practices in hotels are highlighted, besides the most used indicators. The paper also provides future research opportunities.

**Key words:** Water Resources Management; Hospitality Sector; ProKnow-C.

**Resumo:** Sendo o turismo uma das indústrias altamente dependentes de água, esse é um recurso necessário para garantir a sustentabilidade do setor hoteleiro. Devido a isso, o objetivo da pesquisa é levantar os benefícios advindos da literatura científica internacional para contribuir com a gestão dos recursos hídricos no setor. Para isso, a presente pesquisa utiliza o instrumento de intervenção Knowledge Development Process-Constructivist, visando selecionar, identificar e analisar características da literatura. O trabalho seleciona 25 artigos com reconhecimento científico, que identificou os seguintes resultados: a Espanha é o país com maior representatividade nos estudos desenvolvidos; a Universidade das Ilhas Baleares é a universidade origem dos autores mais encontrada; Azilah Kasim é autora proeminente na área; hotéis com mais de três estrelas são os mais estudados; o consumo de água nos quartos dos hóspedes são as áreas dos hotéis mais analisada; o envolvimento dos stakeholders é essencial para uma gestão eficiente da água, especialmente a conscientização ambiental do gerente. Visando auxiliar os gerentes de hotéis a elaborarem um plano de gestão da água e revisarem seu uso da água, práticas de gestão de recursos hídricos são destacadas, além dos indicadores mais utilizados. O artigo também proporciona oportunidade de pesquisas futuras.

**Palavras-Chave:** Gestão de Recursos Hídricos; Setor Hoteleiro; ProKnow-C.

**Resumen:** Siendo el turismo una de las industrias altamente dependientes del agua, ese es un recurso necesario para garantizar la sostenibilidad del sector hotelero. Debido a esto, el objetivo de la investigación es levantar los beneficios procedentes de la literatura científica internacional para contribuir con la gestión de los recursos hídricos

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en el sector. Para ello, la presente investigación utiliza el instrumento de intervención Knowledge Development Process-Constructivist, buscando seleccionar, identificar y analizar características de la literatura. El trabajo selecciona 25 artículos con reconocimiento científico, que identifican los siguientes resultados: España es el país con mayor representatividad en los estudios desarrollados; la Universidad de las Islas Baleares es la universidad de origen de los autores más encontrada; Azilah Kasim es autora prominente en el área; hoteles con más de tres estrellas son los más estudiados; el consumo de agua en las habitaciones de los huéspedes son las áreas de los hoteles más analizadas; la participación de las partes interesadas es esencial para una gestión eficiente del agua, especialmente la concienciación ambiental del gerente. Con el fin de ayudar a los gerentes de hoteles a elaborar un plan de gestión del agua y revisar su uso, se destacan las prácticas de gestión de recursos hídricos en los hoteles, además de los indicadores más utilizados. El artículo también proporciona oportunidades para futuras investigaciones.

**Palabras clave:** Gestión de Recursos Hídricos; Sector de la Hostelería; ProKnow-C.

## 1 Introduction

Over the decades, Hospitality and Tourism Industry has experienced continued growth and deepening diversification to become one of the fastest growing economic sectors in the world (World Tourism Organization, 2018). In 2018, the sector had, directly or indirectly, US\$8.8 trillion contributed to the world's GDP, 10.4% of global GDP (World Travel & Tourism Council, 2019), employed 292 million people and hosted 1.5 billion guests (Whole World Water, 2018).

Among the different impacts of tourism growth and representativeness, the effects on water resources are one of the most relevant (Tortella & Tirado, 2011), seeing that tourism is one of the industries highly dependent on water (Kasim, Dzakiria, Gursoy & Okumus, 2013). In hospitality sector, this dependency is necessary for basics human needs, such as hygienic purposes (e.g. showering, flushing toilets, cleaning rooms, washing bed and table linen) and food needs, and also related to indirect water demand, such as gardens irrigation and leisure activities (e.g. swimming pools, spa facilities and golf) (Gössling, 2015; Deyà-Tortella, Garcia, Nilsson & Tirado, 2016; Gabarda-Mallorquí, Garcia & Ribas, 2017).

This water demand can have a significant negative effect on the destination's tourism cycle and on local residents' welfare (Razumova, Rey-Maqueira & Lozano, 2016). In most countries, water consumption per guest in hotels exceeds that of the local population (Tourism Partnership, 2017). From this perspective, knowing that 1 in 9 people lack access to safe water (World Health Organization & United Nations Children's Fund, 2017), the industry has responsibility to encourage responsible water use and consumption (Tourism Partnership, 2017).

In order to reduce water consumption, the number of hotels implementing water management strategies is increasing (Gabarda-Mallorquí, Fraguell & Ribas, 2018). From an adequate water management, hotels cannot just achieve operating cost saving and environmental

protection (Deng & Burnett, 2002), but also contribute to the long-term sustainability of the sector (Trung & Kumar, 2005; Kasim et al., 2013).

