



Ranking the competitiveness of tourist destinations: An analysis using the OWA operator and the SAW method

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Abstract

This paper aims to rank the competitiveness of tourist destinations based on different aggregation operators, specifically, the ordered weighted average (OWA) operator and the simple additive weighting (SAW) method. The use of these methods allows tourist destinations to be sorted according to their competitiveness. Also, it enables the generation of different scenarios that highlight the relative importance of each criterion. This information is useful for the government and recreation sites when generating further evaluations based on each municipality's specific characteristics. An application of these methods to determine the competitiveness of Sinaloa tourism destinations, Mexico, has been performed.

Keywords. Competitiveness, tourist destinations, SAW method, OWA operator

JEL codes. D49, L83, C44

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Ranking de competitividad de los destinos turísticos: Un análisis utilizando el operador OWA y el método SAW

Resumen

El objetivo de este trabajo es clasificar la competitividad de los destinos turísticos en base a diferentes operadores de agregación, específicamente, el operador de promedio ponderado ordenado (OWA) y el método de ponderación aditiva simple (SAW). El uso de estos métodos permite clasificar los destinos turísticos según su competitividad. Además, permite la generación de diferentes escenarios que resaltan la importancia relativa de cada criterio. Esta información es útil para el gobierno y los sitios de recreación a la hora de generar diferentes evaluaciones en función de las características específicas de cada municipio. Se ha realizado una aplicación de estos métodos para determinar la competitividad de los destinos turísticos de Sinaloa, México.

Palabras clave: Competitividad, destinos turísticos, método SAW, operador OWA.

Códigos JEL: D49, L83, C44

1. INTRODUCTION

There is a worldwide dynamism in tourism that has caused a growing interest in competitiveness (Kubickova and Martin, 2020; Botti and Peypoch, 2013). Due to the tourism system's centrality, destinations benefit from this interest, and many researchers have addressed it. Besides, there is a diversity of existing perspectives when using the term competitiveness, making it challenging to provide a concrete definition for this concept (Abreu Novais, Ruhanen and Arcodia, 2018; Porter, 1990). In addition, to analyze this issue, the determination of numbers must be considered (Enright and Newton, 2004). However, to understand the competitiveness of tourist destinations, we have Ritchie and Crouch (2000) contributions, which is one of the most cited works in this field. The model proposed by these authors integrates all the relevant factors that can characterize recreational sites' competition.

On the other hand, to achieve a competitive advantage, any destination must not only ensure that its attractiveness and the tourist experience offered are superior to those of other places of recreation, but it is also necessary to project striking images to attract more tourists and position worldwide (Vinyals-Mirabent, 2019; Dwyer and Kim, 2003). In that sense, in an increasingly saturated market, the development and promotion of tourist destinations should be guided by analytical frameworks that focus on the concept of competitiveness (Albayrak, Caber, González-Rodríguez and Aksu, 2018; Hassan, 2000). In this way, most of these competitiveness models have focused on the one hand, in the company as a unit of analysis and, on the other, in the identification of those attributes that characterize that recreational site to propose a list of individual indicators (Mendola and Volo, 2017).

Based on the above, it is important to note that the analysis of tourist destinations has an important subjective weight because

some elements are perceived by the tourists in different ways, and some elements are important to some tourists but not as important to others. Because of this subjectivity, the objective of the current study is to compare the application of the multiple criteria decision analysis method (MCDA) between the ordered weighted average (OWA) and the simple additive weighting (SAW) to measure the competitiveness of tourist destinations in Sinaloa. The use of these methods not only allows the classification of tourist destinations according to their competitiveness but also facilitates the generation of different scenarios that highlight the relative importance of the criteria based on the expectations, knowledge, and aptitude of the decision-maker. To achieve the proposed objectives, it was decided to use the definition and approach proposed by Crouch and Ritchie (1999) because they are the best options for measuring and characterizing the competitiveness of recreational sites, and they have been used in several publications in recent years.

Finally, this article is organized as follows. Section 2 presents the theoretical framework on competitiveness of tourist destinations. Section 3 defines the OWA operator and SAW method, and Section 4 presents the use of that methodology to rank the competitiveness of tourist destinations in Sinaloa, Mexico. Finally, section 5 summarizes the main conclusions of the article.

2. THEORETICAL FRAMEWORK

2.1 *A literature review of the competitiveness of tourist destinations*

Different countries have considered tourism as one of their main industries (Carayannis, Ferreira, Bento, Ferreira, Jalali, and Fernandes, 2018; Cracolici and Nijkamp, 2009). In that sense, more and more regions are turning to this sector as an important element in their economic portfolio, as they recognize the potentially significant rewards at stake (Goffi, Cucculelli, and Masiero, 2019; Drakulić Kovačević, Kovačević, Stankov, Dragičević and Miletić, 2018). Therefore, in the words of Crouch and Ritchie (1999), the proper management of this industry could make it a vital engine to achieve broader social objectives.

On the other hand, tourist destinations worldwide compete with each other due to the increasing global mobility of tourists. For this reason, recreation places strive to be more competitive (Zainuddin, Radzi, and Zahari, 2016). Thus, as travel and leisure activities become more frequent, competition increases, demand becomes more complex, and more flexible approaches are needed for recreational sites to compete (Pearce, 1997). In this way, the development potential of any community's tourism sector will depend substantially on its ability to maintain an advantage in the delivery of goods and services to its visitors (Dwyer, Forsyth, and Rao, 2000).

