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Determinants of water management for sustainable coastal tourist destinations: comparative case study between Spain and Malaysia

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A B S T R A C T
Given the economic importance of the tourism sector in coastal regions and its impact on water resources, is increasingly important to prioritise sustainable strategies in water management amid growing tourism in destinations where water availability is scarce at certain times of the year, such as the Costa Brava in Spain and Perhentian and Langkawi islands in Malaysia. This study determines relevant factors for sustainable tourist destinations considering stakeholder preferences following the qualitative Delphi method. Water experts were asked about the importance of technical, economic, social, political and environmental factors in water management, and each factor was weighted, in order to establish priorities and reach a consensus on water management alternatives that affect the different actors. The paper advocates for an integrated and sustainable approach to water management, involving collaboration between the tourism sector, local authorities and communities, and suggests an additional cross-cultural analysis to understand regional nuances in environmental decision-making. The integration of quantitative and qualitative methods in water management research is advocated to improve the understanding and governance of coastal water systems.

Introduction

Tourism, one of the most dynamic and fast-growing industries globally, has experienced significant expansion over the last decade, attracting millions of visitors to both established and emerging destinations, and it is expected to continue to increase by 2030 (United Nations World Tourism Organization [UNWTO], 2020). This expansion has brought a series of economic benefits, however, it has also posed substantial challenges in terms of environmental sustainability (Fodness, 2017; Hall, 2019). In recent years, some touristic destinations prioritise sustainable growth instead of just economic growth, and sustainability efforts are incorporated into their strategies and long-term plans (Gössling et al., 2015), including water management.

Water plays a central role in the tourism industry: from hotels and resorts to theme parks and golf courses, water consumption is dependent on water resources, and its consumption is higher than in the domestic sector (Gössling et al., 2012). In regions where water is scarce, the tension between the needs of the local population and the requirements of the tourism sector has intensified. In many destinations, water supply cannot satisfy the demand of all sectors, and tourism is a water consumer that has fostered a constant water shortage crisis in previous years (Liu et al., 2017), highlighting the importance of adopting sustainable water management practices. Moreover, it is anticipated that the tourism industry will utilise more water in the future due to the escalating tourist numbers, a situation aggravated by climate change (Gössling et al., 2012).

The commercial viability and effectiveness of regional tourism, implying both public and private sectors, as well as the restoration of local ecosystems, could be affected by a deteriorating water situation (Baloch et al., 2023). There exist several technical options to increase available water that have been applied in the tourism sector, for example extracting groundwater or using recycled water for non-potable urban uses such as toilet flushing (Lazarova et al., 2003; Ding et al., 2022). Desalination has been proven to be a viable alternative to enhance water resources in certain regions, however, several sustainable effects should be considered (such as the use of the land or aquifer contamination due to seawater pipe leaks) and in some cases a good demand management has proved to be more efficacious than desalination (Gude et al., 2010; Missimer and Maliva, 2018).

Apart from the implementation of more efficient technologies in the use of water, over the last decade there has been growing recognition of the need to regulate water use within the tourism sector, given its importance for environmental sustainability and social equity. Policy regulations on water for tourism use have evolved to address both growing demand and the challenges of climate change, which threaten global water availability and quality. Although policies vary significantly from country to country, there are several common trends and approaches in water regulation in the tourism sector. Having consensus on which indicators are the most urgent to take into account in these water deficit situations could be a good idea for making effective policies in municipalities. However, the effectiveness of these policies depends largely on their implementation and enforcement, as well as collaboration between the public sector, the private sector and local communities.

Case study: specific touristic destinations

The temporary availability of water and the influx of tourism can aggravate the problem of freshwater availability, especially if the economic income of these touristic areas comes from tourism, which accelerates the debate between different sectors of society. In areas with high population density or with a significant influx of tourists, the demand for water can exceed the capacity of local supply systems, which can lead to water shortages and a deterioration in the quality of life of residents, as well as negatively affect the long-term viability of the tourism sector and other economic sectors. This is the case of crowded tourist areas in specific seasons of the year, such as the Costa Brava in Catalonia (Domínguez and Gomez-Martín, 2019) and the Perhentian and Langkawi islands in Malaysia (Chan, 2009; Elfilthri, 2021).

