



THE TOURIST AND WATER CONSERVATION: A GENERATIONAL APPROACH IN THE NORTHERN REGION OF QUINTANA ROO

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Water is a vital resource for developing tourism activities, and awareness about water conservation among tourists is a key element for achieving sustainable development. This study aims to evaluate the future perspectives of tourists of different generations regarding water conservation within hotels and determine which tourist destination in the northern region of Quintana Roo and which generation needs primarily awareness campaigns to mitigate pollution and water waste in hotels. According to fuzzy logic theory, tourists were enquired and their answers made it possible to obtain the membership functions for the seven destinations. These opinions were aggregated, and an α -cut was obtained. The transitive and intransitive closure algorithm was applied to obtain equivalent destinations. Finally, the obtained classes were ranked according to the Kaufmann and Gil-Aluja Algorithm (1995) shows that this new methodology helps decision-makers who want to implement sustainable programs.

Keywords: *water conservation, tourists' generations, the northern region of Quintana Roo, fuzzy logic.*

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1. INTRODUCTION

Regions around the world recognize the importance of water conservation. Large amounts of water are needed to develop tourist activity (Gössling et al., 2012).

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Water resources are not just essential; they are a lifeline for meeting basic human needs. However, the challenge of conserving them is becoming increasingly urgent as freshwater availability decreases due to population growth, climate change, and wastewater pollution. The global water stress predicted by 2050 (OECD, 2012) is not a distant threat but a looming crisis that demands immediate attention as specific policies and actions within each economic activity for fulfillment (Antonova *et al.*, 2021). This prediction underscores the importance of individual and collective efforts in water conservation and understanding that the seriousness of the issue is not enough, and people must also behave responsibly with the environment (Skeiryté *et al.*, 2022).

Fortunately, there has been a noticeable surge in tourists' awareness about the need to reduce the environmental impact of their travels (Fakfare *et al.*, 2024). This trend has prompted various authors to delve into the study of tourists' intention to stay in hotels with sustainable practices (Van Huy *et al.*, 2023; Pan *et al.*, 2022; Filimonau *et al.*, 2022). Other authors have focused on understanding tourists' attitudes toward environmental protection (Fakfare *et al.*, 2024; Wang and Fu, 2022; Passafaro, 2020; Pradeep and Pradeep, 2023), because attitudes play a crucial role in shaping people's behavior in sustainable tourism (Passafaro, 2020).

Tourists are increasingly conscious of the need to protect the environment. This awareness influences their preference for destinations and hotels committed to sustainable practices (Gomes and Lopes, 2023). According to Tirado *et al.* (2019), tourists' motivations to have sustainable behavior are divided into external and internal; the former refers to the influence of hotels based on the excellent water conservation practices they implement. For example, low-flow accessories, the reuse of towels, intelligent irrigation systems, wastewater for irrigation, and among others. Furthermore, tourist destinations that have environmental certifications influence the sustainable behavior of tourists positively (Gomes and Lopes, 2023). While internal motivations refer to each person's ecological concerns and values (L. Wang *et al.*, 2021).

In addition, other internal and external norms significantly shape tourists' sustainable behavior in hotels (Fakfare *et al.*, 2024). Internal norms, such as moral norms (Pan *et al.*, 2022; Casado-Díaz *et al.*, 2022 and Fakfare *et al.*, 2024), environmental concerns (Pan *et al.*, 2022 and Van Huy *et al.*, 2023) and altruistic values or tourists' concern for their health (Sadiq *et al.*, 2022). In the same way, personal and psychological factors (Butnaru *et al.*, 2022; Kabir and Hassan, 2024), hedonistic motivations, travel habits, emotional response to sustainable advertising, and destination attachment (Casado-Díaz *et al.*, 2022) contribute to sustainable behavior.

On the other hand, external factors such as culture, politics, education, and technology (Kabir and Hassan, 2024; Butnaru *et al.*, 2022), social networks (Van Huy *et al.*, 2023), and destination awareness (Casado-Díaz *et al.*, 2022) exert a significant influence. These societal factors underscore the broader context in

which tourists' sustainable behavior is shaped. The hotel also shapes tourists' environmental attitudes and behavior through sustainable practices and service quality (Sadiq *et al.*, 2022).

