

## **Section ECONOMICS**

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### **Economic Growth Assessment through Tourism Development Using the Type-2 Fuzzy Multi-Criteria Decision-Making Method**

#### **Abstract**

Tourism development plays a significant role in stimulating economic growth by promoting investment, job creation, and regional development. Assessing the impact of tourism on economic growth involves complex decision-making processes characterized by uncertainty, subjectivity, and imprecise expert judgments. To address these challenges, this study proposes a framework for evaluating the economic growth of tourism development using a Type-2 fuzzy set method. The proposed approach utilizes linguistic expert judgments and models the associated uncertainty using Type 2 fuzzy sets. This allows for a more realistic representation of ambiguities compared to traditional Type-1 fuzzy methods. Key tourism-related criteria, including infrastructure development, service quality, accessibility, investment intensity, and socioeconomic impacts, are systematically analyzed and weighed within the framework. The aggregation and defuzzification processes enable the prioritization of tourism development factors according to their contribution to economic growth. A case study serves to validate the applicability and effectiveness of the methodology. The results demonstrate that the Type-2 fuzzy logic approach yields more robust and reliable estimates, thereby supporting policymakers and stakeholders in developing effective tourism development strategies that promote sustainable economic growth in the face of uncertainty.

**Keywords:** Fuzzy Numbers, Type-2 Fuzzy Sets, Multi-Criteria Decision-Making, Economic Growth, Tourism Development

#### **Introduction**

Tourism has become one of the most influential sectors of the global economy, acting as a catalyst for economic growth, employment, foreign exchange earnings, and regional development. The expansion of tourism activities stimulates demand in various sectors, including transportation, accommodation, food services, construction, and culture. Consequently, tourism development is frequently integrated into national and regional economic strategies, particularly in developing and transition economies striving for sustainable growth pathways. The relationship between tourism

development and economic growth is neither linear nor uniform. The economic impact of tourism depends on a multitude of interdependent factors, such as infrastructure quality, accessibility, investment intensity, service standards, environmental sustainability, and social inclusion. These factors often interact in complex ways and are influenced by external conditions, including political frameworks, market volatility, and global uncertainty. Therefore, assessing tourism's contribution to economic growth requires a comprehensive and systematic evaluation framework capable of processing multidimensional and uncertain information. Traditional methods of economic evaluation rely heavily on quantitative indicators such as gross domestic product, employment rate, or tourism revenue. While these indicators are important, they are insufficient to assess qualitative aspects of tourism development, such as service quality, stakeholder satisfaction, institutional effectiveness, and sociocultural impact. Furthermore, many tourism-related evaluations are based on expert knowledge and subjective assessments, which are inherently imprecise and ambiguous. This limitation underscores the need for advanced decision-making methods that can effectively integrate quantitative and qualitative information. In recent years, multi-criteria decision-making (MCDM) methods have become widely adopted for addressing complex evaluation problems with numerous, often conflicting, criteria. Different studies applied to these topics.

Tourism is widely recognized as a key driver of economic growth, contributing to employment generation, foreign exchange earnings, and regional development (Balaguer & Cantavella-Jordá, 2010; Brida et al., 2014). The tourism-led growth hypothesis suggests that growth in tourism activity can stimulate broader economic performance through multiplier effects and intersectoral linkages (Balaguer & Cantavella-Jordá, 2010). Empirical studies indicate that tourism positively impacts macroeconomic indicators, although the magnitude of this effect varies depending on structural characteristics, investment levels, and policy environments (Tang & Jang, 2009). Traditional econometric approaches, such as input–output models and panel data analysis, provide important quantitative insights but often overlook qualitative dimensions such as service quality, governance effectiveness, and social inclusiveness (Brida et al., 2014; Garau & Pavan, 2018). Given the multi-faceted nature of tourism development, multi-criteria decision-making (MCDM) methods have become popular for assessing tourism performance, competitiveness, and policy alternatives (Chang, 1996; Chen, 2000; Kahraman et al., 2003). Methods such as the Analytic Hierarchy Process (AHP), Analytic Network Process (ANP), TOPSIS, and VIKOR allow systematic evaluation of multiple interrelated criteria. Among these, AHP developed by Saaty (1980) is widely used due to its structured pairwise comparison mechanism and ability to decompose complex problems hierarchically.

