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An Integrated Approach with CLFPR-Based ANP and Fuzzy TOPSIS for Evaluating Business Performance of Rural Homestays: Study from China

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Abstract: Given the high importance of the performance of rural homestays to the local economy, this study aims to fill the gap in homestay performance research and make rural homestays more competitive and sustainable after the coronavirus disease epidemic (COVID-19). Integrating a consistent linguistic fuzzy preference relations-based analytic network process (CLFPR-based ANP) and a fuzzy technique for order performance by similarity to ideal solution (TOPSIS), this study constructs a comprehensive evaluation model of the performance of rural homestays and empirically analyzes homestay performance in Zhejiang. The results show the following: (1) Among the criteria's weights by CLFPR-based ANP, homestay operation and management, service quality, and homestay geist and community co-prosperity should be given much more attention; the importance of factors regarding the environment and building of rural homestays is gradually weakening. (2) In light of ranking alternatives based on performance evaluation by fuzzy TOPSIS, the homestay with the optimal performance has been found, which practitioners can use as a benchmark. Therefore, the priorities of these criteria further deepen the understanding of the performance of rural homestays and underline the development direction for practitioners. Simultaneously, in terms of feasibility and reliability, the integrated approach comprises a beneficial attempt and becomes an effective evaluation tool for practitioners to improve effectiveness.

Keywords: rural homestay; performance evaluation; CLFPR-based ANP; fuzzy TOPSIS; MCDM

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1. Introduction

Community-based tourism (CBT) is broadly conceived as an effective alternative and sustainable tourism solution [1], and it is always promoted as a way of developing communities, especially in rural areas with inadequate facilities and services. Therefore, CBT plays a vital role in poverty alleviation, because it contributes to community development, supporting community sustainability [2]. In other words, CBT initiatives have been expected to sustainably direct community development. Moreover, accommodation services through community homestays are regarded as the major component of CBT products [3].

Tourism businesses are divided into simple and complex activities. The former includes businesses that provide only one type of tourism product (accommodation), and the latter is composed of such enterprises that provide more than one type of tourism product (accommodation with catering or other activities) [4]. As an attractive, sustainable rural tourism product [5], homestay belongs to the former. Small accommodation businesses offer few bedrooms and beds, have few employees, use minimal capital [6], and have low efficiency [7]. However, these businesses dominate the rural hospitality industry, producing simple or complex tourist products and services in order to be sustainable and competitive [8]. They play an important role in rural revitalization, poverty diminution, and employment, and they also improve the economic decline in rural areas [9]. Consequently, the sustainability of small accommodation businesses in rural areas affects the region's development [8]. Moreover, because a causal relationship exists between economic performance and sustainability in the short term and long term for all low and high firms [10], rural homestay's performance is highly important for local, regional, and national economies [11].

Given that most tourism and hospitality businesses are considered micro-, small-, and medium-sized enterprises (MSMEs) [12], there are characteristics that render them vulnerable to the negative impacts of external shocks and limit their ability to respond to crises [13]. The COVID-19 pandemic has significantly influenced many sectors of the global economy [14] and brought the deepest historical crisis to the world tourism sector [15]. Hotels, airlines, cruise ships, and tourist operators have suffered an unprecedented number of cancellations and a large volume of economic losses [16]. Moreover, owing to various restrictions on epidemic prevention in many countries, the flow of tourists in the Asia Pacific region has decreased by 96% [17]. Therefore, although businesses with limited resources and small profit margins, such as homestay businesses, face more difficulties in recovering [18], small- and medium-sized enterprises are also a key to recovery from economic crises [19].

Through a systematic review of rural homestay literature worldwide in 2010–2021 by CiteSpace, Qiu and Lin (2022) found that although the topics, methods, and contents of the research in rural homestays tend to be consistent, a difference exists in research focuses [20]. Rural homestay research focuses mainly on four directions: industrial development research, stakeholder research, product and market research, and space construction research. Furthermore, the overall development trend of rural homestays is shifting from the macro market and development environment to improving and upgrading the homestay itself. Consequently, combined with the current economic situation, improving performance and promoting sustainable development have become the main directions of rural homestays.

To contribute to the study gap, this study attempts to reveal the priorities of performance criteria and their influence on the performance of rural homestay businesses using a consistent linguistic fuzzy preference relation-based analytic network process (CLFPR-based ANP) and a fuzzy technique for order performance by similarity to ideal solution (TOPSIS). Specifically, this study intends to answer the research questions (RQ) below:

RQ 1. What are the priorities of these criteria in the performance evaluation of the rural homestay business?

RQ 2. What measures could be implemented for post-pandemic recovery according to the priorities of performance criteria?

RQ 3. What effect do performance criteria have on the performance of rural homestay businesses?

The structure of the paper is organized as follows. Section 2 elaborates on the extant literature on performance evaluations of rural homestay business and multi-criteria decision making (MCDM). Section 3 formulates the study design, especially detailing the study methods. Section 4 explains the application of the proposed method. Section 5 conducts the discussion. Section 6 concludes with limitations and suggestions.

2. Literature Review

2.1. Performance of Homestays

The success or failure of a business's performance usually refers to survival, which represents a simplified view of success [21]. Moreover, small business success is very much linked to small business performance [22]. However, separating the concept of success from performance is difficult, mainly because success can be defined in terms of a certain element of performance [23]. As a result, a similar explanation defines success as a specific aspect of performance [22]. Additionally, the homestays' actual performance is still vague because of the lack of research in Malaysia, which can qualify homestays as tools for sustainable development [24]. The same situation also emerges in other areas.

From the angle of the systematic and holistic performance of homestay operation, some scholars chiefly concentrate on the construction of a performance system of homestay business. Chou (2022) developed an objective and systematic evaluation model for homestay selection in Taiwan by fuzzy multiple-criteria decision-making (FMCDM) methods [25]. Given the selection of optimal homestay from the alternatives, the system approximates the performance evaluation system. Peng et al. (2022) established a performance evaluation framework that combined the prior research results with an expert interview through MCDM techniques in China. A total of five aspects and 31 criteria of the performance evaluation framework involved financial and non-financial criteria [26]. Thanvisitthpon (2021) built a performance system by a statistical analysis of Thailand's sustainable homestay business, incorporating six dimensions and 31 indicators [27]. A conceptual framework of homestay tourism entrepreneurs' success was developed by Devadas and Jayasooriya (2019) [28] on the basis of qualitative grounded theory. The performance system was designed by Hu et al. (2012) in Taiwan; it contains five aspects of the surroundings of the building and the features of service quality, homestay facilities, homestay operation and management, and homestay geist and community co-prosperity [29]. However, a significant flaw in these performance systems is that financial criteria are not included, aside from that in Peng et al. (2022) [26].