Therefore, being water an essential factor of production for hotel activities (Barberán, Egea, Gracia-de-Rentería & Salvador, 2013), knowing what has already been investigated seems to be an important step to encourage this resource management and preservation. Besides, contribute to the business own sustainability (Kasim et al., 2013), helping towards protecting the environment (Tang, 2012) and stakeholders needs, while satisfying customer's requests (March, Gual & Orozco, 2004) and offering benefits to society as a whole (Tortella & Tirado, 2011; Kasim et al., 2013).

Although the number of studies analyzing water management in hospitality sector has been increasing, studies that present a holistic view of this resource management are still limited, especially based in what has been developed in literature. Thus, the present research aims to contribute to fill this gap, guided by the following question: which are the contributions coming from the scientific literature addressing water resources management in the hospitality sector?

With regard to this question, the main objective of this research is to raise the benefits coming from the international scientific literature to contribute to water resources management in hospitality sector. For this reason, the intervention instrument Knowledge Development Process-Constructivist (ProKnow-C) was used, in order to select, identify, and analyze literature characteristics.

This study begins by presenting the research methodology, necessary to understand how the other chapter was developed, the literature review about "water resources management and tourism". The presentation of the bibliometric analysis is found in the "results and discussions" section and, finally, the "conclusions" are exposed.

## **2 Research methodology**

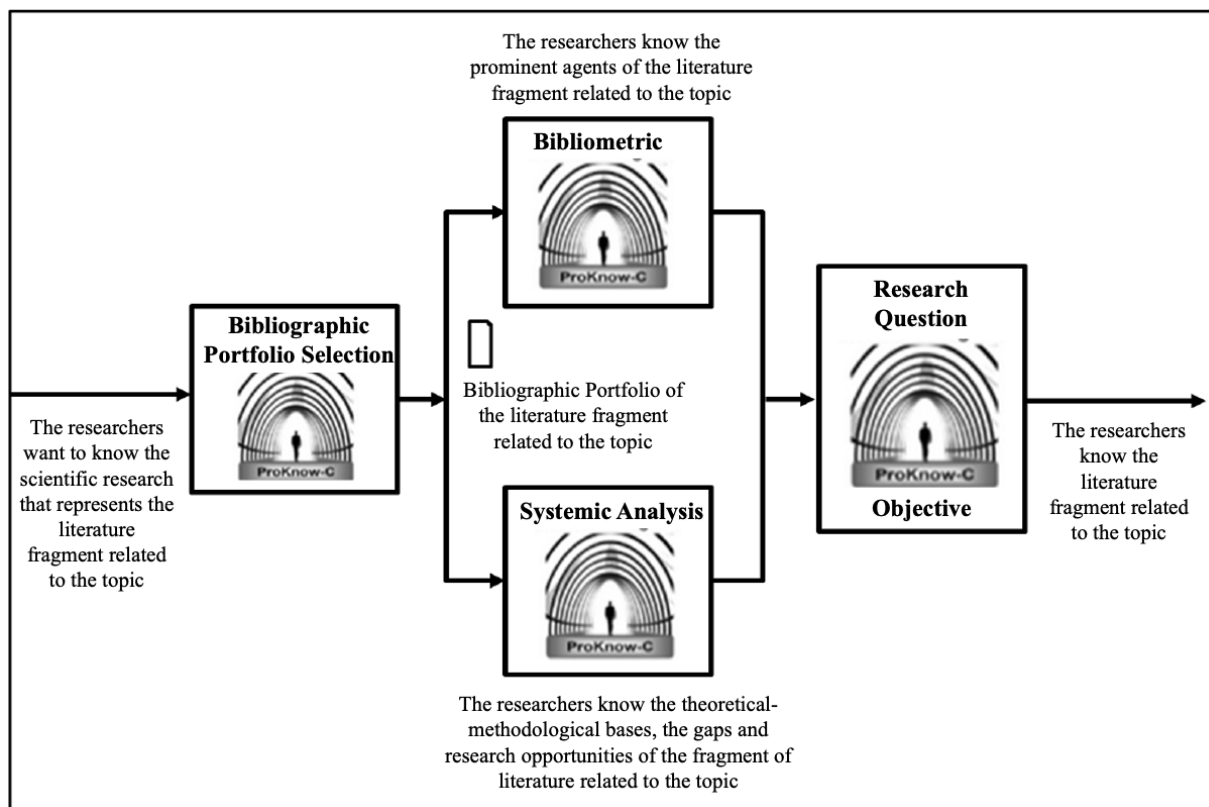
The technical procedures of the present research used bibliographic and action research. It is characterized as a bibliographic research because of its analysis procedures of the articles that compose the bibliographic portfolio. It is also an action research by the interaction of the researchers with the selected data (Creswell, 2010), since the research provides knowledge based on researches that contains perceptions and interpretations given by the authors.

With regard to the nature of the objective, this research is exploratory and descriptive. Data collection was conducted with primary data, defined by selected articles and its correspondent critical analysis made by researches. Parallel to this, secondary data was used, with publications that compose the bibliographic portfolio.