However, traditional AHP relies on precise numerical inputs, which may fail to capture the uncertainty and subjectivity inherent in expert-based assessments (Kahraman et al., 2003). To address the vagueness and imprecision of expert judgments, fuzzy logic has been integrated into MCDM methods (Zadeh, 1965). Fuzzy AHP and fuzzy TOPSIS enable the representation of linguistic variables and uncertain information, allowing decision-makers to evaluate qualitative and quantitative factors simultaneously (Chang, 1996; Chen, 2000; Kahraman et al., 2003). Fuzzy approaches have been applied to tourism destination selection, sustainability evaluation, service quality assessment, and investment prioritization (Garau & Pavan, 2018). Despite these advances, most tourism-related fuzzy studies employ type-1 fuzzy sets, which assume precise membership functions and may underestimate the higher-order uncertainty present in real-world decision-making (Dubois & Prade, 1980; Castillo & Melin, 2008). Type-2 fuzzy sets extend the conventional fuzzy framework by incorporating uncertainty directly into the membership functions, providing a more

flexible and realistic representation of ambiguous and inconsistent expert judgments (Mendel, 2001; Castillo & Melin, 2008; Mendel & John, 2002). Interval type-2 fuzzy sets, in particular, balance modeling power and computational feasibility, making them suitable for complex decision-making contexts (Mendel & John, 2002; Wang & Yu, 2015). Type-2 fuzzy MCDM methods have been successfully applied in engineering management, risk assessment, and strategic planning, demonstrating improved stability and robustness of results compared to type-1 fuzzy approaches (Mendel, 2001; Mendel & John, 2002; Kahraman et al., 2015). Although type-2 fuzzy decision-making has shown effectiveness in various fields, its application in tourism development and economic growth assessment remains limited. Most studies either rely on econometric methods or type-1 fuzzy frameworks, which may inadequately capture uncertainty in expert judgments (Kahraman et al., 2015; Wang & Yu, 2015).

This gap motivates the present study to develop a type-2 fuzzy MCDM framework for evaluating tourism development factors contributing to economic growth. By integrating linguistic assessments, uncertainty modeling, and robust prioritization, the proposed approach aims to support more reliable policy-making and strategic planning in tourism-driven economic development. Among these methods, fuzzy logic-based approaches have proven particularly effective in modeling the uncertainty and ambiguity inherent in human reasoning. While fuzzy type-1 approaches are popular, they require precise membership functions and can oversimplify the uncertainty introduced by experts. In contrast, fuzzy type-2 decision methods extend the traditional fuzzy framework by allowing for uncertainties within the membership functions themselves, thus enabling a more robust representation of linguistic estimates and expert opinions. The application of type-2 fuzzy methods is particularly relevant in the context of tourism-related decision-making, where data scarcity, subjective assessments, and a dynamic environment prevail. Given higher-order uncertainties, type-2 fuzzy models increase the reliability of evaluation results and reduce the risk of biased or inconsistent decisions. Despite these advantages, the application of type-2 fuzzy decision methods to estimate tourism-related economic growth remains limited in the existing literature, revealing a significant research gap. To address this gap, this study develops a framework for estimating economic growth through tourism development using type-2 fuzzy decision methods. The proposed framework systematically identifies and evaluates key tourism development criteria based on expert assessments in linguistic form. By using type-2 fuzzy sets, the methodology can effectively account for uncertainty, ambiguity, and variability in expert opinions. The resulting weights and rankings enable a structured evaluation of tourism development factors regarding their contribution to economic growth.

This study makes four contributions. First, it provides a comprehensive and flexible framework for evaluating tourism-related economic growth under uncertainty. Second, the study demonstrates the applicability and benefits of decision-making methods based on type-2 fuzzy sets for complex socioeconomic valuation problems. Third, it provides decision support for policymakers and stakeholders who wish to prioritize tourism development initiatives. Finally, the study contributes to the growing literature on advanced multi-criteria decision-making methods based on fuzzy sets in tourism economics.