Kosak and Rimmington (1999) express that tourist destination are the central elements of the tourist system; the main characteristics of these destinations, such as their temperature, culture or -

infrastructure, contribute to their general attractiveness because, as tourists gain experience in other recreation sites that compete directly or indirectly with these destinations, the tourist's perceptions will play a relevant role in determining the sites that they will visit in the role of travelers who make purchases between the facilities, attractions and service standards of various leisure venues. However, if recreational sites do not pay attention to these elements, all efforts to be more competitive would be vain (Andrades and Dimanche, 2017).

Consequently, this economic activity has become a global socioeconomic phenomenon in a mobile world, and competitiveness has increased interest among tourism researchers and policymakers due to this dynamism (Enright and Newton, 2004; Goodrich, 1997). Because the competitiveness of a tourist country is important, especially when fighting for higher market shares, tourism managers must analyze the competitive position of the destination because the extent to which that region can benefit from its tourism sector will depend greatly on its competitive position within the tourist market industry (Gomezelij and Mihalič, 2008).

However, addressing this problem is slightly complicated since there is a wide variety of perspectives that make it challenging to provide a conclusive definition of the concept of competitiveness (Botti and Peypoch, 2013). Similarly, the debate on the competitiveness of tourist destinations within tourism research has not yet established a widely accepted definition. However, an early interpretation of the term and its application to recreational sites focus on price levels (Mazanec, Wöber, and Zins, 2007). According to Dwyer, Forsyth and Rao

(2000), this analytical framework was first applied to a comparative study of 19 destinations based on a price competitiveness index supported by purchasing power parities adjusted to the exchange rate. This variable has been mainly used in econometric analyses of tourism demand.

Dwyer and Kim (2003) present a holistic approach consisting of determinants and indicators used to define the competitiveness of a destination. These elements are classified into subgroups labeled as resource endowment, support factors, destination management, situational conditions, demand factors, and market performance indicators. They were generated during workshops held with stakeholders from the tourism industry in Australia and Korea. This tool proposed by the authors not only allows comparisons between countries and between sectors in the tourism sector but also identifies the strengths and weaknesses that can be used by the industry and by governments to increase the numbers and expenses related to tourism and to improve socioeconomic prosperity.

Similarly, Enright and Newton (2004) develop a methodology that puts into practice the concept of tourism destination competitiveness in a useful way for researchers, industry participants, and policymakers. This approach demonstrates the value of including business-related factors and images of more conventional destinations or attraction factors in tourism competitiveness studies. Therefore, when applying this tool to Hong Kong, the 2004 survey also highlights the practical importance of identifying the relevant competitors and understanding the tourist attractions' relative importance to determine the competition between destinations.

Hassan (2000) presents a new detailed competitiveness model that focuses on the sustainability factors associated with travel destinations. Its approach highlights the role played by the relationships between all the stakeholders involved in the creation and integration of value-added products for the maintenance of resources while maintaining the market position concerning other competitors, as the development of future destinations should be guided toward effective and efficient management with a focus on a sustainable customer base. Therefore, maintaining a particular destination's longevity becomes a function of responding to market demands and competitive challenges for the industry to maintain its economic viability.

Similarly, Mihalič (2000) expresses that there are considerable investigations that have addressed various elements of destinations' competitiveness. Still, there have been few attempts to study environmental competitiveness systematically and comprehensively from a management perspective. In this way, the author notes the need to apply a technique where the management element serves as a tool to link competitiveness and environmental management. Thus, the author studies the competition between recreation sites from an ecological perspective because he believes that the ability to identify an attraction can be increased through appropriate administrative efforts related to environmental impacts and through certain marketing activities that focus on environmental aspects such as management by codes of conduct, by self-developed environmental practices or by certified best practices.

In contrast, Kozak and Rimmington (1999) evaluate quantitative and qualitative elements of destinations' competitiveness. In the former approach, they consider the number of tourists and the income related to tourism. In contrast, they feel the relationship between tourists' likes and dislikes for their destinations for the latter approach. According to their findings, travelers compare the quantitative and qualitative aspects of various destinations and choose between them. The authors then reach Mediterranean destinations and find that local people's friendliness, value for money spent, security, local transportation, the natural environment, and food are classified as the most common elements of Turkey's positive tourism industry experiences.

Crouch and Ritchie (1999) add an explanation to the concept of a destination and try to define the factors that make a destination competitive by developing a conceptual model. For the authors, a competitive destination should provide a high standard of living for its residents. In other words, the competitiveness of a destination depends directly on the level of economic, social, and environmental conditions offered to its residents. The model's technique includes certain aspects that increase the competition between recreational places, such as attraction factors and resources, factors and support resources, destination management, and determining factors. For example, the road infrastructure or access to the destination allows travelers to decide which tourist attractions are convenient to visit.

Within this framework, Dwyer, Mellor, Livaic, Edwards, and Kim (2004) develop an instrument to capture the main elements of

competitiveness highlighted in the general literature while also appreciating the particular problems involved in exploring the notion of destination competitiveness as emphasized by tourism researchers. This method presents a set of indicators that can measure the competitiveness of any given destination. These data included both objective and subjective measures and were identified from the discussions in Korea and Australia workshops in 2001. The common elements within this proposal are destination management, nature-based resources, and efficient public service.