There are different behavioral patterns of tourists according to their generation because each one has developed in different contexts. For example, each generation's relationship with technology and economic income differs. In addition, the level of environmental education they have received and the values that motivate each of the generations are different. Some characteristics of each one are:

1. The Baby Boomer Generation (1946-1964) is between 78 and 60 years old. Contrary to their parents when they were the same age, they are still active, healthy, and financially stable (Balderas-Cejudo and Patterson, 2023). However, they are less involved in using services in the collaborative economy, such as Airbnb and Uber platforms (Paro *et al.*, 2021), and still need personalized treatment.
2. Generation X (1965-1979) ranges from 59 to 45. Family and friends are the most important values for this generation. They prefer spiritual values and intellectual development. Although they are more familiar with social networks than their parents, they are less used to handling technologies than millennials (Dabija *et al.*, 2018).
3. Generation Y or Millennials (1980-1994). According to Cavagnaro *et al.* (2018), people between the ages of 44 and 30 are motivated by the values of transcendence. They seek to learn about other cultures and create a better world for themselves and others. In addition, they travel not only for vacation purposes but also for educational purposes, such as learning another language and volunteering, and they find it easy to use technology.
4. Generation Z (1995-2004), aged between 29 and 20, uses technology pro-environmentally. For example, they prefer public transportation, buy unprocessed foods, and do not print invoices. They are also oriented to the value of universalism and are aware of future generations (Parzonko *et al.*, 2021).

Researchers have focused the most on Generation Z and Boomers out of the four generations of tourists. Generation Z represents tourism's future and will play a key role in shaping sustainable tourism. (Pan *et al.*, 2022). On the other hand, there is a growing interest in studying how different generations engage with technology and tourism. According to Dos Santos and Limberger (2024), the Boomer generation is less inclined to use technology in the context of tourism. While Generation Z can use technology to generate sustainable tourist experiences, using metaverse tourism generates virtual experiences to avoid environmental degradation (Go and Kang, 2023). However, for Boomers, one of the ways that they can get involved in sustainable tourism is through volunteering to fulfill the Sustainable Development Goals of the 2030 agenda (Balderas-Cejudo and Patterson, 2023).

There is a significant gap in the existing literature regarding the relationship between water conservation and different generations of tourists. Although age is one factor influencing the intention to stay in a hotel in favor of environmental protection (Filimonau *et al.*, 2022), none of the previous studies have specifically focused on the different generations of tourists.

In this way, Fakfare *et al.* (2024) have studied tourists' intentions regarding ecological protection and water conservation, Casado-Díaz *et al.* (2022) have examined gender differences in hotel guests' water conservation behavior, and MacAskill *et al.* (2023) have studied tourists' involvement in reducing water and energy consumption during their stay. Although several methodologies have been used to examine tourists' sustainable behavior, including statistical analyses, linear regression analyses, and structural equation models, more research is required. In this sense, fuzzy logic is a new approach not considered in previous studies to categorize viewpoints on tourists' water conservation across generations and destinations.

Therefore, the present study used fuzzy logic to evaluate tourists' future perspectives regarding hotel water conservation. The region of Quintana Roo has been divided into seven tourist destinations. Tourists were asked nine questions about their perspective of the water problems and the measures to address them at each destination. Based on the tourists' responses, the seven destinations were ranked according to the Kaufmann and Gil-Aluja Algorithm (1995).

The rest of this paper has the following structure. Section 2 presents the basic concepts, section 3 describes the area of study, section 4 is devoted to ranking the tourist destinations, and, finally, the main conclusions of the paper are presented.

2. BASIC CONCEPTS

Consider a referential E and an ordinary subset $A \subset E$ whose elements present a particular characteristic. In ordinary subsets, there are only two possibilities: x presents the characteristic ($x \in A$) or not ($x \notin A$). The membership function of A is defined as 1, and as 0 otherwise. In a fuzzy subset \tilde{A} , its elements can take any value of the Interval $[0,1]$, that is, the elements of E present the characteristic of the fuzzy subset \tilde{A} , in a certain degree. Then, the membership function is defined as usually represented by α . \tilde{A} is considered a fuzzy subset, whose theory was introduced by Zadeh (1965).

Fuzzy relations. The fuzzy logic allows us to know to what degree they are associated with the characteristics of two objects that belong to the same set or that belong to different sets. Let's consider two referential sets, $E_1 = \{a_1, a_2, \dots, a_n\}$ and $E_2 = \{b_1, b_2, \dots, b_m\}$. We can identify the level of relationship μ_{ij} between these two sets, with values between zero and one, with

0 being the relationship with the lowest degree of affiliation and with 1 being the relationship with the highest degree of affiliation, $\mu_{ij} \in [0,1]$. Figure 1 represents the matrix of these fuzzy relations in a sagittal form.