## 1. Preliminaries

**Definition 1.** Mathematical models that combine linguistic variables with standard arithmetic operations form the basis of the algebra of fuzzy numbers. In many decision-making contexts, experts

express their assessments using imprecise terms like “approximately 0,” “close to 1,” or “around 10,” which correspond to fuzzy numbers. Among the different types, triangular fuzzy numbers are the most used in practical applications. A triangular fuzzy number graphical depiction is illustrated in Fig. 1.

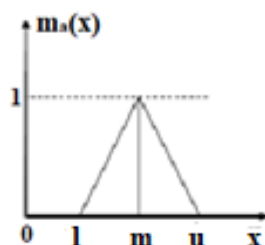


Fig. 1. Triangular type-1 fuzzy set

The membership function of a triangular fuzzy number (TFN) is usually defined in a piecewise linear form. Let a triangular fuzzy number be denoted as

$$\tilde{A} = (l, m, u) \tag{1}$$

where,  $l$  is the lower bound (minimum value),  $m$  is the modal value (most likely),  $u$  is the upper bound (maximum value). The membership function  $\mu_{\tilde{A}}(x)$  is defined as:

$$\mu_{\tilde{A}}(x) = \begin{cases} 0, & x < l \\ \frac{x-l}{m-l}, & l \leq x \leq m \\ \frac{u-x}{u-m}, & m \leq x \leq u \\ 0, & x > u \end{cases} \tag{2}$$

For  $x < l$  or  $x > u$ , the membership is 0 (outside the range). Between  $l$  and  $m$ , membership increases linearly from 0 to 1. Between  $m$  and  $u$ , membership decreases linearly from 1 to 0.

Definition 1. A type-1 fuzzy set  $A$  within the universe  $X$  is defined by a membership function and can be represented as follows [17]:

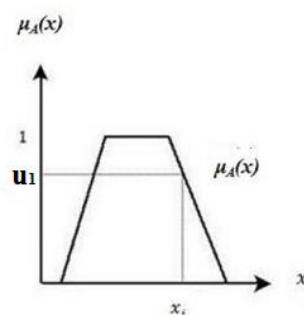


Figure 1. Trapezoidal type-1 fuzzy set

$$A = \{(x, \mu_A(x)) \mid \forall x \in X, \mu_A(x) \in [0,1]\}$$

**Definition 2.** A type 2 fuzzy set  $\tilde{A}$  is characterized by a fuzzy membership function  $\mu_{\tilde{A}}(x,u)$  in the universe  $X$  where  $x \in X$  and  $u \in J_x, J_x \subseteq [0,1]$  is shown as follows [17]:

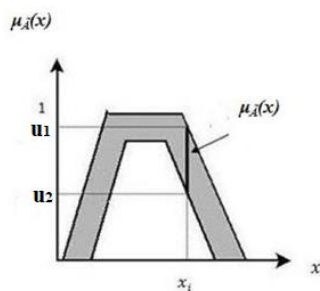


Figure 2. Trapezoidal type-2 fuzzy set

$$\tilde{A} = \{(x, u, \mu_{\tilde{A}}(x, u)) \mid \forall x \in X, u \in [0, 1]\}$$

**Definition 3.** Suppose that  $\tilde{A} = \sum_i \mu_{\tilde{A}}(x_i) / x_i$  and  $\tilde{B} = \sum_j \mu_{\tilde{B}}(x_j) / x_j$  are fuzzy sets included in the set X. According to Zadeh’s extension principle [18]

$$\tilde{A} * \tilde{B} = \left( \sum_i \mu_{\tilde{A}}(x_i) / x_i \right) * \left( \sum_j \mu_{\tilde{B}}(x_j) / x_j \right) = \sum_{i,j} (\mu_{\tilde{A}}(x_i) \wedge \mu_{\tilde{B}}(x_j)) / (x_i * x_j) \quad (3)$$