To achieve the proposed objective, the present research used the intervention instrument Knowledge Development Process-Constructivist (ProKnow-C). The ProKnow-C is based on a sequence of stages that promote researchers' knowledge, for their interests and delimitations, according to the constructivist vision (Dutra, Ripoll-Feliu, Fillol, Ensslin & Ensslin, 2015). It proposes the development of a bibliographic portfolio with scientific recognition and alignment with the research theme. Thus, ProKnow-C made possible to construct a bibliometric analysis, based on the quantitative disclosure of the parameters of a defined set of articles (bibliographic portfolio) for the management of information and scientific knowledge of a given subject (Lacerda, Ensslin & Ensslin, 2012).

In recent years, several studies have been published in different areas of knowledge using ProKnow-C, being widespread in the scientific community. The instrument is developed in four phases, (1) selection of a bibliographic portfolio about the topic; (2) bibliometric analysis; (3) systemic analysis; and (4) identification of research opportunities (Dutra et al., 2015). Figure 1 summarize those procedures.

Regarding the data collection procedures, the first stage of ProKnow-C consists of a bibliographical portfolio selection. Therefore, the most relevant databases for the topic were analyzed, which are the databases that resulted in the biggest number of articles related to the search command and, consequently, to the context.



**Figure 1.** ProKnow-C phases

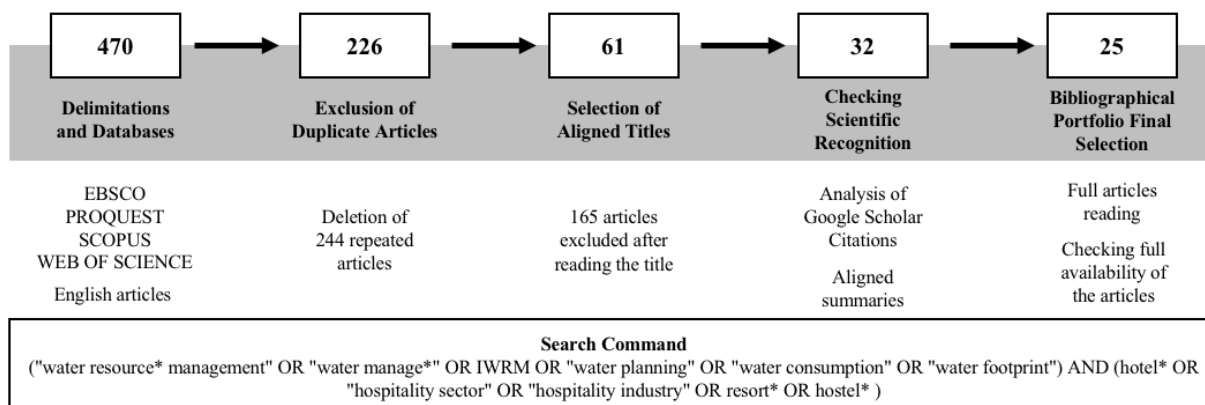
**Source:** Valmorbida, Ensslin, Ensslin and Ripoll-Feliu (2016).

Table 1 presents the number of articles found in each database, establishing a preliminary portfolio of 470 articles. It is important to emphasize that this search was made in September 2018. Thus, the necessary steps to achieve a final significant portfolio, with international scientific literature recognition, are demonstrated in Figure 2.

**Table 1.**  
Results of databases

Database	Articles
SCOPUS	142
PROQUEST	131
WEB OF SCIENCE	102
EBSCO	95

**Source:** Developed by the authors (2019).



**Figure 2.** Bibliographical Portfolio Selection

**Source:** Developed by the authors (2019).

As noticed, through the delimitations established and after excluding the duplicate articles, a selection of the aligned titles was made. In this phase, the authors analyzed whether the titles were related to the context of the research or not. In terms of checking scientific recognition, the next procedure, articles from the past three years (since 2016) had a different treatment. It is necessary because is insignificantly analyze the number of citations of the researches that have just been published. Finally, by selecting the articles aligned and available, a bibliographical portfolio of 25 articles was selected. In the sequence, Table 2 presents the portfolio determined by the phase (1) of ProKnow-C.

**Table 2.**  
Bibliographical Portfolio

Research	Authors	Year	Google Scholar Citations*
Resource use and waste management in Vietnam hotel industry	Trung and Kumar	2005	234
Experiences on greywater re-use for toilet flushing in a hotel (Mallorca, Island, Spain)	March et al.	2004	180
Water use in hotels in Hong Kong	Deng and Burnett	2002	114
Hotel water consumption at a seasonal mass tourist destination. The case of the island of Mallorca	Tortella and Tirado	2011	112
New performance indicators for water management in tourism	Gössling	2015	93
Water use efficiency in the hotel sector of Barbados	Charara, Cashman, Bonnell and Gehr	2011	83
The importance of water management in hotels: A framework for sustainability through innovation	Kasim, Gursoy, Okumus and Wong	2014	59
Monitoring of an indoor pilot plant for osmosis rejection and greywater reuse to flush toilets in a hotel	Gual, Moia and March	2008	50
Evaluation of water saving measures in hotels: A Spanish case study	Barberán et al.	2013	48