From the perspective of the systematic evaluation of homestay performance, business performance evaluations of homestays have not received much attention from scholars. Hu et al. (2012) applied the analytic network process (ANP) with fuzzy theory to evaluate the performance of homestays in Taiwan and revealed that overall, homestay performance has reached a satisfactory level by customer groups. However, the subjective criteria of homestay performance dominated the research, and financial criteria were largely ignored. Similarly, performance has usually been measured from a financial perspective, and efficiency is one of the most frequently applied measures. Peng et al. (2022) studied the business efficiency of homestays in Hangzhou by a three-stage data envelopment analysis (DEA) model. They found that the whole industry is still non-DEA effective, which is due to the low efficiency of the industry's pure technical efficiency and scale efficiency [30]. Dimitriadou et al., (2021) applied a two-stage DEA model to examine the efficiency of small accommodation businesses in non-coastal areas in Greece. They concluded that small accommodation businesses with abundant tourism resources are inefficient, an evaluation that is influenced by business size, operating days, and variety of activities (simple/complex) [8]. However, the focus of efficiency measurement is on financial criteria.

In addition to these, some studies have also highlighted the interrelationships among relevant variables and homestay performance. Supian et al. (2022) found that environmental factors and market orientation interactively impact the homestay performance relationship by a Partial Least Square Structural Equation Modeling (PLS-SEM) approach [31]. Applying correlation and regression analysis, Tang et al. (2022) investigated the relationship between customer integration, information sharing, and supply chain performance in China's community-based homestays [32]. Dawayana et al. (2021) investigated the ways in which homestay capabilities can improve the performance of homestays based on the Resource-Based View (RBV) theory [33]. Pham et al. (2021) clarified the relationship between green performance of homestays and customer loyalty with the mediating role of relationship quality and found that the higher tourists perceive the homestay's green performance to be, the tighter the relationship quality they have towards the homestays, which in turns stimulates their loyalty behavior [34]. Phunnarong (2021) declared that the success of homestays depends on good homestay management and arrangement, the arrangement of learning activities, and a reasonable price for tourism and homestay services [35]. Yong and Hassan (2019) examined the relation between social media marketing and entrepreneurial success by a quantitative approach and asserted that entrepreneurial success can be enhanced through the use of social media marketing in homestay businesses [36]. Yong (2019) found that community participation imposes a positive relationship on entrepreneurial success in the homestay business by structural equation modeling (SEM) [37]. Sawatsuk et al. (2018) revealed that the utmost crucial success factors are the sincere intention and perseverance of the head of the village to improve the quality of life of the people [38]. Ismail et al. (2016) stated that homestay providers should focus on customers' needs and requirements [39]. Kayat et al. (2016) pointed out that homestay operators perceive leadership as a more predominant factor than community support in ensuring the performance of their homestays [40]. Ramli et al. (2015) noted that leadership enhancement and improving ability as well as capacity can improve homestay business performance [41]. However, these studies only explore the impact of variables on homestay performance, but they cannot effectively evaluate or even compare homestay performance.

To sum up, studies on the business performance of rural homestays are relatively scant, especially systematic and holistic studies. Performance measurement can demonstrate the difference between the past and the present and lay a foundation for subsequent management [42]. Therefore, this study focus deserves much more attention.

2.2. MCDM Techniques

As a powerful technique for decision making, MCDM usually assists in obtaining the best choice for a complex decision-making situation. In addition, fuzzy theory involving subjective judgments from an expert panel and enhancing the precision of the decision-making process has been integrated into MCDM. Furthermore, MCDM methods are used in performance measurement, and the results obtained can be used to rank, choose, and classify alternatives [43]. Thus, MCDM is an alternative method employed in performance evaluation [44]. Meanwhile, the tourism and hospitality industries successfully use multi-criteria analysis for managerial decision making [45].

By comparison with the Analytic Hierarchy Process (AHP), ANP considers the internal relationships among criteria through a network structure [46]. Nevertheless, the number of judgments in a pairwise comparison matrix relies on the number of criteria, that is, the number of comparisons increases as the number of criteria and the relationships between criteria increase. A consistency concern arises if the number of criteria goes beyond three [47]. Consequently, the experts' judgments will most likely be inconsistent. Therefore, Herrera-Viedma et al. (2004) proposed the consistent fuzzy preference relation (CFPR) method, which utilizes an additive transitivity property to establish pairwise comparison preference decision matrices [48]. Simultaneously, it greatly reduces the heavy burden of calculation by pairwise comparisons and skips the consistency verification. Moreover, the consistent linguistic fuzzy preference relation (CLFPR) constructs fuzzy preference relation matrices using fuzzy linguistic assessment variables $\widetilde{\alpha} = \widetilde{\alpha^{k}_{ij}} = (\alpha^{L}_{ij},\ \alpha^{M}_{ij},\ \alpha^{R}_{ij})$ in a triangular fuzzy number [49].

TOPSIS is one of the most commonly applied methods to solve multi-attribute decision-making (MADM) problems [50]. TOPSIS is often taken to obtain performance scores for each candidate, as it ranks alternatives based on the shortest distance from the positive ideal solution (PIS) and the farthest distance from the negative ideal solution (NIS) [51]. Then, Chen (2000) proposed a method to combine TOPSIS with fuzzy theory [52]. Fuzzy TOPSIS is applied to ranking alternatives as an accommodating positive factor that maximizes the benefits and a negative factor that minimizes the benefits of all alternatives, making the evaluation more realistic [53]. Consequently, as TOPSIS represents rational human choice and offers simple calculations [54], among many methods, TOPSIS is used extensively in different research areas [55]. The third important domain of TOPSIS applications is business and marketing management, which covers organizational performance, financial measurement, investment projects, customer satisfaction, and competitive advantages [56].

Given the interdependent criteria, this study applies CLFPR-based ANP to generate the weights for the selection criteria and fuzzy TOPSIS to rank the alternatives.

3. Method and Materials

3.1. Research Design

In a nutshell, the study contains three main phases: (1) selecting an optimal homestay performance evaluation system, (2) calculating the weights of each criterion by CLFPR-based ANP, and (3) filtering out the optimal homestay among the alternatives from a performance perspective by fuzzy TOPSIS.

3.2. The Evaluation System

One of the most important steps in performance evaluation is the establishment of indicators [57]. To judge whether sustainability positively or negatively impacts firm performance, financial and non-financial performance should be measured over the long run [58]. As a result, considering the systematic and holistic performance of homestay operations, this study adopts the homestay performance evaluation framework constructed by Peng et al. (2022) [26], as shown in Table 1.

Table 1. Evaluation framework of homestay business performance.

Aspect	Criterion
Surroundings of the building and features (A)	Utilizing plenty of natural light (A1) Using non-toxic paint (A2) Maintaining the land's vitality and good condition in the process of design and construction (A3) Incorporating the local heritage and landscape elements into design (A4) Beautification and uniqueness of the interior design (A5) Greenization and uniqueness of the garden design (A6) Room themes and features (A7) Homestay features (A8) Overall ambience forming (A9)
Service quality (B)	Service attitude (B1) Information service (B2) Catering service and quality (B3) Room tidiness (B4) Room coziness (B5) Room privacy (B6) Safety (B7) Overall tidiness and hygiene (B8)
Homestay facilities (C)	Parking space (C1) Safety facilities (C2) Room settings (C3)
Homestay operation and management (D)	Overnight visitors (D1) Operating income (D2) Actual room nights rented (D3) Room occupancy rate (D4) Average room price (D5) Internet-based operation capability (D6)
Homestay geist and community co-prosperity (E)	Degree of interaction between hosts and lodgers (E1) Arranging local experiential activities and food (E2) Contribution to the living quality of local community (E3) Initiating preserving actions toward local resources (E4) Promoting and preserving local cultural resources (E5)

3.3. Integrated Approach

The composition of the integrated approach is as follows:

3.3.1. CLFPR-Based ANP

The sequences for ANP are as follows: (1) establishing a decision-making model framework, (2) pairing a comparison matrix and calculating eigenvectors, and (3) forming a supermatrix [59,60].