In the lasts decades, Catalonia, one of the most visited regions in Spain, and particularly the Costa Brava, has experienced a notable tourism boom. This growth in tourism has brought significant economic benefits, representing the main socio-economic activity in this region. However, it has also highlighted the growing tension between tourism development and environmental sustainability, particularly with regard to water resources management (Salo et al., 2014). The Mediterranean region faces periods of drought that put water availability at risk, and the government and water companies encounter significant challenges when tourists arrive during the hot, dry summer months. Moreover, some touristic complexes were built in early stages of tourism development and did not consider water efficiency as a priority, although this tendency is changing towards more sustainable water use (Tirado et al., 2019).

Malaysia also suffers similar periods of water shortages on two of its most touristic islands, Langkawi and Perhentian. Although the climate is equatorial, the quality of fresh water is compromised and availability is not sufficient to satisfy tourist demand in specific periods (Elfilthri et al., 2021), in which the choice has been to import water by boat or small portable desalination plants, to the point that there is a high level of agreement from both visitors and residents that the water quality of both islands is affected by tourism (Ramdas and Mohamed, 2017).

Consensus in relevant indicators in water management

In both cases (Costa Brava and Malaysian islands) the relationship between tourism and water demand illustrates the prevailing need to adopt an integrated and sustainable approach to the management of water resources, where collaboration between the tourism sector, local authorities and the community is key to ensure a prosperous and sustainable future. Achieving consensus requires a participatory process that involves all stakeholders, including local and national governments, businesses, local communities, and non-governmental organisations.

There is a gap when it comes to the definition of proper indicators to evaluate water management in touristic sector. Although there exist some tools to manage water resources in touristic sector, such as the Global Reporting Initiative or accounting metrics designed by the Sustainability Accounting Standard Board (SASB), in some cases these indicators are difficult to measure and evaluate numerically because they involve large amounts of information and their qualities are associated with uncertainty. Several environmental management studies have used fuzzy scales (Liu, 2007; Tsoutsos et al., 2009) and qualitative linguistic terms (Afsordegan et al., 2016) to help planners and policy-makers design strategies, while Alonso et al. (2010) suggested inquire a group of experts when precise knowledge is unavailable. Numerous indicators have been created for tourism destinations, despite having different objectives, perspectives, and dimensions, and various studies suggest adding political, technological, and cultural dimensions to the economic, environmental, and social dimensions (Torres-Delgado and Palomeque, 2014; Kristjansdottir et al., 2018).

Anyway, the investigation of indicators in sustainable tourism management, which encompass both quantitative and qualitative indicators, has demonstrated that the integration of relevant indicators in both contexts, with a particular emphasis on stakeholder perspectives, has not been extensively investigated to evaluate diverse water solutions. Qualitative methods can be valuable for understanding the social, cultural, and institutional aspects of water management in coastal destinations. In essence, the qualitative method in water management research offers a nuanced understanding of the complex relationships between humans and water in coastal regions. It enables researchers to delve into the underlying norms, values, and power dynamics that shape water management practices, and to identify innovative and context-specific solutions for sustainable water management. By embracing the qualitative approach, researchers can contribute to more inclusive, culturally sensitive, and effective water management strategies in touristic coastal destinations (Foronda-Robles et al., 2020; Medina et al., 2022). Participant observation allows researchers to gain first-hand insights into the community's water management practices and social dynamics. For example, in Langkawi Island, Malaysia, by rigorously analysing qualitative data collected through participant observation, researchers gain a nuanced understanding of water management dynamics where the thematic analysis and narrative interpretation offer valuable insights into the complexities of coastal governance, community resilience, and sustainable development in the context of evolving environmental challenges and socio-economic pressures (Elfithri et al., 2021). Case studies provide in-depth analysis of water management issues in specific coastal destinations.