Water management in the European hospitality sector: Best practice, performance benchmarks and improvement potential	Styles, Schoenberger and Galvez-Martos	2015	38
Mass tourism and water efficiency in the hotel industry: A case study	Gabarda-Mallorquí et al.	2017	19
Improving efficiency in water use and conservation in Spanish hotels	Cobacho, Arregui, Parra and Cabrera	2005	17
Water consumption by the visitor industry: The case of Hawaii	Gopalakrishnan and Cox	2003	14
A study of water consumption in two Malaysian resorts	Tang	2012	9
Evaluations of on-site wastewater reuse alternatives for hotels through water balance	Hocaoglu	2017	8
The effect of the water tariff structures on the water consumption in Mallorcan hotels	Deyà-Tortella et al.	2016	7
The role of water tariffs as a determinant of water saving innovations in the hotel sector	Razumova, Rey-Maqueira and Lozano	2016	7
Audit of water consumption in hotels in Hong Kong	Deng and Burnett	2000	5
Mathematical model of supply water of consumption systems in hotels	Perez, Chinarro, Mouhaffel, Martín and Otín	2016	3
Water use patterns in Vietnamese hotels: Modeling toilet and shower usage	Toyosada, Otani and Shimizu	2016	2
Exploring environmental awareness and behavior among guests at hotels that apply water-saving measures	Gabarda-Mallorquí et al.	2018	1
A need to motivate hotels in innovative water management	Kasim et al.	2013	-
Does environmental knowledge affect environmental responsiveness? A look at the hotel managers in Malaysia	Kasim	2017	-
Every drop counts: A water conservation experiment with hotel guests	Joo, Lee and Park	2018	-
Novel vertical ecosystem for sustainable water treatment and reuse in tourist resorts	Gattringer et al.	2016	-

\* Citations from February 2019

**Source:** Developed by the authors (2019).

By selecting a consistent and robust bibliographical portfolio, the authors were able to prepare a theoretical discussion in the following section. After that, the next step of ProKnow-C is realized: (2) the bibliometric analysis. It consists of checking the characteristics, relevancies, and peculiarities of the knowledge area. Therefore, this phase aims to better understand how water resources management is treated in hospitality industry researches.

Thus, the following variables were investigated: regions studied in the portfolio; most found authors' home universities; prominent author in the area; hotels categories analyzed, according to the number of stars; water resources management practices in hotels; motivations for the adoption of those; different hotel areas to analyzed water consumption; the role of

stakeholders in water management practices; management influence on environmental practices; and most used indicators to evaluate water.

### **3 Water resources management and tourism**

Tourism is considered the largest and faster growing industry in the world with measurable economic, socio-cultural, and ecological impacts (Kasim, Gursoy, Okumus & Wong, 2014; Kasim et al., 2013). Those happen because of the need for more and more buildings to cater to the increased tourist arrivals. Therefore, it implies in a concurrent growth in tourism amenities such as hotels, restaurants, resorts, golf courses, spas, and water-related recreation facilities, each of which demands water (Tang, 2012; Kasim et al., 2014).

Water is required in large amounts and of high quality to sustain tourist activities and especially hospitality (Deyà-Tortella et al., 2016; Kasim et al., 2014), being a key element to ensure the viability of the sector (Gabarda-Mallorquí et al., 2017). Tourists consume water directly and indirectly for hygienic purposes such as showering or flushing toilets; irrigation of gardens and to fill up swimming pools; leisure activities; cleaning rooms and for washing bed and table linen; and it is embodied in infrastructure, food, fuel, consumption goods, and other services (Gössling, 2015).

Hotels are major water consumers because water consumption per person staying at a hotel tends to be high and can be as much as three times the average consumption of people living at home (Kasim et al., 2014; Barberán et al., 2013; Kasim et al., 2013). Thus, the viability and sustainability of any tourist destination is dependent upon an adequate water supply, both in quantity and quality (Tortella & Tirado, 2011). Worsening water crises can affect hotels' core products, and the tourist experience, having a significant negative effect on local residents' welfare and also on the destination's tourism life cycle (Kasim et al., 2014; Razumova et al., 2016). As a consequence, the efficient use of water resources is a key sustainability challenge for the tourism industry (Gössling, 2015).