For a set of criteria and a set of alternatives, preference relations enable experts to give values, which represent degrees of preference between criteria or alternatives. Commonly used preference relations include multiplicative and fuzzy preference relations [61].

Multiplicative preference relations: a multiplicative preference relationship based on a set of values about X attributes is represented by a matrix A: $A \subset X * X$, $A = (a_{ij})$, where a_{ij} is the preference value of the paired comparison of attribute x_i to x_j. Saaty (1980) suggested that a_ij should be measured on a scale of 1 to 9 [62]. Thus, a_{ij} = 1 means that there is indifference between x_i and x_j, and $a_{ij} = 9$ indicates that x_i is maximally more important than x_j. When a_{ij} and a_{ji} are reciprocal to each other and multiplied by 1, it becomes a multiplicative preference relation [62]; that is, $a_{ij} * a_{ji} = 1,\ \forall i,\ j \in \{1,\ \ldots,\ n\}$.

Fuzzy preference relations: a fuzzy preference value matrix P on a set of X attributes is a fuzzy set on the product set $X * X$ with the membership function as $\mu_p:\ X * X \to [0,\ 1]$. The preference relation is represented by the $n * n$ matrix $P = (p_{ij})$, where $p_{ij} = \mu_p(x_i,\ x_j)$, $\forall i,\ j \in \{1,\ \ldots,\ n\}$. Herein, p_{ij} is the preference value of paired comparison about the x_i and x_j. If $p_{ij} = \frac{1}{2}$ means that no difference exists between x_i and x_j, $p_{ij} = 1$ means x_i is better than x_j, $p_{ij} = 0$ means x_j is definitely better than x_i, and $p_{ij} > \frac{1}{2}$ means x_i is relatively better than x_j. Notably, if the sum of p_{ij} and p_{ji} in the preference matrix P is equal to 1, it becomes a fuzzy preference relationship [63]; that is, $p_{ij} + p_{ji} = 1,\ \forall i,\ j \in \{1,\ \ldots,\ n\}$.

To solve the inconsistency in the traditional decision matrices, Herrera-Viedma et al. (2004) proposed consistent fuzzy preference relations to construct the decision matrices of pairwise comparisons based on additive transitivity. Some important propositions about CFPR are given below:

Proposition 1. *Suppose a set of alternatives $X = \{x_1,\ x_2,\ \ldots,\ x_n,\ n \geq 2\}$ that is related to a reciprocal multiplicative preference relationship $A = (a_{ij})$ for $a_{ij} \in \left[\frac{1}{9},\ 9\right]$. Then, the corresponding reciprocal fuzzy preference relationship $= (p_{ij})$ with $p_{ij} \in [0,\ 1]$; associated with A, it is given as $P = g(A)$. A formula for converting multiplicative preference relations into fuzzy preference relations is shown in Equation (1):*

$$p_{ij} = g(a_{ij}) = \frac{1}{2}(1 + \log_9 a_{ij}) \tag{1}$$

where, if $a_{ij} \in \left[\frac{1}{n},\ n\right]$, $\log_n a_{ij}$ is used.

Proposition 2. *According to a reciprocal fuzzy preference relation, $P = (p_{ij})$, the following statements are equivalent:*

$$p_{ij} + p_{jk} + p_{ki} = \frac{3}{2},\ \forall i,\ j,\ k \tag{2}$$

$$p_{ij} + p_{jk} + p_{ki} = \frac{3}{2},\ \forall i < j < k \tag{3}$$

$$p_{i(i+1)} + p_{(i+1)(i+2)} + \ldots + p_{(j-1)j} + p_{ji} = \frac{j-i+1}{2},\ \forall i < j \tag{4}$$

The formula can be deduced as follows:

$$p_{ji} = \frac{j-i+1}{2} - p_{i(i+1)} - p_{(i+1)(i+2)} - \ldots - p_{(j-1)j} \tag{5}$$

N-1 preference comparison values $\{a_{12},\ a_{23},\ \ldots,\ a_{(n-1)n}\}$ with attribute $X = \{x_1,\ x_2,\ \ldots,\ x_n,\ n \geq 2\}$ can be converted by Equation (3) into n-1 preference relation *values* $\{p_{12}, p_{23}, \ldots, p_{(n-1)n}\}$*, and further fuzzy preference relationship values of the other elements in the decision matrix are obtained by Equations (4) and (5):*

$$B = \{p_{ij}, i < j \wedge p_{ij} \notin \{p_{12}, p_{23}, \ldots, p_{(n-1)n}\}\}$$

However, not all elements in the decision matrix are on [0, 1] but will be in the interval $f : [-c, 1+c]$*. Thus, a transformation function is needed to obtain a consistent complementary fuzzy preference relation* P', $P' = f(P)$ *and maintain its complementarity and consistency.*

$$f(x) = \frac{x+c}{1+2c} \tag{6}$$

Among them, $a = |min\{B \cup \{p_{12}, p_{23}, \ldots, p_{(n-1)n}\}\}|$*. From the above Equation (6), the consistent fuzzy preference relationship* P' *can be obtained.*

Therefore, this study employs additive transitivity in the consistent linguistic fuzzy preference relations (CLFPR). The calculation process includes the following steps:

Step 1: Constructing fuzzy judgment matrix A^k

The fuzzy judgment matrix A^k is a pairwise comparison matrix among each criterion and alternative. Linguistic terms can often represent fuzzy judgments, and many methods are used for converting linguistic terms into fuzzy numbers. For example, Wang and Chen (2008) used the fuzzy number between $[\widetilde{9^{-1}}, \widetilde{9}]$ and its corresponding linguistic variable as the importance of each criterion in the decision maker's rating in the fuzzy preference relation method [64]. However, the evaluation scale can also be established by the evaluators themselves. Given that subjective differences exist exactly in the division of linguistic variables for each evaluator, the utilization of the established fuzzy number scale can easily confine the evaluator's judgment and cannot truly reflect the evaluator's subjective judgment. The study establishes the evaluation scale by evaluators.