In the same way, Kayar and Kozak (2010) evaluate 13 key factors that affect a destination's competitiveness and compare the levels of competition of EU countries with those of Turkey. The authors also focus on detecting the more effective determinants of destinations' ability to compete with others. This analysis includes agents such as the rules and regulations of policies, security, information technology, and communication infrastructure. However, those that most affect competitiveness outcomes are air transport infrastructures, natural and cultural resources, land transportation infrastructures, and health and hygiene. This study made it possible to classify certain components of competitiveness according to the degree to which they effectively determine the competitive advantage of countries.

Finally, the World Economic Forum (2019) has been conducting a travel and tourism competitiveness index since 2006 to measure the factors and policies that make the sustainable development of the tourism sector possible and contribute directly to the promotion of competition among the countries. In its latest edition, the Forum

compares 140 nations through its index composed of 4 subscripts and 14 pillars containing 90 individual indicators. A score between 1 and 7 is assigned; then, an average score is obtained, the score is reported for each territory. This technique's central elements are the environment's conduciveness to tourism, its infrastructure, its natural and cultural resources, and its policies and factors that allow travel and tourism. The results show that Spain, France, and Germany are the most competitive countries since they occupy this index's first places (see table 1).

TABLE 1. TRAVEL AND TOURISM COMPETITIVENESS INDEX

RANK	COUNTRY	SCORE
1	Spain	5.4
2	France	5.4
3	Germany	5.4
4	Japan	5.4
5	United States	5.3
6	United Kingdom	5.2
7	Australia	5.1
8	Italy	5.1
9	Canada	5.1
10	Switzerland	5.0

Source: Own elaboration.

On the other hand, different models have already been presented to evaluate the destinations' competitiveness. However, the term competitiveness still needs to be defined according to the existing literature on this subject. In this way, a meaning presented here is that proposed by Kayar and Kozak (2010), who define the competitiveness of tourist destinations as the ability of entrepreneurs to design, produce and market goods and services, whose prices and qualities are not related to price form a package of benefits that are more attractive than that of competitors. Under this definition, an

entrepreneur who is superior in a quality dimension compared to the competition has a competitive advantage.

The literature also includes definitions that consider it from sustainability or social perspectives. For example, Hassan (2000) defines it as a destination's capacity to create and integrate value-added products that sustain its resources while maintaining the market position with its main competitors. In terms of social benefits, destinations' ability to provide a high standard of living for their residents and visitors is called destination competitiveness (Crouch and Ritchie, 1999).

On the other hand, a study used a multiple criteria approach to assess the competitiveness of tourist destinations. The model used was a combination of cognitive mapping and the MACBETH technique. According to the authors, this methodological framework allowed not only to identify the measurement criteria and their possible cause and effect relationship and attribute weights to these dimensions through semantic judgments. The results show that using these tools is possible to compare recreational sites in Portugal. In this way, it was possible, first, to order the alternatives according to their performance in the selected criteria and, second, to demonstrate that this measurement mechanism is more complete than other procedures currently in use (Carayannis *et al.*, 2018).

For their part, Ćirić and Sedlak (2019) identified the basic characteristics that contribute to making one destination more attractive than others. Subsequently, by applying different diffuse methods of ordering, they managed to make a classification of these recreation places. The

main findings show that the Yager method's rankings correctly determine the destination's importance; in this case, Rome and Berlin are the best-evaluated cities. Whereas granting marks assigns redesigned ratings, Barcelona, Paris, and London are the best performing locations. Consequently, the application of these instruments to measure competition between destinations is revealed.

Similarly, Teixeira, Ferreira, Wanke, and Moreira Antunes (2019), propose a model for evaluating the competitiveness and innovation of destinations in Portugal through the entropy of information to handle different weights calculated with alternative approaches such as Fuzzy Rasch and diffuse hierarchical analysis (AHP). Applying these techniques shows that there is heterogeneity in Portuguese attractions in terms of innovation and establish the relationship between innovative and competitive tourism practices. Therefore, destinations must increase their investment in digital platforms.

Similarly, Lopes, Muñoz, and Alarcón-Urbistondo (2018) ordered eight recreational sites in the northern region of Portugal according to their level of competitiveness. To achieve the above, the authors applied the multicriteria analysis through the PROMETHEE and GAIA method. In this way, it was possible to know the localities' position to their competitors. Also, this demonstrated the suitability of using these multiple criteria techniques to measure competitiveness. The findings of this analysis expose the comparative strengths and weaknesses of each tourist space and allow them to generate an order according to their competing capacity. It is also clear that the metropolitan area of Porto is the most

competitive than the rest. At the same time, Cávado shows deficiencies in his evaluation.

In that order of ideas, Ćirić and Sedlak (2018) also developed a methodology to sort tourist attractions according to their competence level. The method they used focused on multiple attribute decision making (MCDA) and considered some environmental, digital, and quality aspects. In this way, its objective was to build an approach to determine if a destination is competitive according to its ability to deal with sustainability problems. On the other hand, the document results determine that when different elements are known, and everyone is given qualifications, fuzzy logic is a convenient tool for selecting the most appropriate leisure place.