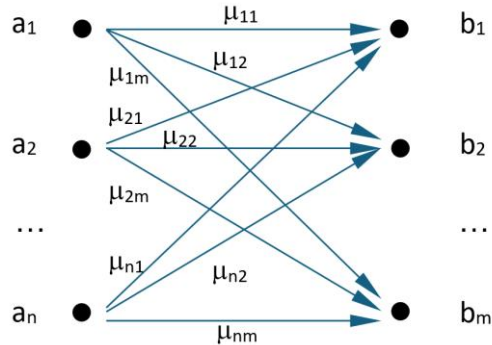


Figure 1. The matrix in sagittal form

Properties: i) reflexive, $\mu(x, x) = 1$, for all $x \in X$, shows which element is indifferent to itself; ii) symmetry $\mu(x, y) = \mu(y, x)$, implies that, if there is an arc going from X to Y , there must be another arc going from y to x with the same value; iii) antisymmetric, if $x \neq y$ $\mu(x, y) \neq \mu(y, x)$, and iv) transitive, $\forall x, y, z \in X: \mu(x, z) \geq \vee_y [\mu(x, y) \wedge \mu(y, z)]$. In other words, the direct relationship between two elements must be greater than or equal to the greater of the indirect relationships (Trillas and Eciolaza, 2015).

3. AREA OF STUDY

The study region in Quintana Roo is described below and divided into three large areas: North, Center (or Maya), and South. This division was generated based on the different economic activities carried out in each one, the diversity of its natural resources, and the sociocultural differences. The present study is based on the northern region, which is the region where tourism activity is mainly carried out and which, in turn, is divided into seven tourist destinations (Figure 2).

Therefore, our objective in the present study is to evaluate the future perspectives of tourists among the different generations of water conservation within the hotel through fuzzy logic and determine which tourist destination in the northern region of Quintana Roo needs a main awareness campaign to mitigate water pollution and waste in hotels.

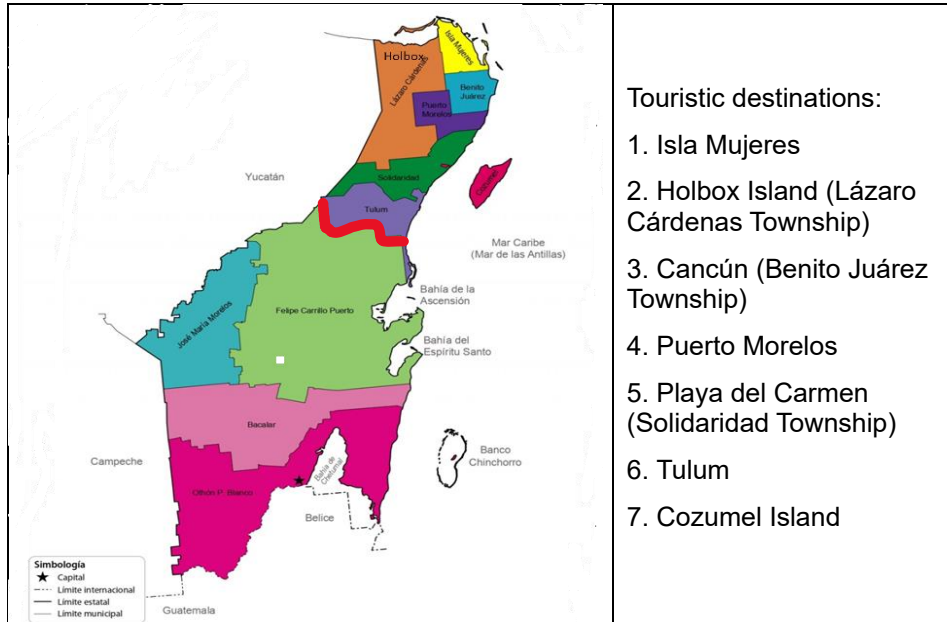


Figure 2. INEGI (2018)

4. RANKING TOURIST DESTINATIONS

This paper aims to rank the seven tourist destinations $E_1 = \{\text{destination 1, destination 2, destination 3, destination 4, destination 5, destination 6, and destination 7}\}$. For this purpose, the following stages have been considered:

Stage 1. Obtaining the membership functions by region for each question. Tourists in the seven tourist destinations were asked nine questions regarding their perception of the water problem and the measures to improve it. From this fuzzy relationship, the square matrix was constructed for each of the nine questions, which for the millennial generation are shown in Table 1. The first column indicates the tourist destination, the following five columns indicate the number of tourists who answered each of the response options, which measure the value between 0 and 1, and the last column μ shows the degree of each of the characteristics evaluated, that is, the intensity with which each value concerning water conservation is manifested to a greater or lesser degree, in this example only the responses of the Millennial generation are shown and are obtained in the following way $(29x0 + 3x0.25 + 2x0.5 + 8x0.75 + 34x1) / 100 = 0.5$, this result corresponds to the calculation of the first question and tourist destination 1.

Table 1. Results of the survey for the Millennial generation

1. How serious are you about the problem of water quality and quantity in Mexico in 10 years?						
Importance level (SE)	1	2	3	4	5	μ
Tourist destination 1	29	3	2	8	34	0.5
Tourist destination 2	4	12	34	15	16	0.58
Tourist destination 3	12	61	32	16	13	0.42
Tourist destination 4	17	15	6	1	7	0.32
Tourist destination 5	2	15	28	19	8	0.56
Tourist destination 6	4	5	8	23	34	0.76
Tourist destination 7	4	11	23	66	35	0.71
2. Are you worried that future generations will not have access to water like you?						
Universalism (SB)	1	2	3	4	5	μ
Tourist destination 1	0	4	4	45	23	0.8
Tourist destination 2	5	15	17	23	27	0.65
Tourist destination 3	17	3	31	7	4	0.41
Tourist destination 4	8	41	43	53	22	0.56
Tourist destination 5	2	5	3	34	23	0.76
Tourist destination 6	1	8	25	34	56	0.77
Tourist destination 7	6	15	21	54	27	0.66
3. Should I care for the water to prevent future societal conflicts over access?						
Security (SC)	1	2	3	4	5	μ
Tourist destination 1	45	6	5	7	28	0.4
Tourist destination 2	8	16	5	56	12	0.62
Tourist destination 3	33	21	3	6	42	0.51
Tourist destination 4	32	34	19	67	28	0.53
Tourist destination 5	4	5	6	6	15	0.66
Tourist destination 6	0	11	29	39	19	0.66
Tourist destination 7	3	17	18	37	32	0.68
4. Would you pay higher lodging rates to obtain better-quality water?						
Economic Resource (SD)	1	2	3	4	5	μ
Tourist destination 1	3	17	18	37	32	0.4
Tourist destination 2	63	12	33	16	13	0.32
Tourist destination 3	71	19	53	12	89	0.53
Tourist destination 4	89	8	1	32	3	0.22
Tourist destination 5	7	15	29	28	3	0.52
Tourist destination 6	59	18	22	42	82	0.58
Tourist destination 7	40	53	6	5	18	0.31
5. Should I be reassured that this is false when paying for sustainable services?						
Skepticism (SE)	1	2	3	4	μ	
Tourist destination 1	3	5	6	89	0.7	
Tourist destination 2	23	17	12	17	0.56	
Tourist destination 3	1	5	19	6	0.57	
Tourist destination 4	34	90	5	2	0.27	
Tourist destination 5	51	32	34	13	0.28	
Tourist destination 6	5	49	6	7	0.43	
Tourist destination 7	7	21	4	38	0.70	

Table 1. Results of the survey for the Millennial generation (continuation)