Furthermore, interviews with key stakeholders such as local residents, government officials, and environmental activists can offer valuable perspectives on the challenges and opportunities related to water management in coastal areas (Can et al., 2023). Through thematic analysis of qualitative data, researchers can uncover patterns and themes that inform policy recommendations and practical interventions. Overall, the qualitative method proves to be essential in advancing our understanding of the intricate dynamics surrounding water management in coastal destinations and in promoting sustainable practices that benefit both the environment and local communities (Medina, et al., 2022). This nuanced understanding is essential for developing effective and inclusive strategies for sustainable coastal development and environmental conservation.

According to bibliography, the indicators to take into account regarding water management in tourism involve technical, economic, environmental, social and political parameters (Rasoolimanesh et al., 2020; Matijová et al., 2023), but there is disagreement on which indicators are the most important in situations of scarcity, even these indicators can vary between regions, between countries but also between regions of the same country (Matijová et al., 2023). Vila et al., (2018) summarised 20 of the most relevant indicators, and classified them into linguistic variables (Table 1). To determine which of these indicators is the most important aspect requires evaluating possible solutions or scenarios. In that sense, a good technique to reach consensus when different qualitative variables have to be evaluated is the Deplhi method described by Dalkey and Helmer (1963).

Evaluating relevant indicators using Q-Delphi method

Delphi method is a good qualitative and structured technique by reaching consensus among experts. This method is designed to obtain a consensus or convergence of opinions and produce reliable forecasts or decisions, especially in situations where there is uncertainty and a lack of complete information. In the area of water management, the Delphi method can be particularly useful for evaluating policy options, identifying investment priorities, anticipating future challenges in water resources management, and developing adaptive strategies that have broad support of experts and interested parties. However, classic Delphi methodology has some limitations, such as dealing with the uncertainty involved in expert opinions. The Q-Delphi method, or Quantitative Delphi method, is a variation of the traditional Delphi method that incorporates quantitative analysis to make the decision-making or forecasting process more objective and systematic. This study has used a modified Q-Delphi method which introduces flexible scales based on linguistic terms as they are appropriate to overcome the ambiguity existing in human knowledge (Choudhury et al., 2006).

The aim of this paper is, on one hand, to determine which factors are relevant to encompass water management in specific tourist destinations of Spain and Malaysia and analyse the criteria between experts of the two countries covering the same issue. On the other hand, the purpose is also to provide an overview of the current state of water use in Spanish and Malaysian specific tourism destinations, emphasising the need for sustainable water management practices in water-stressed touristic regions.

Materials and methods

The used Q-Delphi assumed an ordinal scale using the linguistic terms: “Not important, low importance, medium importance, very important, extremely important, and no idea”, corresponding to the basic labels “B_1; B_2; B_3; B_4; B_5; [B_1, B_5]”, respectively. In addition, to deal with uncertainty, experts could choose a range of options when they were unsure about the importance of an indicator. Moreover, experts are asked about the level of confidence in their responses: sure (1) or not sure (0).

Twenty indicators were selected from bibliography (Table 1). A questionnaire was sent to experts of all sectors, from both regions. Experts used linguistic basic and non-basic labels to present their opinions about the importance of indicators in the area (Table 2), giving a list of indicators. Then, the list of indicators was ordered using two criteria: first, the qualitative median; and second, the length of the union among the expert assessments. This order was performed imposing the higher qualitative median and the lesser length of the union among qualitative assessments as a measure of a degree of consensus among the expert opinions. Finally, each indicator was assigned with a value, following Borda-Kendall approach method (Borda, 1784), using the equation (1):

$$Wi = \frac{2(n+1-i)}{n(n+1)}, i = 1, \dots, n.$$

where *n* is the total number of selected indicators from step 4, thus, $\sum W_i = 1$ and W_i [0,1].