Finally, Fu and Chen (2019) propose a conceptual assessment tool for island tourism competition by applying fuzzy sets theory to integrate expert judgments and provide guidelines for resource allocation. In this procedure, the Delphi fuzzy technique, diffuse hierarchical analysis (AHP), and Kruskal-Wallis test were used. The study revealed that criteria such as natural resources, culture, entertainment activities, transportation, and lodging establishments had improved the degree of competition.

In this context, the concept is mainly based on the many factors involved in micro and macro environments. A literature review indicates that considerable research has been conducted to examine the factors that affect and measure competitiveness at the destination. However, the best definition and a complete framework have been developed by Crouch and Ritchie, as it has been present in several publications in recent years. For this reason, it has been decided to use the

definition and model proposed by these authors to measure and characterize the competitiveness of tourist destinations through an arrangement created through the application of the OWA operator and the SAW method.

2.2 Competitiveness in the tourist destinations of Mexico

In recent years, globalization has transformed the economic and business fields. This gives way to a process of intense global competition between countries around the world to reflect them on important economic and social progress within destinations (Huber and Mungaray, 2017). In this way, Lall (2001) tells us that competitiveness is an issue that worries both governments and business and academic sectors around the planet. There is a demand for analysis on this subject at the international level, as there is a diversity of theoretical, conceptual, and methodological proposals that attempt to evaluate the competency of certain places of recreation through indexes and rankings.

For example, according to the world economic forum (2019), Mexico occupies the 19th position in the travel and tourism competitiveness index. Its competition level is characterized by having exceptional natural and cultural resources, which effectively combine with relatively strong price competitiveness. However, the possibility of generating demand and obtaining value from them depends mainly on the ability to establish and enforce environmental policies. If adequate attention is not given to preserving these assets, they will cease to contribute, as with any resource depleted, to the country's overall competitiveness performance.

However, argue Huber and Mungaray (2013), at the national level, several research projects present models to determine the competitiveness of tourist destinations through different methodologies and conceptualizations. Such is the case of the proposal made by the Instituto Tecnológico y Estudios Superiores de Monterrey (2012), which was the first formal elaboration in Mexico to measure federal competitiveness entities. This study defined competitiveness as a characteristic assigned to a region that reaches levels higher than in other regions. In addition, it represents 125 tourism content variables that were grouped into ten dimensions and selected through a theoretical analysis of factors that influence tourism competitiveness.

Similarly, the Instituto Mexicano para la Competitividad (2016) developed a state competitiveness index to analyze the 32 states that make up the Mexican territory. This classification comprises 100 indicators, categorized into ten subindexes, to identify each state's strengths and weaknesses to attract and retain investments. The analysis shows Mexico City, Aguascalientes, Nuevo León, Colima and Querétaro as the most competitive entities.

Additionally, in that year, the institute also evaluated the competition of the 74 most important cities in the country through 120 variables grouped into ten subscripts. This urban competitiveness index measures the ability of Mexican cities to attract and retain talent and investments. In this way, a competitive city is one that maximizes the productivity and well-being of its inhabitants. The results point to Mexico City, San Luis Potosí, Campeche, Querétaro, and Monterrey as the municipalities that reached

the highest competitiveness levels (see table 2).

TABLE 2. URBAN COMPETITIVENESS INDEX

RANK	CITY	LEVEL
1	Mexico City	Very high
2	San Luis Potosí	Very high
3	Campeche	High
4	Querétaro	High
5	Monterrey	High
34	Cuernavaca	Medium
43	Culiacán	Medium
66	Tapachula	Low
67	Cárdenas	Low
74	Tulancingo	Very low

Source: Own elaboration.

Similarly, Unger (2017) estimates the competitiveness of the 32 federal states of Mexico. To calculate each state's competitiveness, the author considers two fundamental economic indicators, namely, labor productivity and wages. This study's main result is that the 13 most competitive entities have more productive economies with more diversified and higher levels of productivity and wages. These more economically mature entities include Nuevo León, Mexico City, Querétaro, the State of Mexico, Jalisco, Guanajuato, and San Luis Potosí, as well as the northern border states. The other 19 states demonstrate a relatively backward attempt to compensate for their lack of productivity with the punishment of wages. The most critical conditions are observed in the southeastern states and other states along the Pacific coast.

In contrast, León and Leyva (2017) address the competitiveness of tourist destinations as a matter of multicriteria classification. This comparison is a complex exercise because the destinations present significant heterogeneity among them. In this work, the

Crouch and Ritchie model is used to focus on the tourist-related analysis of competition between recreational sites. The objective of the study is to compare and classify the main tourist destinations in northwestern Mexico. The ranking is carried out in two stages. The first stage used the Elimination and Choice Expressing Reality (ELECTRE) III method to build a valued improvement relationship. The second stage used a multiobjective evolutionary algorithm to exploit those relationships and generate the classification of destinations. This research finds that the cities of Tijuana and Los Cabos are the destinations with the highest level of competitiveness compared to the rest of the regions in the northwest region.