6. Am I worried that staying in a water-friendly hotel will be unpleasant and make me unhappy?						
Happiness (SF)	1	2	3	4	μ	
Tourist destination 1	4	6	4	6	0.6	
Tourist destination 2	8	16	5	56	0.56	
Tourist destination 3	33	21	3	6	0.50	
Tourist destination 4	32	34	19	67	0.48	
Tourist destination 5	4	5	6	6	0.65	
Tourist destination 6	4	5	6	6	0.52	
Tourist destination 7	3	17	18	37	0.55	
7. Is visiting a sustainable hotel pleasant?						
Hedonism (SG)	1	2	3	4	μ	
Tourist destination 1	16	34	26	21	0.6	
Tourist destination 2	5	18	15	8	0.57	
Tourist destination 3	67	23	37	19	0.28	
Tourist destination 4	20	29	68	52	10.36	
Tourist destination 5	24	19	6	6	0.48	
Tourist destination 6	1	19	2	4	0.44	
Tourist destination 7	7	23	39	48	0.57	
8. Would you be willing to take a course on water care in hotels?						
Education (SH)	1	2	3	4	μ	
Tourist destination 1	7	28	45	52	0.6	
Tourist destination 2	6	12	12	25	0.74	
Tourist destination 3	17	16	1	53	0.61	
Tourist destination 4	15	43	18	9	0.34	
Tourist destination 5	17	25	8	6	0.37	
Tourist destination 6	4	15	0	39	0.78	
Tourist destination 7	5	25	0	26	0.64	
9. Would you be willing not to use sunscreen in order not to contaminate the water?						
Conformism (SI)	1	2	3	4	5	μ
Tourist destination 1	45	23	13	34	54	0.5
Tourist destination 2	8	16	19	12	24	0.59
Tourist destination 3	1	18	22	32	14	0.61
Tourist destination 4	8	3	12	4	3	0.43
Tourist destination 5	2	3	17	8	15	0.67
Tourist destination 6	5	25	0	26	32	0.66
Tourist destination 7	5	9	26	16	15	0.60

Table 2 shows the membership functions by generation for the nine questions in the seven destinations. In Destination 3, Generation X, with a value of 0.84, considers the water conservation problem the most serious. In contrast, in Destination 4, the generation of Boomers with a value of 0.44 is the one that gives it less importance; the Boomer generation tends to be skeptical towards climate change and maintains a position in favor of conspiracy theories (Grindal *et al.*, 2023).

Table 2. Membership functions for the seven destinations (d1, d2, ..., d7) and the nine questions for the four Boomer, X, Millennial, and Z generations

Destination	Generation
	Boomer
d1	{0.44; 0.50; 0.29; 0.36; 0.75; 0.46; 0.48; 0.49; 0.25}
d2	{0.70; 0.49; 0.64; 0.45; 0.34; 0.59; 0.80; 0.59; 0.63}
d3	{0.86; 0.85; 0.75; 0.32; 0.85; 0.52; 0.79; 0.65; 0.42}
d4	{0.74; 0.86; 0.75; 0.44; 0.68; 0.55; 0.76; 0.40; 0.65}
d5	{0.88; 0.90; 0.77; 0.38; 0.80; 0.66; 0.84; 0.86; 0.81}
d6	{0.90; 0.79; 0.88; 0.41; 0.86; 0.88; 0.82; 0.53; 0.25}
d7	{0.90; 0.86; 0.86; 0.39; 0.77; 0.61; 0.76; 0.41; 0.16}
	Generation X
d1	{0.85; 0.84; 0.88; 0.73; 0.87; 0.72; 0.92; 0.90; 0.63}
d2	{0.94; 0.95; 0.97; 0.27; 0.84; 0.80; 0.63; 0.61; 0.55}
d3	{0.97; 0.93; 0.88; 0.09; 1.00; 0.60; 0.86; 0.66; 0.59}
d4	{0.73; 0.63; 0.64; 0.41; 0.75; 0.67; 0.63; 0.82; 0.48}
d5	{0.60; 0.63; 0.65; 0.37; 0.67; 0.66; 0.59; 0.75; 0.65}
d6	{0.59; 0.67; 0.57; 0.36; 0.65; 0.55; 0.59; 0.68; 0.75}
d7	{0.73; 0.64; 0.46; 0.33; 0.68; 0.62; 0.61; 0.65; 0.22}
	Millennials
d1	{0.55; 0.79; 0.41; 0.38; 0.70; 0.56; 0.61; 0.56; 0.54}
d2	{0.58; 0.65; 0.62; 0.32; 0.56; 0.56; 0.57; 0.74; 0.59}
d3	{0.42; 0.41; 0.51; 0.53; 0.57; 0.50; 0.28; 0.61; 0.61}
d4	{0.32; 0.56; 0.53; 0.22; 0.27; 0.48; 0.59; 0.34; 0.43}
d5	{0.56; 0.76; 0.66; 0.52; 0.28; 0.65; 0.48; 0.37; 0.67}
d6	{0.76; 0.77; 0.67; 0.58; 0.43; 0.52; 0.44; 0.78; 0.66}
d7	{0.71; 0.66; 0.68; 0.31; 0.70; 0.55; 0.57; 0.64; 0.60}
	Generation Z
d1	{0.95; 0.94; 0.93; 0.29; 0.94; 0.85; 0.95; 0.93; 0.68}
d2	{0.92; 0.93; 0.84; 0.32; 0.66; 0.62; 0.82; 0.89; 0.40}
d3	{0.51; 0.54; 0.65; 0.23; 0.81; 0.76; 0.77; 0.64; 0.74}
d4	{0.50; 0.60; 0.46; 0.58; 0.47; 0.62; 0.45; 0.42; 0.61}
d5	{0.68; 0.60; 0.53; 0.37; 0.57; 0.40; 0.63; 0.61; 0.46}
d6	{0.71; 0.71; 0.31; 0.32; 0.56; 0.52; 0.53; 0.62; 0.65}
d7	{0.48; 0.52; 0.56; 0.32; 0.65; 0.27; 0.62; 0.78; 0.69}