Assume that the criteria are X_1, X_2, $X_3 \ldots X_n$, pairwise comparisons are made for n criteria in sequence, and n-1 preference values need to be compared. The "×" in the matrix means that no preference information is required. Suppose α^k refers to the preference value of the k^{th} decision maker for the pairwise comparison of X_i and X_j. Vague information can be represented by linguistic variables, where $\widetilde{\alpha_{ij}^k} = (\alpha_{ij}^L, \alpha_{ij}^M, \alpha_{ij}^R)$, α_{ij}^L is the left number of the triangular fuzzy linguistic preference relation value, α_{ij}^M is the middle number, and α_{ij}^R is the right number. Thus, fuzzy judgment matrix $\widetilde{A^k} = \widetilde{(\alpha_{ij}^k)}_{n*n}$ is shown below:

$$\widetilde{A^k} = \begin{bmatrix} 1,1,1 & a_{12}^L, a_{12}^M, a_{12}^R & \times & \times & \ldots & \times \\ \times & 1,1,1 & a_{23}^L, a_{23}^M, a_{23}^R & \times & \ldots & \times \\ \times & \times & 1,1,1 & a_{34}^L, a_{34}^M, a_{34}^R & \ldots & \times \\ \ldots & \ldots & \ldots & \ldots & \ldots & a_{(n-1)n}^L, a_{(n-1)n}^M, a_{(n-1)n}^R \\ \times & \times & \times & \times & \ldots & 1,1,1 \end{bmatrix}$$

Step 2: Converting to fuzzy preference relation matrix $\widetilde{p_{ij}^k}$

According to Equation (1), the fuzzy preference relation matrix $\widetilde{(p_{ij}^k)}_{n*n}$ (k = 1, 2, 3, 4, …, m) is obtained by converting $\widetilde{\alpha_{ij}^k}$ into p_{ij}^k, where $\widetilde{p_{ij}^k} = \left(p_{ij}^L, p_{ij}^M, p_{ij}^R\right)$, p_{ij}^L is the left number of the triangular fuzzy linguistic preference relations, p_{ij}^M is the middle number, and p_{ij}^R is the right number.

$$\widetilde{A^k} \Rightarrow \widetilde{P^k}$$

$$= \begin{bmatrix} 0.5, 0.5, 0.5 & p_{12}^L, p_{12}^M, p_{12}^R & \times & \times & \cdots & \times \\ 1-p_{12}^L, 1-p_{ij}^M, 1-p_{12}^R & 0.5, 0.5, 0.5 & p_{23}^L, p_{23}^M, p_{23}^R & \times & \cdots & \times \\ \times & 1-p_{23}^R, 1-p_{23}^M, 1-p_{23}^L & 0.5, 0.5, 0.5 & p_{34}^L, p_{34}^M, p_{34}^R & \cdots & \times \\ \cdots & \cdots & \cdots & \cdots & \cdots & p_{(n-1)n}^L, p_{(n-1)n}^M, p_{(n-1)n}^R \\ \times & \times & \times & \times & \cdots & 0.5, 0.5, 0.5 \end{bmatrix}$$

Each $\widetilde{p_{ij}^k}$ value represented by "×" in the judgment matrix can be calculated by Equations (7)–(10) to obtain a complete fuzzy linguistic preference relation matrix.

$$\mathrm{p}_{\mathrm{ij}}^{\mathrm{L}} + \mathrm{p}_{\mathrm{ji}}^{\mathrm{R}} = 1,\ \mathrm{p}_{\mathrm{ij}}^{\mathrm{M}} + \mathrm{p}_{\mathrm{ji}}^{\mathrm{M}} = 1,\ \mathrm{p}_{\mathrm{ij}}^{\mathrm{R}} + \mathrm{p}_{\mathrm{ji}}^{\mathrm{L}} = 1,\ \forall \mathrm{i},\ \mathrm{j} \in \{1,\ \ldots,\ \mathrm{n}) \tag{7}$$

$$\mathrm{p}_{\mathrm{ji}}^{\mathrm{L}} = \frac{\mathrm{j}-\mathrm{i}+1}{2} - \mathrm{p}_{\mathrm{i(i+1)}}^{\mathrm{R}} - \mathrm{p}_{\mathrm{(i+1)(i+2)}}^{\mathrm{R}} \cdots - \mathrm{p}_{\mathrm{j(j-i)}}^{\mathrm{R}} \tag{8}$$

$$\mathrm{p}_{\mathrm{ji}}^{\mathrm{M}} = \frac{\mathrm{j}-\mathrm{i}+1}{2} - \mathrm{p}_{\mathrm{i(i+1)}}^{\mathrm{M}} - \mathrm{p}_{\mathrm{(i+1)(i+2)}}^{\mathrm{M}} \cdots - \mathrm{p}_{\mathrm{j(j-i)}}^{\mathrm{M}} \tag{9}$$

$$\mathrm{p}_{\mathrm{ji}}^{\mathrm{R}} = \frac{\mathrm{j}-\mathrm{i}+1}{2} - \mathrm{p}_{\mathrm{i(i+1)}}^{\mathrm{L}} - \mathrm{p}_{\mathrm{(i+1)(i+2)}}^{\mathrm{L}} \cdots - \mathrm{p}_{\mathrm{j(j-i)}}^{\mathrm{L}} \tag{10}$$

Through the following conversion Equations (11)–(13), each fuzzy preference relation value is clustered between the interval [0, 1], where c is the minimum e of the triangular fuzzy preference relationship value in the fuzzy preference relation matrix to maintain the additive reciprocal consistency in the method.

$$\mathrm{f}(\mathrm{x}^{\mathrm{L}}) = \frac{\mathrm{x}^{\mathrm{L}} + \mathrm{c}}{1 + 2\mathrm{c}}, \tag{11}$$

$$\mathrm{f}(\mathrm{x}^{\mathrm{M}}) = \frac{\mathrm{x}^{\mathrm{M}} + \mathrm{c}}{1 + 2\mathrm{c}},\ \mathrm{c} \in [-\mathrm{c},\ 1+\mathrm{c}] \tag{12}$$

$$\mathrm{f}(\mathrm{x}^{\mathrm{R}}) = \frac{\mathrm{x}^{\mathrm{R}} + \mathrm{c}}{1 + 2\mathrm{c}},\ \mathrm{c} \in [-\mathrm{c},\ 1+\mathrm{c}] \tag{13}$$

Step 3: Calculating the weight of the fuzzy preference relation

In calculating the fuzzy relative weight of each criterion of group decision, the arithmetic average is widely used to integrate evaluators' opinions [65]. This study adopts the arithmetic average to obtain the relative weight of the fuzzy preference relation. Equation (14) integrates the fuzzy preference relation values of m evaluators, and Equation (15) obtains the average of $\widetilde{\mathrm{p}}_{\mathrm{i}}$, that is, the average value of the fuzzy preference relation of the ith criterion.

$$\overline{\widetilde{\mathrm{p}}}_{\mathrm{i}} = \frac{\sum_{\mathrm{k}=1}^{\mathrm{m}} \overline{\widetilde{\mathrm{p}}_{\mathrm{ij}}^{\mathrm{k}}}}{\mathrm{m}},\ \forall \mathrm{i},\ \mathrm{j} \tag{14}$$

$$\overline{\widetilde{\mathrm{p}}}_{\mathrm{i}} = \frac{\sum_{\mathrm{i}=1}^{\mathrm{n}} \overline{\widetilde{\mathrm{P}}_{\mathrm{ij}}}}{\mathrm{n}}, \tag{15}$$