Similarly, Álvarez, León, Gastélum, Vega (2013) develop an analysis of the competitiveness of three main cities in Sinaloa, Mexico. They also use as a base for the well-known model proposed by Crouch and Ritchie. Like the previous authors, these authors decide to address the comparison as a multicriteria classification problem using the overcoming method of a multicriteria group decision support system to generate a classification of these municipalities. The Crouch and Ritchie approach is then used to generate information to assess the competitiveness of the destinations. An overcoming method is then used to create a preferential model and obtain destination competitiveness based on the cities' ranking. The results show that the town of Mazatlan is the most competitive recreational site.

In contrast, Amaya, Conde, and Covarrubias (2008) present a model for analyzing the factors that determine Manzanillo to be the more competitive tourist attraction concerning other destinations. The authors use a reference to

the destination's competitive advantage in tourism that refers to the ability of a destination to use its resources in the long-term effects. Similarly, the authors use Crouch and Ritchie's main ideas to identify the leading indicators that measure competition between recreational sites. Also, they suggest that the annual occupation rate, the attraction of investment, and the tourists' level of satisfaction are the necessary attributes to boost the competitiveness of the cities.

Finally, Jiménez and Aquino (2012) present a model that allows the analysis of the competitiveness of destinations located in Oaxaca through the successive study of groups of factors with common effects on the relationship between tourists and destinations that occur at different times, as well as the final result product of that relationship in terms of tourist satisfaction, environmental care, equity, and economic efficiency. Unlike other approaches that only consider resources, activities, and processes, the approach proposed by these authors gives relevant weight to the results of tourist activity manifested by the tourists, the level of responsible use of natural resources, and the socioeconomic effects. Besides, this approach discards the premise that all factors have similar importance in the destination decision.

3. METHODOLOGY: THE OWA OPERATOR AND SAW METHOD

In this section, the definitions of the two main methodologies used to measure competitiveness in the tourism destinations of Sinaloa are explained. These two methodologies are the OWA operator and the SAW method. The main idea is to

compare the different choices that can be made depending on both methods. These methodologies are similar because both are based on using a weighting vector; the difference is that the SAW method only has one unique ranking, while the OWA operator can have multiple rankings depending on the reordering process.

3.1 The OWA operator

The OWA operator was introduced by Yager (1988). Its main characteristic is that it makes it possible to obtain the maximum and minimum values according to the operator's reordering step. It can be defined as follows.

Definition 1. An OWA operator of dimension n is a mapping of $OWA: R^n \rightarrow R$ that has an associated weighting vector W of dimension n with $w_j \in [0, 1]$ and $\sum_{j=1}^n w_j = 1$, such that:

$$OWA(a_1, a_2, \dots, a_n) = \sum_{j=1}^n w_j b_j, \quad (1)$$

where b_i is the j th largest of the a_i .

Decisions within the OWA operators can be made under the following four criteria (Blanco-Mesa *et al.*, 2018).

→ Optimistic criterion. This criterion assumes that the most favorable state is presented; therefore, the decision-maker should select each alternative's most favorable result. The results obtained demonstrate the most favorable outcome of all. This criterion is based on a maxim that is formulated as follows:

$$Decision = Max\{E_i\} = Max[Max\{Max\{a_j\}]$$

→ Pessimistic or Wald criterion. This criterion argues that the decision-maker must select the alternative that provides a higher security level; thus, the final decision should be the most favorable outcome out of the most unfavorable

outcomes for each alternative. This method is known as Max-Min, and its formula is as follows:

$$Decision = Max\{E_i\} = Max[Min\{a_j\}]$$

→ Hurwicz criterion. In this criterion, the decision-maker ponders the most optimistic coefficient and the most pessimistic coefficient as the best and worst cases. The decision maker then considers the values and chooses the alternative that proposes a greater result. The formula for this criterion is as follows:

$$Decision = Max\{E_j\} = Max[\alpha Max\{a_j\} + (1 - \alpha) Min\{a_j\}]$$

where $\alpha + (1 - \alpha) = 1$.

→ Laplace criterion. This criterion is based on the principle of insufficient reason; thus, the same degree of probability is associated with each different scenario, as long as there are no indications of opposite outcomes. The formula is as follows:

$$Decision = Max\{E_j\} = Max[(1/n) \sum_{j=1}^n a_j]$$

There are different possibilities for assigning weights to arguments based on these different criteria. To choose the best criteria for assigning weight, it is necessary to ask the decision-maker about their expectations and aptitude for the future. Thus, it can be determined if the desired results should be based on the maximum or the minimum criteria or other criteria, such as the Hurwicz and Laplace criteria.

3.3 SAW method

The SAW approach is also known as the linear weighted combination or scoring method and is considered a simple multiattribute decision technique. It is

famous for its simplicity and speed in forming a comprehensive judgment on alternatives' performance (Afshari *et al.*, 2010; Fadafan *et al.*, 2018; Setiawan *et al.*, 2018). Below are the steps to follow to apply this multicriteria analysis strategy.

Step 1. A pairwise comparison matrix ($n \times n$) is constructed for the criteria with respect to the objective, using the theory of personal construction proposed by Roger, Bruen, and Maystre (2000), as shown in table 3. In other words, the matrix is used to compare each criterion with the other criteria individually.

TABLE 3. ASSESSMENT SCALE OF THE THEORY OF PERSONAL CONSTRUCTION

INTENSITY OF IMPORTANCE	DEFINITION	EXPLANATION
1	Equal importance	The importance between the two criteria is equal
2	Very low importance	The importance presented by one criterion in relation to the other criteria is very low
3	Low importance	The importance presented by one criterion in relation to the other criteria is low
4	High importance	The importance presented by one criterion in relation to the other criteria is high
5	Very high importance	The importance presented by one criterion in relation to the other criteria is very high

Source: Own elaboration.