Table 1. Relevant indicators used as a lingüístic variables (Vila et al., 2018)

Technical	Economic	Environmental	Social	Political
Water quality	Water cost	Environmental risk	Tourist satisfaction	Consistency with policies
Energy consumptio n	Refinery cost	Damage to land	Public health	Political acceptance
Water losses	Investment cost	Climate change	Public acceptance	Environmental policy
	Operational cost	Ecological impact	Stakeholder acceptance	
	Financial support			
	Return on investment			

Table 2. An example of qualitative analysis for technical criteria

	Technical criteria					
	Water quality	Sure (1) Not sure (0)	Water losses	Sure (1) Not sure (0)	Energy consumption	Sure (1) Not sure (0)
Expert 1	B_3	1	B_2, B_3	0	B_5	1
Expert 2	B_5	0	B_5	0	B_5	1
Expert 3	B_3	1	B_3	1	B_3	0
...						
Expert n	B_2, B_3	1	B_5	1	B_2, B_3	1
Qualitative median	B_3		B_3		B_4	
Connected union	B_3, B_5		B_2, B_5		B_2, B_5	

Results and discussion.
The form was answered by a total of 17 experts, 11 of which were from Malaysia and 6 from Spain.
In a first step, all the responses were treated together (Table 3), ordered and weighted following the eq (1). As it can be seen from the results, all the indicators were considered important (Qualitative median [B_3, B_5] or above), meaning that, in general terms, all the indicators should be taken into account nowadays. Occupying the first two positions were the indicators *Consistency with policies* and *Water quality*, with a weight of 0.09524 and 0.09048 respectively. The last three indicators were *Environmental policy*, *Refinery cost* and *Return on investment*.

Table 3. Order of indicators and their weights for all indicators.

Indicator	Qualitative median	Connected Union	Lenght of connected union	Orders	Weights	Sector
Consistency with policies	B_5	[B_2, B_5]	4	1	0,095238	political
Water quality	B_5	[B_1, B_5]	5	2	0,090476	technical
Environmental risk	B_4	[B_2, B_5]	4	3	0,085714	environmental
Climate change	B_4	[B_2, B_5]	4	3	0,085714	environmental
Ecological impact	B_4	[B_2, B_5]	4	3	0,085714	environmental
Public health	B_4	[B_2, B_5]	4	3	0,085714	social
Public acceptance	B_4	[B_2, B_5]	4	3	0,085714	social

Political acceptance	B_4	[B_2, B_5]	4	3	0,085714	political
Energy consumption	B_4	[B_1, B_5]	5	4	0,080952	economical
Water losses	B_4	[B_1, B_5]	5	4	0,080952	technical
Water cost	B_4	[B_1, B_5]	5	4	0,080952	economical
Investment cost	B_4	[B_1, B_5]	5	4	0,080952	economical
Operational cost	B_4	[B_1, B_5]	5	4	0,080952	economical
Financial support	B_4	[B_1, B_5]	5	4	0,080952	economical
Damage to land	B_4	[B_1, B_5]	5	4	0,080952	environmental
Tourist satisfaction	B_4	[B_1, B_5]	5	4	0,080952	social
Stakeholder acceptance	B_4	[B_1, B_5]	5	4	0,080952	social
Environmental policy	[B_3, B_5]	[B_3, B_5]	3	5	0,07619	political
Refinery cost	[B_3, B_5]	[B_1, B_5]	5	6	0,071429	economical
Return on investment	[B_3, B_5]	[B_1, B_5]	5	6	0,071429	economical

Categorisation by countries

The responses of both countries were studied separately, in order to determine if there are different approaches on the importance of the indicators. Table 4 shows both the importance of the indicators of Malaysia and Spain. For Malaysia, not all the indicators were significant, as *Damage to land* scored a qualitative median of B_2. In the first four positions were found *Environmental risk* (0.10000), *Water quality* (0.09474), *Political acceptance* (0.08947) and *Water losses* (0.08421), all having a qualitative median of more than [B_4, B_5]. On the contrary, in the last positions were found economic indicators (*Water cost, Refinery cost, Investment cost, Operational cost, Financial support*) and one technical (*Energy consumption*). Similar results were found in previous studies in the region of Costa Brava (Vila et al., 2018): also ranked *Water quality, Energy consumption, Water losses* and *Operational cost* were also ranked as important [more than B_4, 3 length union]. Moreover, the same study showed indicators *Return on investment, environmental policy* and *Political acceptance* with low marks, which means that the priorities have not changed much among time and experts of the same region.