Several studies demonstrate that an effective water management program can significantly reduce water consumption in hotels (March et al., 2004; Tortella & Tirado, 2011; Gössling, 2015; Kasim et al., 2014; Gual, Moià & March, 2008; Barberán et al., 2013; Styles, Schoenberger & Galvez-Martos, 2015; Cobacho, Arregui, Parra & Cabrera, 2005; Gabarda-



Mallorquí et al., 2017; Tang, 2012; Hocaoglu, 2017; Razumova et al., 2016; Perez, Chinarro, Mouhaffel, Martín & Otín, 2016; Toyosada, Otani & Shimizu, 2016; Kasim et al., 2013; Joo, Lee & Park, 2018; Gattringer et al., 2016). In turn, some researches state that water resources management can help hotels to reduce their operating costs (Trung & Kumar, 2005; March et al., 2004; Deng & Burnett, 2002; Tortella & Tirado, 2011; Gössling, 2015; Barberán et al., 2013; Gabarda-Mallorquí et al., 2017; Razumova et al., 2016; Toyosada et al., 2016; Kasim et al., 2013; Kasim, 2017; Joo et al., 2018; Gattringer et al., 2016). On the other hand, others argue that the water price is not a significant determinant of water use, probably due to the small share of water costs concerning the total hotel's operational costs (Charara, Cashman, Bonnell & Gehr, 2011; Kasim et al., 2014; Styles et al., 2015; Gopalakrishnan & Cox, 2003; Deyà-Tortella et al., 2016).

The idea of water management in the hospitality sector has inspired many studies to discover hotels' motivations to implement related practices. Among them, researches identified: market differentiation, company image, visibility, desire to appear legitimate in the eyes of society, economic implications, competitive advantages, or to get a certification, besides water-savings and environmental protections (Charara et al., 2011; Kasim et al., 2014; Gual et al., 2008; Styles et al., 2015; Cobacho et al., 2005; Razumova et al., 2016). Also, water policies and incentive schemes have responsible to encourage greener practices, having an important role to make the implementation of water and wastewater management among hotels successful. The government agencies and trade associations in each country need to play a role in enhancing awareness of water issues (Charara et al., 2011; Kasim et al., 2014).

Besides government agencies and trade associations, all the stakeholders should support the hotels' goals of minimizing water consumption. Tang (2012) demonstrate that gaining senior management commitment and support to develop a water conservation policy is a prerequisite to achieving significant water conservation for resorts. Staff environmental awareness training is highlighted as an essential action for water-savings in some studies (Trung & Kumar, 2005; Deng & Burnett, 2002; Charara et al., 2011; Tang, 2012; Kasim et al., 2013), as well as staff job satisfaction (Razumova et al., 2016). Hotel water consumption is also partly affected by the customs of the guests (Deyà-Tortella et al., 2016; Toyosada et al., 2016; Joo et al., 2018; Gabarda-Mallorquí et al., 2018). According to Joo et al. (2018), behavioral interventions can induce a sizable reduction in the amount of water used by guests.

Thus, hotel water consumption can be significantly impacted by the hotel management system. Key management issues, such as the strategy followed by hotels, the system of accommodation on offer, the development of water-saving initiatives, and chain affiliation, might all play a relevant role in explaining hotel water consumption (Tortella & Tirado, 2011).

From this perspective of reducing water consumption, there is a need to implement water management indicators, capable to measure performance, and often to inform the hotel's policies (Gössling, 2015). For hospitality managers, benchmarking is a useful management tool for reviewing progress towards targets, highlight considerable improvement potential, and establish "best practices" within a hotel or across hotels in the industry (Trung & Kumar, 2005; Styles et al., 2015). In this way, the following section provides a more detailed analysis of important variables to achieve adequate water management for the hospitality sector.

#### 4 Results and discussion

Through a brief analysis of the bibliographic portfolio characteristics, Spain is the country with the highest representativeness of studies developed in the portfolio (47,83%), according to Table 3. Theoretical articles were excluded. This Spanish expressiveness also appears in the most found authors' home university, the University of the Balearic Islands. Its research group related to the study area, 'business management and tourism destinations', might be a contributor to that (Universitat de les Illes Balears, 2019). The Balearic Islands is also a recent target of anti-tourism protests, which claim that mass tourism is making the area suffer from an environmental crisis (Morris, 2018). This reaction emphasizes the importance of studies that encourages water-saving initiatives in hotels. Besides that, another three universities in Spain are highlighted as authors' home universities: The University of Girona, the University of Valencia, and the University of Zaragoza.

**Table 3.**  
 Countries representativeness

Country	Articles	%
Spain	11	47,83%
Malaysia	3	13,04%
China (Hong Kong)	2	8,70%
Vietnam	2	8,70%

Barbados	1	4,35%
Greece	1	4,35%
Korea	1	4,35%
United States of America	1	4,35%
Turkey	1	4,35%
<b>Total</b>	<b>23</b>	<b>100,00%</b>

**Source:** Developed by the authors (2019).

The most important author for the research field, Azilah Kasim, was another emphasis from the analysis. From the Northern University of Malaysia, she is considered a prominent author, with scientific recognition about the theme. In turn, Environmental Management in Hotel Business is one of her research interests. Table 4 presents this significance, as well as the other authors with more than one article in the portfolio.