Then, the fuzzy preference relation weight $\widetilde{\mathrm{W}}_{\mathrm{i}}$ of the ith criterion is calculated by Equation (16), and the fuzzy preference relation weight is defuzzified by Equation (17).

$$\widetilde{\mathrm{W}}_{\mathrm{i}} = \frac{\overline{\widetilde{\mathrm{p}}}_{\mathrm{i}}}{\sum_{\mathrm{i}}^{\mathrm{n}} \overline{\widetilde{\mathrm{p}}}_{\mathrm{i}}} \tag{16}$$

$$\mathrm{W}_{\mathrm{i}} = \frac{1}{3}\left(\mathrm{w}_{\mathrm{i}}^{\mathrm{L}},\ \mathrm{w}_{\mathrm{i}}^{\mathrm{M}},\ \mathrm{w}_{\mathrm{i}}^{\mathrm{R}}\right) \tag{17}$$

Step 4: Synthesizing weight to construct weighted matrix

In the matrix, $\mathrm{w_{ij}}$ represents the $\mathrm{n_i * n_j}$ weight matrix of the criteria, and $\mathrm{w_{in_i}^{jn_j}}$ represents the defuzzification value obtained by the fuzzy preference relation. Moreover, w_i is the criteria weight calculated by the fuzzy preference relation without the interaction. Finally, the weight W_i under the influence of the factor interaction is multiplication of $\mathrm{w_{in_i}^{jn_j}}$ and w_i, as shown in Equation (18):

$$w_{\mathrm{ij}} = \begin{bmatrix} \mathrm{w_{i1}^{j1}} & \mathrm{w_{i1}^{j2}} & \cdots & \mathrm{w_{i1}^{jn_j}} \\ \mathrm{w_{i2}^{j1}} & \mathrm{w_{i2}^{j2}} & \cdots & \mathrm{w_{i2}^{jn_j}} \\ \mathrm{w_{i3}^{j1}} & \mathrm{w_{i3}^{j2}} & \cdots & \mathrm{w_{i3}^{jn_j}} \\ \vdots & \vdots & \ddots & \vdots \\ \mathrm{w_{in_i}^{j1}} & \mathrm{w_{in_i}^{j2}} & \cdots & \mathrm{w_{in_i}^{jn_j}} \end{bmatrix}$$
$$w_i = \begin{bmatrix} w_{i1} \\ w_{i2} \\ w_{i3} \\ \vdots \\ w_{in} \end{bmatrix}$$
$$W_i = w_{ij} * w_i \tag{18}$$

Step 5: Obtaining the weight of each criterion

The weight W_i is normalized by the following Equation (19) to obtain the weight $\mathrm{W}'_i = (\beta'_1, \beta'_2, \ldots, \beta'_n)$, where

$$\beta'_i = \frac{\beta_i}{\sum_i^n \beta_i}, \ i = 1, 2, \ldots, n \tag{19}$$

The weight W'_i consists of the supermatrix according to the proper position. Thus, the weighted supermatrix can be multiplied by the limiting power until each row has converged to a constant value, each row number being the criterion's weight.

3.3.2. Fuzzy TOPSIS

The procedure consists of the following steps:

Step 1: Establishing a normalized fuzzy evaluation matrix

The experts score the performance of all alternatives on each criterion by semantic variables, wherein m alternatives $(\mathrm{A}_i, i = 1, \ldots, \mathrm{m})$ and n criteria $\left(\mathrm{C}_j, j = 1, \ldots, \mathrm{n}\right)$. When the evaluation of all alternatives by the experts is completed, all scores for the criteria of the alternatives are integrated by the geometric mean. Thus, the following fuzzy evaluation matrix is obtained:

$$\widetilde{X} = (x_{ij}) = \begin{bmatrix} \widetilde{x_{11}} & \widetilde{x_{12}} & \cdots & \widetilde{x_{1n}} \\ \widetilde{x_{21}} & \widetilde{x_{22}} & \cdots & \widetilde{x_{2n}} \\ \vdots & & \ddots & \vdots \\ \widetilde{x_{m1}} & \widetilde{x_{m2}} & \cdots & \widetilde{x_{mn}} \end{bmatrix} \quad \forall i, j$$

where $\widetilde{x_{ij}} = \left(a_{ij}, b_{ij}, c_{ij}\right)$ is a triangular fuzzy number, which represents the fuzzy evaluation value of the ith alternative on the jth criterion. As a result, the normalized fuzzy performance matrix defines as $\widetilde{R} = \left[\widetilde{r_{ij}}\right]_{m*n}$ according to Equations (20) and (21).

$$\widetilde{r_{ij}} = \left(\frac{a_{ij}}{c_j^+}, \frac{b_{ij}}{c_j^+}, \frac{c_{ij}}{c_j^+}\right), j \in B \tag{20}$$

$$\widetilde{r_{ij}} = \left(\frac{c_j^-}{c_{ij}}, \frac{c_j^-}{b_{ij}}, \frac{c_j^-}{a_{ij}}\right), j \in C \tag{21}$$

$$c_j^+ = \max_i c_{ij} \; if \; j \in B$$
$$c_j^- = \min_i c_{ij} \; if \; j \in C$$

Among them, B and C represent the set of benefit criteria and the set of cost criteria, respectively, and $\widetilde{r_{ij}} \in [0,\ 1]$.

Step 2: Constructing weighted normalized fuzzy evaluation matrix

$$\widetilde{V} = \left[\widetilde{v_{ij}}\right]_{\mathrm{m*n}},\ i = 1,\ 2,\ \ldots,\ \mathrm{m},\ j = 1,\ 2,\ \ldots,\ \mathrm{n},$$

where

$$\widetilde{v_{ij}} = \widetilde{r_{ij}} \times \widetilde{W_j} \tag{22}$$

and $\widetilde{v_{ij}} \in [0,\ 1]$, $\widetilde{W_j}$ is the fuzzy weight value of the jth criterion.

Step 3: Determining fuzzy positive and negative ideal solutions

The fuzzy positive ideal solution A^+ and the fuzzy negative ideal solution A^- can be defined as

$$A^+ = \left(\widetilde{v_1^+},\ \widetilde{v_2^+},\ \ldots,\ \widetilde{v_n^+}\right) = \left(\widetilde{1},\ \widetilde{1},\ \ldots,\ \widetilde{1}\right)$$
$$A^- = \left(\widetilde{v_1^-},\ \widetilde{v_2^-},\ \ldots,\ \widetilde{v_n^-}\right) = \left(\widetilde{0},\ \widetilde{0},\ \ldots,\ \widetilde{0}\right)$$

where $\widetilde{v_j^+} = \max\{\widetilde{v_{ij}}\}$, $\widetilde{v_j^-} = \min\{\widetilde{v_{ij}}\}$.