On the other hand, for Spanish experts not all the indicators were significant: for economic indicators (*Water cost, Financial support, Refinery cost, Return on investment*), one environmental (*Ecological impact*) and one social (*Tourist satisfaction)* scored a qualitative median less than [B_3, B_5]. On the top of the list was *Water quality* (0.14286) and *Consistency with policies* (0.13187), and on the bottom *Environmental policy* and *Political acceptance*.

Similarities and differences between countries have been observed. Experts from both countries found *Water quality* above the ranking, with a qualitative median of [B_5] in both cases. *Water losses* and *Climate change* were also weighted similarly. *Water losses* occupied the fourth position in Malaysia (0.08421) and fifth in Spain (0.09890), and *Climate change* fifth in Malaysia (0.07895) and fourth in Spain (0.10989). *Water quality* and *Water losses*

account for technical and *Climate change* for the environment.
With similar weight but at the bottom of the list were economic factors such as *Water cost*, *Refinery cost, Financial support* (not significant in Spain), environmental *Damage to land* (not significant in Malaysia), and technical *Energy consumption* (ranked 7th in both countries).

Among the different indicators between countries were *Consistency with policies* (0.13187 in Spain but 0.07368 in Malaysia), *Public health* (0.12088 in Spain but 0.07368 in Malaysia), *Environmental risk* (0.10000 in Malaysia but 0.07692 in Spain), *Political acceptance* (0.08947 in Malaysia but 0.05495 in Spain) and *Tourist satisfaction* (0.07895 in Malaysia but non-significant in Spain).

Table 4. Order of indicators and their weights for Malaysia and Spain.

Malaysia				*Spain*			
Indicator	*Qualitative median*	*Orders*	*Weights*	*Indicator*	*Qualitative median*	*Orders*	*Weights*
Environmental risk	B_5	1	0,10000	Water quality	B_5	1	0,14286
Water quality	B_5	2	0,09474	Consistency with policies	B_5	2	0,13187
Political acceptance	B_4, B_5	3	0,08947	Public health	B_4, B_5	3	0,12088
Water losses	B_4, B_5	4	0,08421	Climate change	B_4, B_5	4	0,10989
Climate change	B_4	5	0,07895	Water losses	B_4	5	0,09890
Tourist satisfaction	B_4	5	0,07895	Investment cost	B_4	6	0,08791
Stakeholder acceptance	B_4	5	0,07895	Energy consumption	B_4	7	0,07692
Environmental policy	B_4	5	0,07895	Operational cost	B_4	7	0,07692
Return on investment	B_4	6	0,07368	Environmental risk	B_4	7	0,07692
Ecological impact	B_4	6	0,07368	Public acceptance	B_4	7	0,07692
Public health	B_4	6	0,07368	Damage to land	B_4	7	0,07692
Public acceptance	B_4	6	0,07368	Stakeholder acceptance	B_4	7	0,07692
Consistency with policies	B_4	6	0,07368	Environmental policy	B_3, B_5	8	0,06593
Energy consumption	B_4	7	0,06842	Political acceptance	B_3, B_5	9	0,05495
Water cost	B_4	7	0,06842	Water cost	~~B_3, B_4~~	-	-
Refinery cost	B_4	7	0,06842	Financial support	~~B_3, B_4~~	-	-
Investment cost	B_4	7	0,06842	Ecological impact	~~B_3, B_4~~	-	-
Operational cost	B_4	7	0,06842	Tourist satisfaction	~~B_3, B_4~~	-	-
Financial support	B_4	7	0,06842	Refinery cost	~~B_2, B_4~~	-	-
Damage to land	~~B_2~~	-	-	Return on investment	~~B_2, B_4~~	-	-

Categorisation by sectors
The answers were also separated by the sector of expertise of the respondents. For each sector, those indicators in the first quartile or scoring equal or more than a quantitative median of [B_4, B_5] and a length of [B_3, B_5] were considered relevant. Only those indicators being considered important in more than one sector were counted. *Water quality* was considered important in three sectors, while *Operational cost*, *Climate change*, *Public acceptance*, *Consistency with policies*, *Tourist satisfaction* and *Public Health* were considered

important in two sectors. Following the above criteria, 7 indicators categorised as Social were found important, 5 Technical, 4 Political, 4 Economic and 2 Environmental.