The extension principle enables the generalization of the classical function  $f$  from a set  $X$  to a fuzzy set  $A$  on  $X$ . For each element  $x$  in  $A$ , the degree of membership in the fuzzy set  $f(A)$  is defined by applying the function  $f$  to the degree of membership of  $x$  in  $A$ .

$$\mu_{f(A)}(y) = \sup_{x \in X, f(x)=y} \mu_A(x) \quad (4)$$

This means the membership function of the fuzzy set  $f(A)$  at  $y$  is maximum membership degree of all elements  $x$  in  $A$  such that  $f(x) = y$ . The Extension Principle also applies to set operations. The union of two fuzzy sets  $A$  and  $B$  is given below.

$$\mu_{A \cup B}(x) = \max(\mu_A(x), \mu_B(x)) \quad (5)$$

The **intersection** is given below.

$$\mu_{A \cap B}(x) = \min(\mu_A(x), \mu_B(x)) \quad (6)$$

The **complement** of a fuzzy set is given below.

$$\mu_{\sim A}(x) = 1 - \mu_A(x) \quad (7)$$

**Definition 4.** If  $\mu_{\tilde{A}}(x)$  and  $\mu_{\tilde{B}}(x)$  are membership degrees of type-2 fuzzy sets  $\tilde{A}$  and  $\tilde{B}$  of the fuzzy set  $J \in [0, 1]$ , then

$$\mu_{\tilde{A}}(x) = f(u_1) / u_1 + f(u_2) / u_2 + \dots + f(u_n) / u_n = \sum_i f(u_i) / u_i, \quad u_i \in J \quad (8)$$

$$\mu_{\tilde{B}}(x) = g(w_1) / w_1 + g(w_2) / w_2 + \dots + g(w_m) / w_m = \sum_j g(w_j) / w_j, \quad w_j \in J \quad (9)$$

where  $f$  and  $g$  are membership functions.

**Definition 5.** The union and intersection of type-2 fuzzy sets are defined as below [18]:

$$\begin{aligned} \tilde{A} \cup \tilde{B} &\Leftrightarrow \mu_{\tilde{A} \cup \tilde{B}}(x) = \mu_{\tilde{A}}(x) \cup \mu_{\tilde{B}}(x) = \left( \sum_i f(u_i) / u_i \right) \cup \left( \sum_j g(w_j) / w_j \right) = \\ &= \sum_{i,j} (f(u_i) \vee g(w_j)) / (u_i \vee w_j) \end{aligned} \quad (10)$$

$$\begin{aligned} \tilde{A} \cap \tilde{B} &\Leftrightarrow \mu_{\tilde{A} \cap \tilde{B}}(x) = \mu_{\tilde{A}}(x) \cap \mu_{\tilde{B}}(x) = \left( \sum_i f(u_i) / u_i \right) \cap \left( \sum_j g(w_j) / w_j \right) = \\ &= \sum_{i,j} (f(u_i) \wedge g(w_j)) / (u_i \wedge w_j) \end{aligned} \quad (11)$$

### 3. Case Study Example: Economic Growth Assessment through Tourism Development

The assessment is based on expert opinions from academia, tourism management, and economic planning. In this study, the problem is formulated as a multi-criteria decision-making problem in which several tourism development alternatives are evaluated based on a set of relevant criteria. Let  $A = \{A_1, A_2, \dots, A_m\}$  denote the set of tourism development alternatives. In this research, four alternatives are considered:  $A_1$  - Urban Tourism Development,  $A_2$  - Eco-Tourism Development,  $A_3$  - Cultural and Heritage Tourism Development,  $A_4$  - Adventure Tourism Development. These alternatives represent different strategic directions that governments and stakeholders may adopt to enhance tourism activity and stimulate economic growth. The alternatives are evaluated according to a set of criteria  $C = \{C_1, C_2, \dots, C_n\}$  that reflect the main factors influencing tourism-related economic development. Based on an extensive literature review and expert consultation, the tourism development criteria influencing economic growth are grouped into the following main categories:  $C_1$  - Tourism Infrastructure (transportation, accommodation capacity, facilities),  $C_2$  - Investment and Financial Support (public and private investment, incentives),  $C_3$  - Service Quality and Human Resources (staff skills, service standards),  $C_4$  - Accessibility and Connectivity (transport access, digital connectivity). These criteria reflect both quantitative and qualitative aspects of tourism development and are suitable for evaluation using a fuzzy-based decision-making approach.