Step 4: Calculating the distances between each alternative and the positive and negative ideal solutions

$$d_i^+ = \sum_{j=1}^{n} d\left(\widetilde{v_{ij}^+},\ \widetilde{v_j^+}\right),\ i = 1,\ 2,\ \ldots,\ m \tag{23}$$

$$d_i^- = \sum_{j=1}^{n} d\left(\widetilde{v_{ij}^-},\ \widetilde{v_j^-}\right),\ i = 1,\ 2,\ \ldots,\ m \tag{24}$$

where d represents the distance between two fuzzy numbers. Assume that the two triangular fuzzy numbers are $\widetilde{\mathrm{A}} = (\mathrm{a}_1,\ \mathrm{a}_2,\ \mathrm{a}_3)$, $\widetilde{\mathrm{B}} = (\mathrm{b}_1,\ \mathrm{b}_2,\ \mathrm{b}_3)$; then, the distance between them is calculated by Equation (25) as follows:

$$\mathrm{d}\widetilde{A},\ \widetilde{B} = \sqrt{\left[(a_1 - b_1)^2 + (a_2 - b_2)^2 + (a_3 - b_3)^2\right]/3} \tag{25}$$

Step 5: Calculating the closeness coefficient (CC) of the alternative $\mathrm{A_i}$

$$CC_i = \frac{d_i^-}{d_i^+ + d_i^-},\ \ i = 1,\ 2,\ \ldots,\ m \tag{26}$$

Step 6: Determining the optimal about ranking of the alternatives

All alternatives are ranked according to the closeness coefficient. The alternative with the largest closeness coefficient is the ideal alternative.

4. Empirical Analysis

4.1. Interrelationship and Measurement Scale

Through the extensive and in-depth discussion from the expert panel, the interrelationship among aspects and criteria needs to be constructed in advance according to the dependence and self-feedback among aspects and criteria about homestay business performance, as illustrated in Appendix A Table A1.

On the evaluation scale to measure importance, ANP traditionally utilizes a nine-point evaluation scale. Saaty (1980) concluded that the basic scale of human judgment is a five-point scale [62]. He et al. (1995) found that the weight difference generated by a nine-point scale and a five-point scale does not exist significantly when studying the transformation feasibility of the two scales [66]. Thus, this study adopts the five fuzzy linguistic variables defined by Hu and Xiao (2012) [67], which are "equally important," "slightly important," "important," "extremely important," and "absolutely important." As the evaluation scale of a comparison among aspects and criteria, the five fuzzy linguistic variables respectively correspond to five triangular fuzzy numbers, that is, (1, 1, 1), (1, a, b), (a, b, c), (b, c, 9), (c, 9, 9). The values of a, b, and c influence the value range of the fuzzy numbers for the evaluation scale of "slightly important," "important," "extremely important," and "absolutely important." Moreover, different respondents have different subjective evaluations of the importance of pairwise comparison. Consequently, the values of a, b, and c must be determined by respondents. Meanwhile, the study's consistent fuzzy preference relationship leads to the interval [0.5, 1] as the range of preference value. Thus, by the conversion equation $y = 0.005x + 0.5$, the evaluation level of x filled by the respondents between [0, 100] can be converted into an evaluation level of y between [0.5, 1].

By averaging the three values of x assigned by four respondents, the comprehensive values of the dividing point are 27.5, 52.5, and 77.5, respectively. Furthermore, by the conversion equation, the values of a, b, and c are, in turn, calculated as 0.64, 0.76, and 0.89. Therefore, the fuzzy numbers corresponding to the evaluation scale are shown in Table 2.

Table 2. Fuzzy numbers of judgment scale about ANP.

Linguistic Variable	Code	Fuzzy Number
Equally important	M	0.5, 0.5, 0.5
Slightly important	FH	0.5, 0.64, 0.76
Important	H	0.64, 0.76, 0.89
Extremely important	VH	0.76, 0.89, 1
Absolutely important	AH	0.89, 1, 1

4.2. Weight Analysis by CLFPR-Based ANP

A pairwise comparison matrix was constructed according to the relationships among aspects and criteria about homestay performance and fuzzy numbers of the evaluation scale. Taking the matrix of aspects as an example, the solution process of aspects' weights is shown below.

G	A	B	C	D	E
A	0.5, 0.5, 0.5	0.5, 0.5, 0.5			
B		0.5, 0.5, 0.5	0.76, 0.89, 1		
C			0.5, 0.5, 0.5		
D			0.89, 1, 1	0.5, 0.5, 0.5	0.64, 0.76, 0.89
E					0.5, 0.5, 0.5

Further calculation is obtained according to Equation (7),

G	A	B	C	D	E
A	0.5, 0.5, 0.5	0.5, 0.5, 0.5			
B	0.5, 0.5, 0.5	0.5, 0.5, 0.5	0.76, 0.89, 1		
C		0,0.11,0.24	0.5, 0.5, 0.5	0, 0, 0.11	
D			0.89, 1, 1	0.5, 0.5, 0.5	0.64, 0.76, 0.89
E				0.11, 0.24, 0.36	0.5, 0.5, 0.5

$\widetilde{p_{31}}$ is calculated according to Equations (8)–(9),

$$\widetilde{p_{31}} = (p_{31}^{l},\ p_{31}^{m} p_{31}^{u}) = (1.5 - p_{12}^{u} - p_{23}^{u},\ 1.5 - p_{12}^{m} - p_{23,}^{m}\ 1.5 - p_{12}^{l} - p_{23}^{l})$$
$$= (1.5 - 0.5 - 1, 1.5 - 0.89 - 0.5, 1.5 - 0.75 - 0.5) = (0, 0.11, 0.24)$$

Thus, $\widetilde{p_{42}} = (0.39,\ 0.61,\ 0.74)$, $\widetilde{p_{53}} = (0.5,\ 0.74,\ 0.86)$, $\widetilde{p_{41}} = (0.39,\ 0.61,\ 0.74)$, $\widetilde{p_{51}} = (0,\ 0.35,\ 0.6)$, $\widetilde{p_{52}} = (0,\ 0.35,\ 0.6)$. Similarly, $\widetilde{p_{13}}$, $\widetilde{p_{14}}$, $\widetilde{p_{15}}$, $\widetilde{p_{24}}$, $\widetilde{p_{25}}$, $\widetilde{p_{35}}$ can be calculated in the same way. Table 3 demonstrates the fuzzy preference relationship matrix of aspects.

Table 3. Fuzzy preference relationship matrix of aspects.

G	A	B	C	D	E
A	0.5, 0.5, 0.5	0.5, 0.5, 0.5	0.76, 0.89, 1	0.26, 0.39, 0.61	0.4, 0.65, 1
B	0.5, 0.5, 0.5	0.5, 0.5, 0.5	0.76, 0.89, 1	0.26, 0.39, 061	0.4, 0.65, 1
C	0, 0.11, 0.24	0, 0.11, 0.24	0.5, 0.5, 0.5	0, 0, 0.11	0.24, 0.36, 0.5
D	0.39, 0.61, 0.74	0.39, 0.61, 0.74	0.89, 1, 1	0.5, 0.5, 0.5	0.64, 0.76, 0.89
E	0, 0.35, 0.6	0, 0.35, 0.6	0.5, 0.74, 0.86	0.11, 0.24, 0.36	0.5, 0.5, 0.5

Finally, according to Equations (13)–(16), the relative weight vectors of the aspects under the target were obtained as (0.24, 0.24, 0.09, 0.27, 0.17).