On the other side, for each sector, those indicators in the fourth quartile or scoring less than a qualitative median of B_4 and a length of $[B_3, B_5]$ (including those non-significant) were also considered as irrelevant. Only those indicators being considered important in more than two sectors were counted. *Ecological impact* and *Return of investment* (4) and *Investment cost*, *Environmental policy, Political acceptance, Water cost* and *Refinery cost* (3) were found less relevant by sectors. That political indicators have been found generally with low importance (especially in Spain). In order to effectively develop and implement sustainability metrics for tourism, Bramwell (2010) suggested that new opportunities needed to be provided at destinations for actors who previously have been excluded from the policy process. Moreover, other studies also found that the dimension of governance has received little attention, even if they are often attached to participatory approaches in tourism planning (Hall, 2019; Rasoolimanesh et al., 2020).

Following the above criteria, 3 indicators categorised as Technical were found not relevant, 4 environmental, 6 political, 7 social and 16 economic.

Conclusions

The presented findings offer a nuanced insight into the diverse approaches of Malaysia and Spain in prioritising environmental indicators, shedding light on the complex interplay of factors influencing expert opinions in sustainability assessments. The analysis from both countries reveals notable distinctions in the perceived significance of various indicators. For Malaysia, the prioritisation hierarchy places emphasis on *Environmental risk*, *Water quality*, *Political acceptance*, and *Water losses*, all surpassing a qualitative median of [B4, B5]. Strikingly, economic indicators and one technical indicator (*Energy consumption*) occupy lower positions, suggesting a nuanced balance between environmental and economic considerations. These results align with a precedent study in the Costa Brava region, underlining the stability of certain priorities over time. In contrast, Spanish experts exhibit a unique pattern, with not all indicators deemed significant. *Water quality* and *Consistency with policies* take precedence, while economic and environmental factors, such as *Water cost*, *Refinery cost*, *Financial support*, *Ecological impact*, and *Political acceptance*, are ranked lower. The comparative analysis further unveils commonalities, such as the universal prioritisation of *Water quality* and similar weight assigned to *Water losses* and *Climate change*. Noteworthy is the shared devaluation of economic indicators, which are positioned at the bottom in both countries. Differences, however, are discernible in indicators like *Consistency with policies*, *Public health*, *Environmental risk*, *Political acceptance*, and *Tourist satisfaction*, showcasing the intricacies of regional variations in environmental concerns. This academic discussion highlights the importance of context-specific considerations and cultural nuances in shaping sustainability priorities, urging scholars to explore the underlying factors influencing expert opinions and policymaking in different global contexts.

In summary, the study conducted a detailed examination of responses from Malaysia and Spain, aiming to identify variations in the perceived importance of environmental indicators. Notably, tables were utilised to illustrate the significance of indicators for each country, revealing distinct patterns. In Malaysia, *Environmental risk*, *Water quality*, *Political acceptance*, and *Water losses* were deemed crucial, whereas economic and some technical indicators were less significant. Conversely, Spanish experts displayed differences, with certain economic, environmental, and social indicators considered less significant. Despite these disparities, both countries shared common ground, prioritising *Water quality* and showing similar weighting for *Water losses* and *Climate change*. However, differences were evident in indicators such as *Consistency with policies*, *Public health, Environmental risk, Political acceptance,* and *Tourist satisfaction*. In conclusion, the study unveiled both similarities and distinctions in the prioritisation of environmental indicators between Malaysia and Spain, providing valuable insights for understanding regional perspectives on sustainability considerations. Further research in the realm of environmental indicators and sustainability priorities should consider a more in-depth exploration of the cultural and contextual factors influencing the differential rankings observed between Malaysia and Spain. Conducting a cross-cultural analysis involving a diverse set of countries can provide a broader understanding of how regional nuances impact environmental decision-making. Quantitative and qualitative approaches in water management research offer complementary perspectives and methodologies for understanding the complexities of coastal water systems, human interactions, and governance dynamics. Integrating both quantitative and qualitative methods can enhance the robustness and comprehensiveness of research findings and inform evidence-based decision-making and policy development in coastal destinations.

Conflict of interests

The authors declare no conflict of interest.

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