**Table 4.**  
 Featured authors

Authors	Articles
Kasim, A.	3
Gabarda-Mallorquí, A.	2
Ribas, A.	2
Gursoy, D.	2
Tirado, D.	2
Okumus, F.	2
Burnett, J.	2
March, J. G.	2
Gual, M.	2
Deng, S. M.	2

**Source:** Developed by the authors (2019).

In order to better understand the hotels' profile analyzed in the articles, their categories were selected according to the number of stars, from hotels without stars until five-stars hotels. According to Table 5, hotels with more than three stars are the most studied. This occurs since it is easier for higher-category hotels to produce data thanks to greater levels of systemization and cost control, and this is probably particularly true in the case of water consumption (Gabarda-Mallorquí et al., 2017).

**Table 5.**  
 Hotels categories

Categories	Articles	%
Without stars	2	8%
One-star (★)	6	24%
Two-stars (★★)	7	28%
Three-stars (★★★)	13	52%
Four-stars (★★★★)	12	48%
Five-stars (★★★★★)	14	56%

**Source:** Developed by the authors (2019).

According to Kasim et al. (2014), understanding that hotels of various sizes and categories can address the challenge of implementing water management is essential for its preservation. Therefore, different water-savings strategies can be adapted to the hotels' availability of financial resources, adequate information, and technological capabilities. With this purpose, Table 6 presents the most found practices that could help hotels with water-saving initiatives, in conformity with the portfolio.

**Table 6.**  
 Water-saving practices

Practices	Sources
Reusing greywater, wastewater, sea water or rainwater for toilet flushing and irrigation	March et al. (2004); Gual et al. (2008); Styles et al. (2015); Gabarda-Mallorquí et al. (2017); Tang (2012); Hocaoglu (2017); Deyà-Tortella et al. (2016); Deng and Burnett (2000); Gattringer et al. (2016)
Installing a series of water-saving devices (dual-flush toilet, low-flow faucet aerators, water-efficient shower heads)	Trung and Kumar (2005); Barberán et al. (2013); Styles et al. (2015); Cobacho et al. (2005); Gabarda-Mallorquí et al. (2017); Tang (2012); Deyà-Tortella et al. (2016); Gabarda-Mallorquí et al. (2018)
Installing submeters for stricter control of water consumption in major water end-uses	Trung and Kumar (2005); Deng and Burnett (2002); Styles et al. (2015); Gabarda-Mallorquí et al. (2017); Tang (2012); Gabarda-Mallorquí et al. (2018)
Measuring water consumption performance, using targets according to the hotel areas	Deng and Burnett (2000, 2002); Gössling (2015); Styles et al. (2015); Cobacho et al. (2005)
Promoting staff awareness programs	Deng and Burnett (2002); Charara et al. (2011); Tang (2012); Gabarda-Mallorquí et al. (2018)
Developing a water management plan	Deng and Burnett (2002); Styles et al. (2015); Tang (2012)
Encouraging innovative water-saving technologies	Deng and Burnett (2002); Kasim et al. (2014); Kasim et al. (2013)
Promoting active engagement of guests to save water (with pictures in bathrooms,	Trung and Kumar (2005); Tang (2012); Gabarda-Mallorquí et al. (2018)

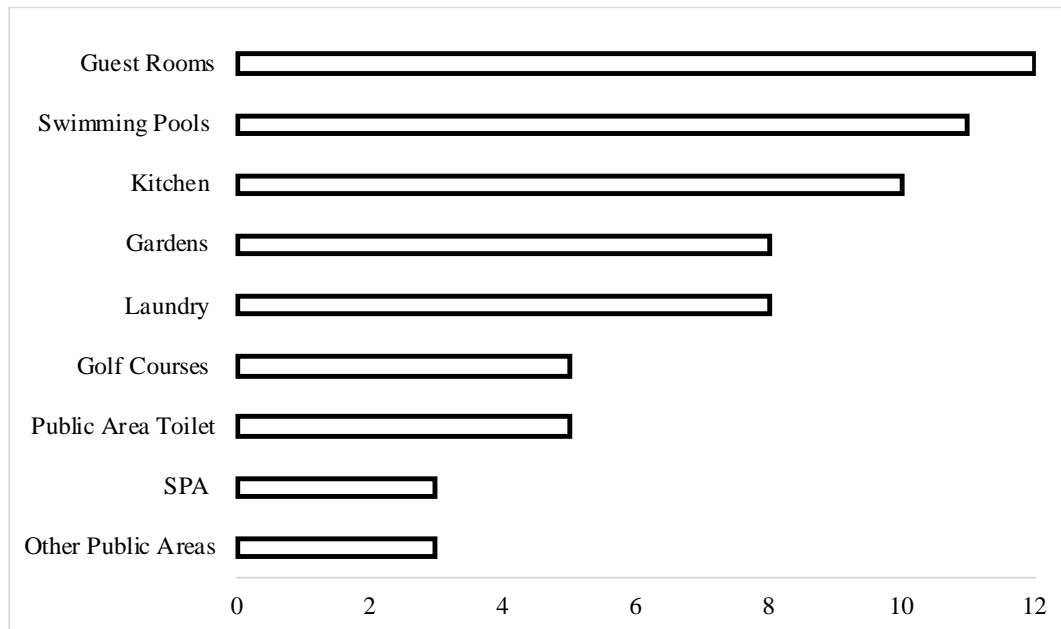
issuing certificates recognizing good behavior, applying discounts on hotel bills)	
Avoiding thawing food under running water	Styles et al. (2015); Kasim et al. (2013)
Being more vigilant about leakages	Trung and Kumar (2005); Kasim et al. (2013)
Developing water policies and incentives	Deng and Burnett (2002); Charara et al. (2011)
Increasing price which is charged to hotels for water	Charara et al. (2011); Razumova et al.(2016)
Promoting bed linen and towel reuse programs	Styles et al. (2015); Gabarda-Mallorquí et al. (2018)
Reusing swimming pool water and use a pool cover overnight to reduce evaporation	Styles et al. (2015); Deyà-Tortella et al. (2016)
Washing dishes or laundry only on full loads	Tang (2012); Kasim et al. (2013)