When the four respondents completed the evaluation of the criteria, all evaluations were integrated by the geometric mean method. Then, on the basis of the fuzzy preference relationship matrix of the criteria, the relative weight vectors of the criteria under non-interactive influence were calculated, that is, an unweighted matrix as shown in Appendix A Table A1. As a consequence, the weight vectors of each criterion under the interactive influence were obtained by multiplying the relative weight vectors of each criterion under the non-interactive influence and the relative weight vectors of each aspect, and the weight vectors of each criterion were arranged in sequence to construct the weighted supermatrix of criteria as shown in Appendix A Table A2.

Finally, the weighted supermatrix is multiplied until the number in each column is equal, indicating that all columns in the matrix have the same vector, and each row converges on a constant value to obtain the stable probability. At this point, this matrix is a limiting supermatrix (Saaty, 1996). Hence, in the limiting supermatrix, the number in each column corresponds to the weight of each criterion. As shown in Appendix A Table A3, the performance criteria's weights of homestay were as follows: A1 (0.001), A2 (0.006), A3 (0.001), A4 (0.008), A5 (0.008), A6 (0.003), A7 (0.030), A8 (0.042), A9 (0.035), B1 (0.123), B2 (0.013), B3 (0.006), B4 (0.018), B5 (0.026), B6 (0.010), B7 (0.014), B8 (0.038), C1 (0.000), C2 (0.011), C3 (0.048), D1 (0.071), D2 (0.070), D3 (0.044), D4 (0.055), D5 (0.039), D6 (0.051), E1 (0.099), E2 (0.007), E3 (0.060), E4 (0.035), and E5 (0.029). Service attitude (B1, 0.123), degree of interaction between hosts and lodgers (E1, 0.099), overnight tourists (D1, 0.071), operating income (D2, 0.070), and contribution to the living quality of local community (E3, 0.060) ranked as the top five criteria. The bottom five criteria included parking space (C1, 0.000), utilizing plenty of natural light (A1, 0.001), maintaining the land's vitality and good condition in the process of design and construction (A3, 0.001), greenization and uniqueness of the garden design (A6, 0.003), catering service and quality (B3, 0.006), and using non-toxic paint (A2, 0.006).

With that, according to the weight sum of the criteria under each aspect, the ranking of five aspects was: homestay operation and management (D; 0.329), service quality (B; 0.248), homestay geist and community co-prosperity (E; 0.229), surroundings of the building and features (A; 0.135), and homestay facilities (C; 0.059).

4.3. Alternative Ranking by Fuzzy TOPSIS

The study applied five fuzzy linguistic variables as the evaluation scale for performance evaluation criteria of the alternative (homestay), which are "very low," "low," "medium," "high," and "very high." However, due to the influence of subjective assessment, each respondent in practice defines the evaluation interval of linguistic variables differently. Thus, the fuzzy linguistic values of the evaluation scale of criterion were set by the respondent. First, each linguistic variable constructs a set through the values given by all respondents, ranging from 1 to 10. Second, the triangular fuzzy number can be set as a linguistic variable according to Equation (27):

$$L_k = (l_k,\ m_k,\ u_k) \tag{27}$$

where L_k is the triangular fuzzy number of the Kth linguistic variable, l_k is the minimum in the set of evaluation values given by respondents, that is, the left bound of triangular fuzzy numbers, m_k is the geometric mean in a certain evaluation value set given by respondents, whose membership degree equals to 1, and u_k is the maximum in a set of evaluation values given by respondents, namely, the right bound of the triangular fuzzy number. Therefore, five respondents gave clear values for the five-level evaluation scales in the interval of [1, 10], and the triangular fuzzy numbers of the five linguistic variables were calculated as shown in Table 4.

Table 4. Triangular fuzzy number of five linguistic scale.

Linguistic Variable	Code	Triangular Fuzzy Number
Very low	VL	1.00, 1.31, 2.00
Low	L	2.00, 3.31, 4.00
Medium	M	4.00, 5.04, 6.00
High	H	6.00, 6.87, 8.00
Very high	VH	8.00, 9.14, 10.00

Five respondents were asked to evaluate the performance indicators of the alternatives. Given that Zhejiang has been becoming a benchmarking area for homestay development in China [26], five rural homestays from various regions in Zhejiang were chosen, including Moganshan, Qiandaohu, Xiangshan, Wenling, and Songyang. These rural homestays have been in operation for more than 5 years and have received higher online reviews from tourists on third-party platforms.

By the geometric mean method to integrate the evaluation of each indicator from respondents, the fuzzy evaluation values of each indicator about different alternatives constituted the fuzzy evaluation matrix of the indicators. Then, the fuzzy evaluation matrix of the indicators was normalized using Equations (20) and (21). Furthermore, the weighted normalized fuzzy evaluation matrix of the alternative was obtained by multiplying the normalized fuzzy evaluation matrix of the indicator by the weights of corresponding indicators. Subsequently, the positive and negative ideal solutions for each indicator were calculated by defuzzifying the weighted normalized fuzzy evaluation matrix. The distances between each indicator and the positive and negative ideal solutions were calculated using Equations (22)–(24), resulting in the distance matrix shown in Table 5.

According to the above results, the distances of the alternative on the positive and negative ideal solutions, as well as the closeness coefficient of each alternative, were calculated using Equation (26), as shown in Table 6.

Table 5. Distance matrix of the indicator and the positive/negative ideal solution.