Step 2. A decision matrix ($m \times n$) is constructed that includes m alternatives and n criteria. Besides, a normalized decision matrix is calculated for the positive criteria as follows:

$$r_{ij} = \frac{X_{ij}}{X_j^{max}} \quad i = 1, \dots, m, \quad j = 1, \dots, n. \quad (5)$$

And for the negative criteria, the following decision matrix is calculated:

$$r_{ij} = \frac{X_j^{min}}{X_{ij}} \quad i = 1, \dots, m, \quad j = 1, \dots, n, \quad (6)$$

where r_{ij} is the normalized performance rating value, X_j^{max} is the maximum number of r in the column j , X_j^{min} is the minimum number of r in the column j , and X_{ij} is the attribute value owned by each criterion.

Step 3. Each A_i alternative is evaluated with the following formula:

$$A_i = \sum_{j=1}^n w_j r_{ij}, \quad (7)$$

where A_i is each alternative to evaluate, r_{ij} is the normalized performance rating value of the i^{th} alternative with respect to the j^{th} criteria, and w_j is the weighted criteria.

Finally, when all the evaluations for each alternative are calculated, the sum of all the alternatives is determined; using that information, it is possible to rank the different alternatives and decide which one is the best and which one is the worst.

4. MEASUREMENT OF THE COMPETITIVENESS IN THE TOURIST DESTINATIONS IN SINALOA WITH THE OWA OPERATOR AND THE SAW METHOD

4.1 Steps to measure the competitiveness of tourist destinations

Measuring competition between recreational sites is important because it improves tourism products through public policies that boost the quality of goods or services and recreation sites' conditions and, therefore, increase the sites' competitiveness. In addition, the attraction of tourists is also increased since the different destinations will

be able to satisfy the needs and preferences of their visitors through a greater tourism offer (Martínez et al., 2014). In this way, this study's main idea is to present a new dynamic way of assessing the competitiveness of tourist destinations.

The steps for analyzing the competitiveness of a tourist destination through the OWA operator and the SAW method are as follows:

Step 1. Determine the items that will be considered in the evaluation of tourist destinations.

Step 2. After determining the criteria and their indicators, it is important to indicate the alternatives that will be evaluated.

Step 3. Construct a table indicating the score of each item for each alternative.

Step 4. Having accomplished the above, apply the SAW method procedure as specified in section 3.3 of the current document.

Step 5. Determine the rankings using the SAW method.

The next two steps are used to determine the ranking with the OWA operator:

Step 6. Determine the weighting vector that will be used to incorporate each criterion in the result for each alternative.

Step 7. With that information, three different rankings are created: two based on the OWA operator with the maximum and minimum criteria, and one based on the weighted average (WA) operator.

Step 8. Finally, analyze the three different results.

4.2 Measuring the competitiveness of the tourist destinations of Sinaloa, Mexico

This paper presents a way to measure the competitiveness of tourist destinations in Sinaloa, Mexico. The main idea is to compare the results obtained based on the SAW method and the OWA operator ranking the most competitive tourist destinations based on four criteria that group 20 indicators. To accomplish this objective, the steps determined in section 3.1 are followed. The results for each step are as follows.

Step 1. The items that will be used to evaluate the tourist destinations are presented in Table 4.

TABLE 4. ITEMS CONSIDERED TO ASSESS THE COMPETITIVENESS OF TOURIST DESTINATIONS

ID	Items	CATEGOR Y
AFR	Attraction factors and resources	Criteria
AAT	Average annual temperature (centigrade)	Indicator
HOL	Holidays	Indicator
HOE	Hosting Establishments	Indicator
RES	Restaurants	Indicator
TRU	Transport units	Indicator
FSR	Factors and support resources	Criteria
DSS	Drainage and sewer systems	Indicator
IEP	Installed electrical power sockets	Indicator
RNL	Road network length (kilometers)	Indicator
AIR	Airports	Indicator
FTS	Fixed telephone subscriptions in service	Indicator
DEM	Destination management	Criteria
TAR	Travel agencies and reservation services	Indicator
TOG	Tour Guides	Indicator
TAM	Tourist Assistance Modules	Indicator
MTD	Municipal Tourism Departments	Indicator
PAM	Personnel assigned to municipal tourism departments	Indicator
DEF	Determining factors	Criteria
EPU	Electric power users	Indicator
AVD	Annual volume of drinking water supplied (cubic meters)	Indicator
NUC	Number of crimes	Indicator
TEA	Territorial area (square kilometers)	Indicator
MEU	Medical units	Indicator

Sources: Own elaboration.

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Step 2. The alternatives to be evaluated are the 18 municipalities in Sinaloa state (see Table 5).

Step 3. The score for each item for each alternative can be seen in Annex 1.

Step 4. To initiate the SAW method, the first step is to determine the weights that will be used. The opinions of three experts within the tourism sector using scale values ranging from 1 to 5 were obtained and Table 6 shows the generated matrix.