The objective of the problem is to determine the most suitable tourism development alternative that maximizes economic growth by considering the relative importance of these criteria. Since expert evaluations of criteria importance and alternative performance are often expressed using linguistic assessments such as “high,” “medium,” or “low,” uncertainty and ambiguity arise in the decision-making process. To effectively handle this uncertainty, the present study employs a multi-criteria decision-making framework based on Type-2 fuzzy sets. Type-2 fuzzy sets provide a more flexible and accurate representation of linguistic judgments by capturing higher-order uncertainty associated with expert opinions. The experts provide pairwise comparisons of the criteria using predefined linguistic terms. Each linguistic term is represented by an Interval Type-2 fuzzy number to capture uncertainty and variability in expert judgments. The assessments from each expert are combined through suitable Type-2 fuzzy aggregation operators to form the final fuzzy pairwise comparison matrices.

**Table 1.** Linguistic terms modeled using Type-2 fuzzy set values

Linguistic terms	Linguistic values of type-2 fuzzy sets for linguistic terms	
	First-order membership function	Second-order membership function
Extremal Low	(0.1,0.2,0.3;0.3)	(0.15,0.25,0.35;0.35)
Very Low	(0.2,0.3,0.4;0.4)	(0.25,0.35,0.45;0.45)
Medium	(0.3,0.4,0.5;0.5)	(0.35,0.45,0.55;0.55)
High	(0.4,0.5,0.6;0.6)	(0.45,0.55,0.65;0.65)
Very High	(0.5,0.6,0.7;0.7)	(0.55,0.65,0.75;0.75)
Extremal High	(0.6,0.7,0.8;0.8)	(0.65,0.75,0.85;0.85)

Within this framework, experts provide pairwise comparisons and performance evaluations for the alternatives with respect to the defined criteria. These evaluations are represented using Type-2 fuzzy numbers and processed through the decision-making model to calculate criteria weights and determine the overall ranking scores of the alternatives. The alternative with the highest-ranking score is considered the most appropriate tourism development strategy for promoting economic growth. The fuzzy values of the alternatives and the weights of the criteria are determined as in Table 2.

**Table 2.** Fuzzy values of alternatives and weights of criteria

	$C_1$	$C_2$	$C_3$	$C_4$
$w_j$	(0.2,0.3,0.4,0.4; 0.25,35,0.45;0.45)	(0.4,0.5,0.6,0.6;0.5 5,0.65,0.75;0.75)	(0.3,0.4,0.5,0.5;0. 55,0.65,0.75;0.75)	(0.5,0.6,0.7,0.7; 0.55,0.65,0.75,0.75)
$A_1$	(0.2,0.3,0.4,0.4; 0.25,35,0.45;0.45)	(0.4,0.5,0.6,0.6;0.5 5,0.65,0.75;0.75)	(0.3,0.4,0.5,0.5;0. 55,0.65,0.75;0.75)	(0.5,0.6,0.7,0.7;0.55, 0.65,0.75,0.75)
$A_2$	(0.6,0.7,0.8,0.8; 0.7,0.8,0.9,0.9)	(0.2,0.3,0.4,0.4; 0.25,35,0.45;0.45)	(0.5,0.6,0.7,0.7;0. 55,0.65,0.75,0.75)	(0.3,0.4,0.5,0.5;0.55, 0.65,0.75;0.75)
$A_3$	(0.3,0.4,0.5,0.5;0.5 5,0.65,0.75;0.75)	(0.4,0.5,0.6,0.6;0.5 5,0.65,0.75;0.75)	(0.6,0.7,0.8,0.8; 0.7,0.8,0.9,0.9)	(0.5,0.6,0.7,0.7; 0.55,0.65,0.75,0.75)
$A_4$	(0.5,0.6,0.7,0.7;0.5 5,0.65,0.75,0.75)	(0.6,0.7,0.8,0.8; 0.7,0.8,0.9,0.9)	(0.3,0.4,0.5,0.5;0. 55,0.65,0.75;0.75)	(0.4,0.5,0.6,0.6;0.55, 0.65,0.75;0.75)