Stage 2. Aggregation of opinions. Each characteristic is represented by SA, SB, SC, SD, SE, SF, SG, SH, and SI. And at the same time, SA represents the first question, SB the second, and so on. The matrix elements take the value of 1 if they are greater than the element is compared to. If it is less than the element, it takes the value of 0. μ_{ij} is the characteristic function of row i , column j , of the fuzzy relationship $[R]$. The results are placed in (Table 3) and represent the future

perspective of the level of importance that the Millennial generation will give to the problem of water quality and quantity in Mexico in each of the tourist destinations of the northern region of Quintana Roo in 10 years—similar interpretations for the remaining generations.

Table 3. A comparison of tourist destinations for the SA characteristic.

Importance level (SA)	1. how seriously are you considering the problem of water quality and quantity in 10 years in Mexico?						
	d 1	d 2	d 3	d 4	d 5	d 6	d 7
d 1	x	1	0	0	1	1	1
d 2	0	x	0	0	0	1	1
d 3	1	1	x	0	1	1	1
d 4	1	1	1	x	1	1	1
d 5	0	1	0	0	x	1	1
d 6	0	0	0	0	0	x	0
d 7	0	0	0	0	0	1	x

It is observed that there is an anti-symmetry relationship and that tourists assign greater importance to water conservation in tourist destinations 3 and 4 than to the rest of these. This process is repeated for each characteristic's evaluation. Subsequently, the “ones” in each cell are added to generate the aggregate matrix, shown in Table 4. We will obtain a matrix for each generation.

Table 4. Aggregate matrix for the Millennial generation

SA	d 1	d 2	d 3	d 4	d 5	d 6	d 7
d 1	x	5	4	1	5	5	5
d 2	4	x	3	1	5	6	5
d 3	5	6	x	3	6	8	7
d 4	8	8	6	x	8	8	8
d 5	4	4	3	1	x	5	5
d 6	4	3	1	1	3	X	4
d 7	4	4	2	1	4	5	x

Next, these values are divided into 9 (number of questions). If the result is higher or equal to 0.5, the α -cut 0.5 takes the value 1, and 0 otherwise (Table 5). Before ranking, it is necessary to look for the existence of circuits, that is, indifferent objects that cannot be ordered.

Stage 3: Search for similar or indifferent objects using the transitive and inverse transitive closure algorithms.

- 3.1. Based on the last matrix $S_{0.5}$ (Table 5), one of the elements of the referential of E_1 is taken. In this case, we will take the tourist destination one and obtain its transitive closure (Γ {Tourist destination 1}), and immediately seek to obtain the inverse transitive closure (Γ^- {Tourist destination 1}) (Table 5).
- 3.2. When making the transitive closure of the Γ {Tourist destination 1} represented by the right column, a 0 is entered in the box corresponding

to tourist destination 1. It is observed in which elements of the row there is a 1, and for each 1 that exists in the row, a 1 is placed in the right column; for the inverse transitive closure process that is represented in the row below the matrix, a 1 is noted for each column of tourist destination one that has one, in this case, tourist destinations 3 and 4 have a one in the column; For this reason, in the reverse intransitive closure, the 1s are placed in the row that corresponds to tourist destinations 3 and 4. This process is repeated for each tourist destination until the matrix is depleted.