TABLE 5. TOURIST DESTINATIONS ALTERNATIVES IN SINALOA

Abbreviation	Alternative
A1	Ahome
A2	Angostura
A3	Badiraguato
A4	Choix
A5	Concordia
A6	Cosalá
A7	Culiacán
A8	El Fuerte
A9	Elota
A10	Escuinapa
A11	Guasave
A12	Mazatlán
A13	Mocorito
A14	Navolato
A15	Rosario
A16	Salvador Alvarado
A17	San Ignacio
A18	Sinaloa

Source: Own elaboration.

TABLE 6. WEIGHTS OF CRITERIA BY COMPARISON MATRIX

AFR	AAT	HOL	HOE	RES	TRU	SUM	WEIGHT
AAT	1.00	1.00	5.00	4.00	2.00	13.00	34.30%
HOL	1.00	1.00	5.00	1.00	2.00	10.00	26.39%
HOE	0.20	0.20	1.00	4.00	2.00	7.40	19.53%
RES	0.25	1.00	0.25	1.00	2.00	4.50	11.87%
TRU	0.50	0.50	0.50	0.50	1.00	3.00	7.92%
TOTAL						37.90	100%
FSR	DSS	IEP	RNL	AIR	FTS	SUM	WEIGHT
DSS	1.00	3.00	3.00	5.00	4.00	16.00	36.35%
IEP	0.33	1.00	4.00	5.00	5.00	15.33	34.84%
RNL	0.33	0.25	1.00	4.00	1.00	6.58	14.96%
AIR	0.20	0.20	0.25	1.00	1.00	2.65	6.02%
FTS	0.25	0.20	1.00	1.00	1.00	3.45	7.84%
TOTAL						44.02	100%
DEM	TAR	TOG	TAM	MTD	PAD	SUM	WEIGHT
TAR	1.00	1.00	3.00	2.00	2.00	9.00	28.13%
TOG	1.00	1.00	3.00	2.00	2.00	9.00	28.13%
TAM	0.33	0.33	1.00	3.00	2.00	6.67	20.83%
MTD	0.50	0.50	0.33	1.00	2.00	4.33	13.54%
PAM	0.50	0.50	0.50	1.00	1.00	3.00	9.38%
TOTAL						32.00	100%
DEF	EPU	AVD	NUC	TEA	MEU	SUM	WEIGHT
EPU	1.00	3.00	1.00	4.00	4.00	13.00	30.89%
AVD	0.33	1.00	1.00	4.00	4.00	10.33	24.55%
NUC	1.00	1.00	1.00	4.00	4.00	11.00	26.14%
TEA	0.25	0.25	0.25	1.00	4.00	5.75	13.66%
MEU	0.25	0.25	0.25	0.25	1.00	2.00	4.75%
TOTAL						42.08	100%

Source: Own elaboration.

Therefore, Table 6 indicates the relative importance of the columns' criteria compared to the criteria in the rows. Next, the second step is to build the decision matrix ($m \times n$) that includes m alternatives and n criteria. The above is achieved through formula 5 if the criteria are positive; for negative criteria, formula 6 is used. In this case study, formula 5 was used in most of the criteria; only in

criterion 6 was formula 6. The results are presented in Annex 2.

Following the SAW methodology detailed in section 3.3, the next step is to evaluate each alternative using formula 7. The results are presented in Annex 3. Based on that information, the results for each criterion are presented in Table 7.

TABLE 7 RESULTS FOR EACH CRITERION IN EACH ALTERNATIVE

Criteria	A1	A2	A3	A4	A5	A6	A7	A8	A9
AFR	0.62	0.5	0.52	0.49	0.54	0.46	0.87	0.54	0.47
FSR	0.52	0.27	0.04	0.06	0.09	0.13	0.98	0.16	0.16
DEM	0.45	0.07	0.07	0.07	0.07	0.28	0.72	0.35	0.28
DEF	0.51	0.1	0.26	0.32	0.16	0.33	0.7	0.18	0.12
Sum	2.1	0.94	0.89	0.94	0.86	1.2	3.27	1.23	1.03
Criteria	A10	A11	A12	A13	A14	A15	A16	A17	A18
AFR	0.53	0.5	0.9	0.42	0.46	0.55	0.47	0.46	0.42
FSR	0.05	0.49	0.49	0.08	0.28	0.08	0.1	0.1	0.19
DEM	0.1	0.15	0.88	0.28	0.13	0.29	0.1	0.28	0.08
DEF	0.09	0.26	0.41	0.13	0.12	0.12	0.08	0.2	0.29
Sum	0.77	1.4	2.68	0.91	0.99	1.04	0.75	1.04	0.98

Source: Own elaboration.

Step 5. With the information provided by table 7, the ranking of the alternatives is as follows:

$$A7 > A12 > A1 > A11 > A8 > A6 > A17 > A15 > A9 > A14 > A18 > A2 > A4 > A13 > A3 > A5 > A10 > A16$$

Step 6. In this step, the weighting vector, which determines the importance of each criterion to the results, is based on the three different experts' information and is unified based on an average. The results are as follows:

Criteria	Weight
AFR	31.4%
FSR	33.1%
DEM	16.0%
DEF	19.5%

Source: Own elaboration.

Step 7. With the information provided by the experts and presented in step 6, three different rankings are made using the WA operator and the OWA operator. The results are presented in Table 8, and the rankings are presented in Table 9.