The crisp weights  $w_j$  for the criteria  $C_j (j=1,2,3,4)$  were calculated by applying formula (12), which consolidates the aggregated fuzzy evaluations into precise numerical values, thereby quantifying the relative importance of each criterion in the decision-making process.

$$R(C_i) = \frac{1}{2} \left\{ \frac{1}{3} \frac{c_i^3 (b_i - a_i) + c_i (b_i^3 - a_i^3) - a_i b_i (b_i^2 - a_i^2)}{c_i^2 (b_i - a_i) + c_i (b_i^2 - a_i^2) - a_i b_i (b_i - a_i)} + \frac{b_i (a_i + 2b_i + c_i)}{2} \right\} \quad (12)$$

The weights of the criteria are normalized using formula (13), ensuring that the sum of all criteria weights equals one. This normalization process converts the calculated weights into comparable proportions, allowing for a consistent and balanced assessment of each criterion's relative importance in the overall decision-making framework.

$$w_j = \frac{R(w_j)}{\sum_{j=1}^n R(w_j)} \quad (13)$$

So, the crisp weight  $R(C_1)$  for the criterion  $C_1$  is determined as shown below, providing a precise numerical representation of its relative importance within the set of criteria considered in the decision-making process.

$$R(C_1) = \frac{1}{2} \left\{ \frac{1}{3} \frac{0.3^3 (0.4 - 0.2) + 0.3 (0.4^3 - 0.2^3) - 0.2 \times 0.4 (0.4^2 - 0.2^2)}{0.3^2 (0.4 - 0.2) + 0.3 (0.4^2 - 0.2^2) - 0.2 \times 0.4 (0.4 - 0.2)} + \frac{0.4 (0.25 + 2 \times 0.45 + 0.35)}{2} \right\} = 0.20$$

Similarly, calculations are carried out for the remaining criteria, applying the same procedure to determine their respective crisp weights. This ensures that all criteria are quantitatively evaluated,

allowing for a comprehensive and consistent comparison of their relative importance in the decision-making process.

$$R(C_2) = 0.50, \quad R(C_3) = 0.40, \quad R(C_4) = 0.54$$

$$\sum R(w_j) = 0.20 + 0.50 + 0.40 + 0.54 = 1.64$$

The weight of each criterion is calculated as follows, providing a precise quantification of its relative importance. This calculation allows for a systematic and consistent evaluation of all criteria, ensuring that their contributions to the overall decision-making process are properly balanced and comparable

$$w_1 = \frac{0.20}{1.64} = 0.12, \quad w_2 = \frac{0.50}{1.64} = 0.30, \quad w_3 = \frac{0.40}{1.64} = 0.25, \quad w_4 = \frac{0.54}{1.64} = 0.33$$

The ranking weights for the alternatives  $A_i$  ( $i = 1, 2, 3, 4$ ) are determined using formula (14), which aggregates the evaluated criteria weights and their respective performance scores.

$$R_{w_j}(A_i) = \sum_{j=1}^n w_j R(S_{ij}) \quad (14)$$

This calculation provides a quantitative basis for ranking the alternatives, allowing decision-makers to identify the most preferred options in a systematic and consistent manner.