Table 5. α -cut 0.5 millennial generation

	Tourist d 1	Tourist d 2	Tourist d 3	Tourist d 4	Tourist d 5	Tourist d 6	Tourist d 7	T(SA)
Tourist d 1	X	1			1	1	1	0
Tourist d 2		X			1	1	1	1
Tourist d 3	1	1	x		1	1	1	
Tourist d 4	1	1	1	x	1	1	1	
Tourist d 5					x	1	1	1
Tourist d 6						X		1
Tourist d 7						1	x	1

T ⁻¹ (SA)	0		1	1				
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3.3. The intersection between the transitive closure and the inverse transitive closure of destination 1 of the millennial generation is obtained:
 $\Gamma \{\text{Destination 1}\} \cap \Gamma^{-}\{\text{Destination 1}\} = \{d1, d2, d5, d6, d7\} \cap \{d1, d3, d4\} \rightarrow \{d1\}$ which correspond to the first equivalence class.

3.4. Subsequently, the rows and columns of the previous intersection $\{d1\}$ are eliminated, and Table 5 is reduced to Table 6:

Table 6. α -cut 0.5 millennial generation after eliminating the homogeneous group $\{d1\}$

	Tourist d 2	Tourist d 3	Tourist d 4	Tourist d 5	Tourist d 6	Tourist d 7	T(SA)
Tourist d 2	X			1	1	1	0
Tourist d 3	1	x		1	1	1	
Tourist d 4	1	1	x	1	1	1	
Tourist d 5				X	1	1	1
Tourist d 6					X		1
Tourist d 7					1	x	1

T ⁻¹ (SA)	0	1	1				
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Moreover, we get: $\Gamma \{\text{Destination 2, destination 5, destination 6, destination 7}\} \cap \Gamma^{-}\{\text{Destination 2, Destination 3, destination4}\} = \{d2, d5, d6, d7\} \cap \{d2, d3, d4\} \rightarrow \{d2\}$.
 The process is repeated until all regions are depleted. The equivalence classes obtained are: C1: $\{d1\}$; C2: $\{d2\}$; C3: $\{d3\}$; C4: $\{d4\}$; C5: $\{d5\}$; C6: $\{d6\}$; C7: $\{d7\}$.

Stage 4. Ranking (Kaufmann and Gil-Aluja, 1995). In the sagittal graph, the origin of the vectors indicates which region gives more and less importance to water conservation. Based on the $S_{0.5}$ matrix (Table 5), the tourist destination that offers less importance is the tourist destination where more vectors are originated, as can be seen in the first sagittal graph (Figure 3), millennials give less importance to water conservation in tourist destination four, because it is where more vectors are originated. The vertices that have no predecessor are sought and discarded from the graph, and in this way, the levels are assigned. The first level indicates which region gives less importance to hotel water conservation.

The arches from the first level are discarded, and then the process is repeated to obtain the following levels. In this way, the order of destinations presented in Table 7 indicates that tourist destination four is the least important. In contrast, destination six is the most important. Therefore, destination 4 is the tourist destination that primarily needs the campaign to make tourists aware of water conservation.

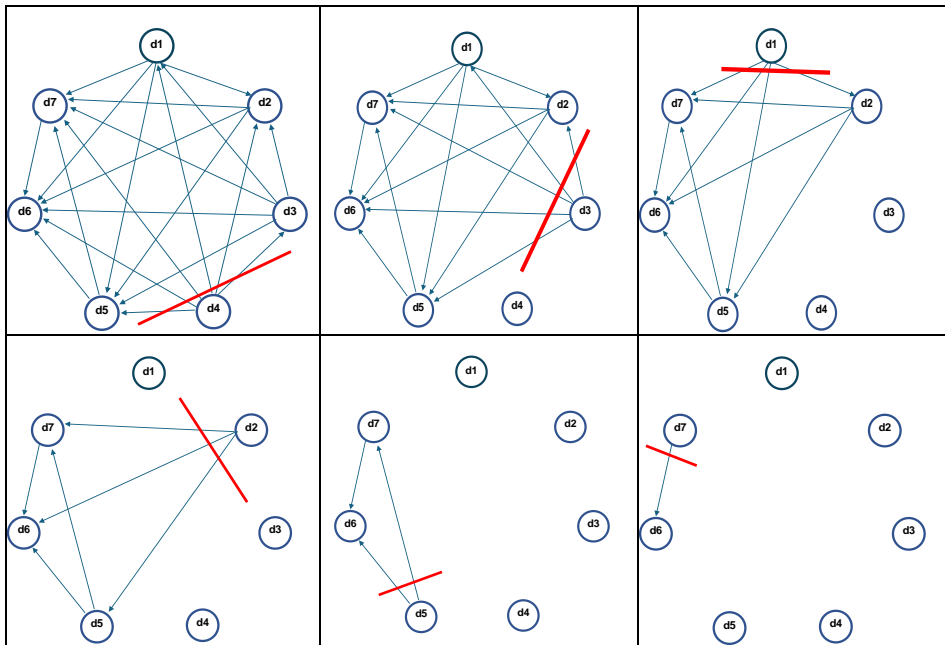


Figure 3. Sagittes graphs based on the $S_{0.5}$ matrix for the management of tourist destinations. Where d = tourist destination.