**Source:** Developed by the authors (2019).

Emphasis should be made that, besides water and environmental preservation, most of those practices can generate an economic payback, being one of many hotels' motivations (Charara et al., 2011; Gössling, 2015; Gual et al., 2008; Barberán et al., 2013; Styles et al., 2015; Gabarda-Mallorquí et al., 2017; Tang, 2012; Razumova et al., 2016). Market differentiation, company image, visibility, desire to appear legitimate in the eyes of society, competitive advantages, and to get certification are other motivations for the sector to implement water resources management practices (Charara et al., 2011; Kasim et al., 2014; Gual et al., 2008; Styles et al., 2015; Cobacho et al., 2005; Razumova et al., 2016).

By controlling those practices' performance is crucial to ensure water management development. According to the practice observed above, in the studies of Deng and Burnett (2000, 2002), Gössling (2015), Styles et al. (2015), and Cobacho et al. (2005), measuring water consumption performance according to the hotel areas provides this control analysis. Figure 3 illustrates which hotel areas were more analyzed according to the bibliographic portfolio.

Although water consumption in swimming pools is widely analyzed, the authors' opinions diverge on the subject. Tortella and Tirado (2011) conclude that the existence of swimming pools has a high effect on water consumption, even higher than the number of rooms. Furthermore, in the case of swimming pools, hotel water consumption probably also increases as an indirect result of increased use of the showers. On the other hand, according to Deng and Burnett (2000), swimming pools do not consume much water, as only makeup loss due to evaporation is required.



**Figure 3.** Most studied hotel areas

**Source:** Developed by the authors (2019).

Guest rooms tend to be the most analyzed area because it is recognized that the number of hotel rooms and the guest behavior considerably increases water consumption. Hotel guests are prone to have a ‘pleasure approach’ to shower or bath, which increases the tendency to use more water than they normally would at home (Kasim et al., 2013). Moreover, water is free of charge for hotel guests, having no direct pecuniary incentive for them to save water (Joo et al., 2018).

Gabarda-Mallorquí et al. (2018) investigate guest profiles in a hotel to determine how different types of them contribute to saving water during their stay. Therefore, they provided new insights into how environmental awareness and engagement of hotel guests can influence a hotel’s water-saving efforts. Joo et al. (2018) also found that behavioral interventions can induce a sizable reduction in the amount of water used by guests.

In order to understand this influence, another question analyzed in the bibliographic portfolio is the stakeholders’ involvement with the best water management practices in the hospitality sector. Thus, guests can contribute to reducing water consumption in the hotel industry. Indirectly educate customers, informing hotel environmentally management philosophy can make them prefer a hotel with a sustainable water management system and influence them to

save water during their stay (Trung & Kumar, 2005; March et al., 2004; Deng & Burnett, 2002; Charara et al., 2011; Gual et al., 2008; Styles et al., 2015; Deyà-Tortella et al., 2016).

Most of the researches also highlighted staff as a key stakeholder to promote water-savings in hotels. Therefore, some authors raised the importance of behavior changes, through staff education, able to train and raise awareness about water-saving initiatives (Trung & Kumar, 2005; Deng & Burnett, 2002; Charara et al., 2011; Kasim et al., 2014; Tang, 2012; Kasim et al., 2013; Joo et al., 2018).

According to Razumova et al. (2016), staff job satisfaction is, moreover, crucial for water-saving performance. Thus, implementing practices to improve staff wellbeing in the workplace, as providing fair treatment and remuneration, offering promotion opportunities, and encouraging the atmosphere of partnership, are important actions to properly promote water resources management.

The environmental awareness of the manager has an essential role to make those initiatives possible since it affects how a hotel responds to water management (Charara et al., 2011; Kasim, 2017). Tortella and Tirado (2011) consider that the hotel management system might have a significant impact on hotel water consumption. Key management issues, such as the strategy followed by hotels, the system of accommodation on offer, the development of water-saving initiatives, and chain affiliation, might all play a relevant role in explaining hotel water consumption.

Some hotel managers do not view environmental management as strategic and are unable to imagine the commercial payoffs that could accrue from adopting environmental practices (Kasim, 2017). For this reason and to help to promote an appropriate water performance evaluation in the hospitality industry, besides encouraging future research on the subject, water resources management indicators are present in Table 7.