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TABLE 8. RESULTS BASED ON WA AND OWA OPERATOR

Operators	Results								
	A1	A2	A3	A4	A5	A6	A7	A8	A9
WA	0.5383	0.2771	0.2384	0.2473	0.2418	0.2966	0.8493	0.3136	0.2687
	A10	A11	A12	A13	A14	A15	A16	A17	A18
	0.2165	0.3939	0.6655	0.2285	0.2813	0.2690	0.2123	0.2613	0.2641
OWA_{Max}	A1	A2	A3	A4	A5	A6	A7	A8	A9
	0.5400	0.2810	0.2738	0.2859	0.2577	0.3313	0.8500	0.3493	0.2939
	A10	A11	A12	A13	A14	A15	A16	A17	A18
OWA_{Min}	A1	A2	A3	A4	A5	A6	A7	A8	A9
	0.5097	0.1872	0.1691	0.1826	0.1690	0.2689	0.7842	0.2641	0.2198
	A10	A11	A12	A13	A14	A15	A16	A17	A18
	0.1491	0.3068	0.6052	0.1891	0.2087	0.2087	0.1526	0.2241	0.2099

Source: Own elaboration.

TABLE 9. RANKING BASED ON DIFFERENT OPERATORS

Operators	Ranking
WA	A7 > A12 > A1 > A11 > A8 > A6 > A14 > A2 > A15 > A9 > A18 > A17 > A4 > A5 > A3 > A13 > A10 > A16
OWA_{Max}	A7 > A12 > A1 > A11 > A8 > A6 > A15 > A17 > A9 > A4 > A14 > A2 > A18 > A3 > A13 > A5 > A10 > A16
OWA_{Min}	A7 > A12 > A1 > A11 > A6 > A8 > A17 > A9 > A18 > A14 > A15 > A13 > A2 > A4 > A3 > A5 > A16 > A10

Source: Own elaboration.

Step 8. The analysis of the results obtained in Table 8 and Step 5 using all the methods shows that the top 3 competitive tourism destinations are Culiacan, Mazatlán, and Ahome. It is possible to note is that there are important changes in the top 4 and top 13 results among the operators. For example, Cosala is number 6 according to SAW, WA and OWA_{Max} , but it is number 5 according to OWA_{Min} . Another example is Angostura, which is number 12 according to SAW but is 8th according to WA, 12th according to

OWA_{Max} and 13th according to OWA_{Min} . Similar to the case of Angostura, Rosario is number 8 according to SAW, 9th according to WA, 7th according to OWA_{Max} and 11th according to OWA_{Min} . As seen in these cases, it is possible to determine the changes in the tourist destinations' competitiveness according to the importance outlined by each criterion. In this way, when one criterion is more important than the others, the tourist destination can improve in that specific area to obtain a better result. In the example provided in this study, it is possible to see that according to the experts, destination management (DEM) is a criterion with low importance. For example, A8 has a medium value for DEM but a low value for FSR, which has a high importance (33.1%). In that sense, if the weight given to DEM increases, then the ranking of A8 will improve.

Finally, it is important to visualize how much the perspective of the decision maker can modify the competitiveness of a tourism destination because there are certain subjective values that each person gives to a tourism destination. With the use of different

aggregation operators such as the SAW and the OWA, it is possible to visualize how much the score of a destination will change according to the aptitudes and expectations of the tourist, organization, government or any other decision maker.

5. CONCLUSION

This article presents a ranking of the competitiveness of the tourist destinations in Sinaloa, Mexico. The research uses a multicriteria analysis tool and a fuzzy systems technique, which allows for supportive decision making. The methods used are the OWA operator and the SAW method, which make it possible to compare the different ranks of the competitiveness of the tourist destinations based on different weighting vectors that can be used in both methodologies; having a reordering step in the OWA operator allows the results obtained to have both a maximum and minimum result.

The application of the methodologies thus described was carried out on the specific case of Sinaloa, Mexico. This analysis demonstrated that with the OWA operator, it is possible to obtain different rankings based on each criterion's importance, instead of using only the SAW method, which obtains a unique rank. The main changes obtained were located in the middle section of the rankings; for example, while the top 3 tourist destinations in Sinaloa are consistently Culiacan, Mazatlan and Ahome, it is possible to note some interesting changes such as those seen in the cases of Angostura and Rosario in which their rank can vary by 5 positions depending on the operator. In this sense, it is possible to visualize the subjectivity of the evaluations. Thus, the use of these instruments can present an

important opportunity to visualize a specific scenario for different actors, such as the tourist destination itself, enterprises, decision-makers, tourists, investors, governments, and many more.

For future research, the use of more complex aggregation operators based on the OWA operator should be conducted, such as the heavy OWA (Leon-Castro *et al.*, 2018a; 2018b), the prioritized OWA (Perez-Arellano *et al.*, 2019), Bonferroni means (Blanco-Mesa *et al.*, 2019) and the logarithmic OWA (Alfaro-Garcia *et al.*, 2018). Additionally, a more complex analysis using information from different countries should be carried out.

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Martín León-Santiesteban was responsible for reviewing and editing the drafts of the document.

All authors contributed to the conceptual direction, the research design, and the robustness of the conceptions emerging from the data. Furthermore, all authors have read and accepted the published version of the manuscript.

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