$$R_w(A_{11}^L) = 0.11, \quad R_w(A_{11}^U) = 0.13; \quad R_w(A_{12}^L) = 0.45, \quad R_w(A_{12}^U) = 0.6;$$

$$R_w(A_{13}^L) = 0.3, \quad R_w(A_{13}^U) = 0.5; \quad R_w(A_{14}^L) = 0.6, \quad R_w(A_{14}^U) = 0.64$$

$$Rank(A_1^L) = \frac{1}{n(n-1)} \times \left( \sum P(A_1^L) + \frac{n}{2} - 1 \right) = \frac{1}{12} (1.45 + 1) = 0.21$$

$$Rank(A_1^U) = \frac{1}{n(n-1)} \times \left( \sum P(A_1^U) + \frac{n}{2} - 1 \right) = 0.24$$

$$Rank(A_1) = \frac{Rank(A_1^L) + Rank(A_1^U)}{2} = \frac{0.21 + 0.24}{2} = 0.225$$

We also apply these calculations to the other alternatives, following the same systematic procedure. This ensures that all alternatives are evaluated consistently across all criteria, allowing for a comprehensive comparison and enabling the identification of the most favorable option based on their aggregated ranking weights

$$Rank(A_2) = \frac{Rank(A_2^L) + Rank(A_2^U)}{2} = \frac{0.20 + 0.23}{2} = 0.215$$

$$Rank(A_3) = \frac{Rank(A_3^L) + Rank(A_3^U)}{2} = \frac{0.23 + 0.26}{2} = 0.245$$

$$Rank(A_4) = \frac{Rank(A_4^L) + Rank(A_4^U)}{2} = \frac{0.23 + 0.26}{2} = 0.24$$

Finally, all alternatives are ranked based on their calculated  $R_{w_j}(A_i)$  values, and the alternative with the highest  $R_{w_j}(A_i)$  is identified as the most favorable choice. This ranking reflects a comprehensive assessment of all criteria and ensures that the decision-making process selects the option with the greatest overall suitability and preference.

$$Rank(A_1) = 0.225, \quad Rank(A_2) = 0.215, \quad Rank(A_3) = 0.245, \quad Rank(A_4) = 0.24$$

$$A_3 > A_4 > A_1 > A_2$$

Based on the calculated ranking values, it is determined that the most favorable alternative is  $A_3$ , while the least preferred alternative is  $A_2$ . This result reflects the comprehensive evaluation of all criteria and demonstrates the effectiveness of the applied decision-making methodology in distinguishing between the alternatives according to their overall performance.

## **Conclusion**

This study introduces a comprehensive framework for assessing the economic impact of tourism development by employing a multi-criteria decision-making (MCDM) approach grounded in Type-2 fuzzy sets. Tourism development is a complex phenomenon influenced by a variety of interrelated economic, social, and infrastructural factors, whose evaluation is often hindered by uncertainty, subjectivity, and imprecise expert judgments. To effectively address these challenges, the proposed methodology leverages Type-2 fuzzy sets, which capture higher-order uncertainties and provide a more nuanced and realistic representation of linguistic assessments compared to conventional Type-1 fuzzy approaches. The framework systematically identifies, quantifies, and evaluates the critical criteria that drive tourism development and contribute to economic growth. By integrating expert knowledge within a structured decision-making process, the model generates robust weights and rankings for each tourism development factor, allowing for reliable prioritization. The results highlight that tourism infrastructure, socioeconomic impacts, and investment intensity are the primary drivers of economic growth, while factors such as service quality and accessibility also have substantial effects. These findings underscore the advantages of incorporating Type-2 fuzzy sets into MCDM, as they enhance the reliability, consistency, and stability of assessment outcomes under conditions of uncertainty. The proposed model offers valuable insights for policymakers and tourism stakeholders, enabling data-driven decisions and strategic planning for sustainable economic growth. The study has certain limitations. The analysis relies on expert opinions, which may introduce variability depending on the selected experts or regional context. Future research could expand the model by integrating dynamic datasets, hybrid Type-2 fuzzy approaches, or comparative evaluations with alternative decision-making methods. Additionally, applying the framework across diverse countries, tourism segments, or development scenarios would further validate its adaptability and generalizability. It makes a significant contribution by bridging tourism economics with advanced fuzzy decision-making techniques, offering a practical, reliable, and systematic tool for evaluating tourism-driven economic growth in environments characterized by uncertainty and imprecision.

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