**Table 7.**  
 Water resources management indicators

General water consumption indicators	Water performance (m <sup>3</sup> water/guest day) Wastewater performance (m <sup>3</sup> wastewater/guest day) Water consumption (m <sup>3</sup> /m <sup>2</sup> year) Wastewater consumption (m <sup>3</sup> /m <sup>2</sup> year) Water Use Index (annual water consumption/floor area)
Guests water use	Consumption per guest room (showers, bathtub, toilet, faucets, bidet) Daily per capita consumption Hourly water use profile on guest floors

Hotel management system	Environmental or Quality Certification Hotel chain affiliation (small, medium or big chain; independent operation) Strategy Types of board Water-saving initiatives
Hotel physical characteristics	Constructed area Construction date Garden area Golf field area Hotel capacity (number of rooms or beds) Hotel category (number of stars or without star) Land area Number of restaurants Spa facilities Swimming pools area
Hotel seasonality level	Number of months of activity Occupation level Quarterly seasonal effects (distinguishing the 4 seasons of the year)
Water consumption sources	Bar Canteen General cleaning Irrigation source Kitchen Laundry Number of meals offered Outdoor showers Public toilet Restaurants Spa facilities (filling and operation) Staff quarters Swimming pools (filling and evaporation)
Water quality	Microbiological contamination pH Other chemical characteristics of water

**Source:** Developed by the authors (2019).

Measuring hotel water performance requires several types of indicators to control aspects related to water management. For this reason, Gössling (2015) has already highlighted the necessity of using not only direct water use indicators, for instance, water consumption per guest per day, but also measures factors that indirectly influence water consumption, as the number of meals offered. Moreover, those indicators are useful for developing a benchmarking strategy, establishing “best practices” within a hotel or across hotels in the industry. Those benchmarks provide challenging but achievable targets and highlight considerable improvement potential for hospitality managers (Styles et al., 2015).



## 5 Conclusions

The present research objective was to raise the benefits coming from the international scientific literature to contribute to water resources management in the hospitality sector, while used the intervention instrument Knowledge Development Process-Constructivist (ProKnow-C). It enabled the selection of a bibliographic portfolio of 25 articles, with international scientific recognition, able to build a solid literature review about the theme. Besides, highlight characteristics of the research subject development and, most important, about water management aspects that should be considered when developing a robust water management plan.

Initially, the portfolio characteristics were related to the countries with the highest representativeness of studies developed in the portfolio. In this case, Spain had the biggest representativeness (47,83%). The country was also featured having a university as the most found authors' home university, the University of the Balearic Islands.

The next characteristic was the existence of a prominent author of the research area, Azilah Kasim, from the Northern University of Malaysia. About the hotel's categories, those were selected according to the number of stars. Hotels with more than three stars were the most studied. This behavior probably happens because is easier for hotels with higher categories to produce data thanks to greater levels of systemization and cost control.

The best practices that could help hotels with water-saving initiatives were another important water management aspect contributed by the present research. Based on the portfolio, the major motivations for those adoptions were analyzed as well, being economic payback the most commonly found. Under those practices in the hotels studied, measuring water consumption in guest rooms was the most analyzed hotel area.

Stakeholders' involvement with the best water management practices was another relevant aspect considered in the portfolio analysis. Guest contributions, staff behavior, and manager's environmental awareness were all discussed as necessary for efficient water resources management in the hospitality sector. Finally, were presented water resources management indicators. Those initiative aim to help hotel managers to elaborate on a water use performance measurement system and a benchmarking strategy within a hotel or across hotels in the industry.

According to those findings, it was emphasized as an adequate instrument to understand relevant aspects of the literature which deals with water management in the hospitality sector. The raised results can contribute to hotel managers while elaborating a water management plan and reviewing their water usage practices. This contribution benefits the environment and society since water is a necessary element for its sustainability and development. It may also have a positive effect on the hotel's business economy, arising from a water bills economy and a market differentiation, increasing competitive advantages.

Future research opportunities are crucial to raising the paper contributions to the academic environment, as exposed by ProKnow-C. Thus, future studies should focus on how different stakeholders' groups recognize their importance to achieving a more sustainable water use in hotels, to promote environmental awareness among them. It would also be interesting to identify organizational factors that serve as possible barriers to achieving considerable water management in the hospitality industry, aiming to find solutions to encourage the implementation of water management practices. Finally, researchers may evaluate the water management practices found in the present literature used in specific scenarios. It is suggested the elaboration of a whole water performance measurement system as well, based on the indicators already highlighted.

Some research limitations were observed. The bibliographic portfolio was restricted to English scientific articles, freely available in only four databases, chosen by the authors. Besides, the results are based on perceptions and interpretations given by the authors and may have different interpretations if were made by the original articles' authors.

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**Artigo recebido em: 14/05/2020**

**Avaliado em: 14/05/2020**

**Aprovado em: 25/06/2020**