Table 7. Levels of the tourist destination ranking for the four generations

Generation Baby Boomers		Generation X		Generation Millennials		Generation Z	
Level	Destination	Level	Destination	Level	Destination	Level	Destination
N_1	{d1}	N_1	{d7}	N_1	{d4}	N_1	{d4}
N_2	{d2}	N_2	{d6}	N_2	{d3}	N_2	{d5, d6, d7}
N_3	{d3}	N_3	{d5}	N_3	{d1}	N_3	{d3}
N_4	{d4}	N_4	{d4}	N_4	{d2}	N_4	{d2}
N_5	{d7}	N_5	{d2}	N_5	{d5}	N_5	{d1}
N_6	{d5}	N_6	{d3}	N_6	{d7}		
N_7	{d6}	N_7	{d1}	N_7	{d6}		

According to the results presented in Table 7, destination 4 (at level 1 for Millennials and Generation Z) gives minor importance to water conservation in hotels for the youngest generations. Therefore, this destination needs a campaign to raise awareness among the youngest tourists regarding hotel water conservation. On the other hand, Destination 1 (the maximum level for Generations X and Z) and Destination 6 (the maximum level for Boomers and Millennials) attract tourists who are most conscious about water conservation. Destinations 5, 6, and 7 are at level 2 in Generation Z, meaning it is impossible to order them because they have similar values.

The four generations all agree that they are worried about future generations not having the same access to water as they do. However, they are not willing to pay higher rates for water conservation. The Boomer and X generations are also unwilling to stop using sunscreen to prevent water contamination, while Millennials and Z generations are not concerned about avoiding sunscreen use. Additionally, the Millennial and Z generations are worried about having a negative experience at a sustainable hotel, but this is not a significant concern for the Boomer and X generations.

It seems contradictory that Generation Z is shown in Destination 4 as the most unconscious generation, while in Destinations 1 and 6, it is shown as the most conscious generation; this is explained by the fact that although according to (Butnaru *et al.* 2022; Gomes and Lopes, 2023) Generation Z seeks to focus on low-impact tourism and travel in sustainable ways. At the same time, some of them have the habit of consuming things that are not environmentally friendly, prioritizing obtaining a lower price over investing in a sustainable product or service; this behavior demonstrates the gap that exists between attitude and behavior that some authors mentioned (Frias *et al.*, 2021; Butnaru *et al.*, 2022, J. Wang *et al.*, 2021; L. Wang *et al.*, 2021 and Filimonau *et al.*, 2022)

In destinations 1 and 6, generations X and Boomers were the most conscious, which shows that the influence of the destinations and hotels is evident in shaping tourists' perspectives toward water conservation (Sadiq *et al.*, 2022; Gomes and

Lopes, 2023; Fakfare *et al.*, 2024; Kabir and Hassan, 2024; Casado-Díaz *et al.*, 2022). Based on this, governments should invest in programs supporting policies and activities favoring sustainable tourism, as Fakfare *et al.* (2024) and Filimonau *et al.* (2022) pointed out. Tourists can have different perspectives on water conservation in the same tourist destination.

5. CONCLUSIONS

Many authors have studied tourists' intentions, attitudes, and values, while others have focused on personal and social factors or behavior related to environmental protection. However, this study uses fuzzy logic to assess tourists' future perspectives, considering sustainable tourism emphasizes preserving natural resources for future generations. In addition, the role of tourists in water conservation is crucial. Understanding the perspectives of different generations is critical to predicting their behavior.

Through fuzzy logic, we established a range of five options that allowed us to evaluate the degree to which the tourists interviewed agreed with their perspectives. The answers ranking clarified the vision of tourists of different generations regarding water conservation and identified that Tourist Destination 4 needs to carry out an awareness campaign for millennials and Z generations. On the other hand, in Destination 1, Generation X and Z were the most aware, and for Destination 6, Boomers and Millennials were the most aware.

This new methodology is essential to decision-makers who want to implement awareness sustainable programs and determine priorities for whom and in what place, considering the generation to which the tourists belong and the destination they visit.

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