Distance	MS1		MS2		MS3		MS4		MS5	
Indicator	D^+	D^-	D^+	D^-	D^+	D^-	D^+	D^-	D^+	D^-
A1	0.00016	0.000082	0.00021	0.000034	0.00000	0.000241	0.00024	0.000000	0.00001	0.000235
A2	0.00107	0.000772	0.00136	0.000459	0.00000	0.001815	0.00182	0.000000	0.00012	0.001701
A3	0.00018	0.000151	0.00033	0.000000	0.00000	0.000330	0.00027	0.000065	0.00002	0.000311
A4	0.00172	0.000640	0.00191	0.000416	0.00000	0.002325	0.00233	0.000000	0.00050	0.001831
A5	0.00218	0.000000	0.00190	0.000349	0.00089	0.001314	0.00069	0.001497	0.00000	0.002184
A6	0.00027	0.000545	0.00080	0.000000	0.00012	0.000678	0.00014	0.000657	0.00000	0.000802
A7	0.00685	0.001219	0.00754	0.000000	0.00000	0.007538	0.00180	0.005745	0.00212	0.005441
A8	0.01031	0.000000	0.00463	0.005783	0.00107	0.009322	0.00000	0.010305	0.00000	0.010305
A9	0.00122	0.007980	0.00893	0.000000	0.00292	0.006010	0.00000	0.008926	0.00201	0.006924
B1	0.02256	0.000000	0.01019	0.012592	0.01019	0.012592	0.00000	0.022563	0.00000	0.022563
B2	0.00215	0.000415	0.00219	0.000000	0.00000	0.002189	0.00011	0.002097	0.00151	0.000706
B3	0.00080	0.000465	0.00123	0.000000	0.00102	0.000217	0.00000	0.001234	0.00033	0.000901
B4	0.00323	0.001313	0.00446	0.000000	0.00219	0.002276	0.00000	0.004465	0.00000	0.004465
B5	0.00239	0.002159	0.00438	0.000000	0.00000	0.004380	0.00022	0.004196	0.00165	0.002747
B6	0.00297	0.000269	0.00301	0.000000	0.00085	0.002162	0.00000	0.003009	0.00193	0.001084
B7	0.00195	0.001139	0.00302	0.000000	0.00179	0.001232	0.00000	0.003018	0.00270	0.000328
B8	0.01018	0.000000	0.00617	0.004184	0.00312	0.007116	0.00173	0.008473	0.00000	0.010180
C1	0.00003	0.000085	0.00007	0.000045	0.00000	0.000118	0.00002	0.000101	0.00012	0.000000
C2	0.00182	0.001499	0.00326	0.000000	0.00000	0.003257	0.00058	0.002685	0.00160	0.001663
C3	0.01254	0.000000	0.00781	0.004904	0.00374	0.008872	0.00000	0.012537	0.00677	0.005823
D1	0.00000	0.011356	0.01136	0.000000	0.00270	0.009193	0.00166	0.010133	0.00166	0.010133
D2	0.01324	0.005163	0.01806	0.000000	0.00000	0.018057	0.00446	0.013623	0.01354	0.004535
D3	0.00141	0.009304	0.01039	0.000000	0.00118	0.009257	0.00000	0.010391	0.00733	0.003065
D4	0.00819	0.009895	0.01790	0.000000	0.00372	0.014225	0.00000	0.017895	0.00963	0.008271
D5	0.00091	0.008182	0.00814	0.000000	0.00000	0.008140	0.00030	0.007897	0.00579	0.002363
D6	0.00819	0.001534	0.00834	0.000000	0.00189	0.006461	0.00000	0.008342	0.00723	0.001158
E1	0.01882	0.000000	0.01778	0.002387	0.00000	0.018823	0.00526	0.013605	0.01055	0.008333
E2	0.00094	0.000129	0.00000	0.000967	0.00030	0.000664	0.00035	0.000619	0.00097	0.000000
E3	0.01140	0.014007	0.02525	0.000000	0.00000	0.025254	0.00318	0.022105	0.01166	0.013610
E4	0.00425	0.008459	0.01353	0.000000	0.00000	0.013914	0.00028	0.013583	0.00515	0.008556
E5	0.00868	0.004187	0.01279	0.000000	0.00000	0.012789	0.00156	0.011249	0.00823	0.004563

Table 6. Distance and CC_i of the alternative.

Alternative	MS1	MS2	MS3	MS4	MS5
Distance to positive ideal solution	0.161	0.217	0.0377	0.0270	0.1034
Distance to negative ideal solution	0.091	0.032	0.211	0.221	0.145
CC_i	0.362	0.129	0.848	0.891	0.584
Rank	4	5	2	1	3

Figure 1 shows that the closer the distance to the positive ideal solution, the higher the performance of the alternatives. The order of the alternatives was MS4, MS3, MS5, MS1, and MS2. The farther away the negative ideal solution is, the better the performance of the alternatives. The order of the alternatives was MS4, MS3, MS5, MS1, and MS2. To sum up, the greater the closeness coefficient is, the more superior the performance of the alternatives. The order of the alternatives was MS4, MS3, MS5, MS1, and MS2.

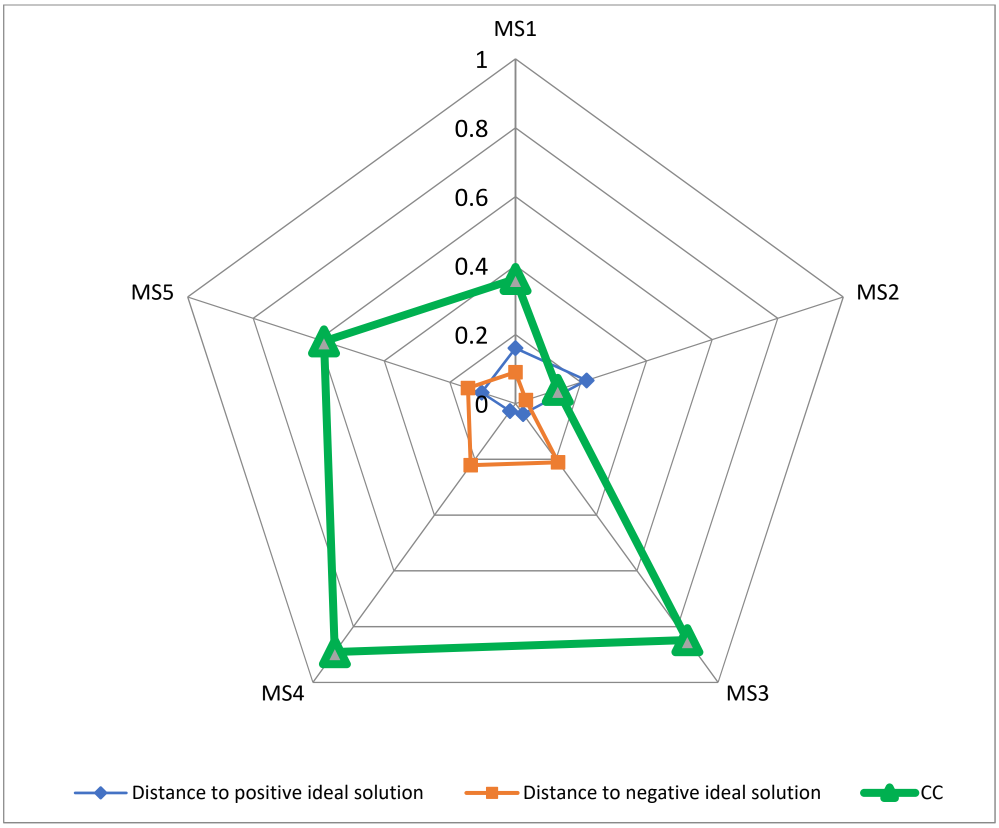

Figure 1. Radar chart of distance and closeness coefficients.

5. Discussion

The study evaluated the business performance of rural homestays using CLFPR-based ANP and fuzzy TOPSIS to calculate the weights of evaluation criteria and rank the alternatives in the Chinese context. In light of the analysis results, the research questions were effectively answered.

A high factor loading indicates that the criterion is attached considerable importance and thereby plays a crucial role in the success and sustainability of local homestay businesses [27]. With high global weight, service attitude (B1, 0.123), degree of interaction between hosts and lodgers (E1, 0.099), overnight tourists (D1, 0.071), operating income (D2, 0.070), and contribution to the living quality of local community (E3, 0.060) had the top priority. Conversely, parking space (C1, 0.000), utilizing plenty of natural light (A1, 0.001), maintaining the land's vitality and good condition in the process of design and construction (A3, 0.001), greenization and uniqueness of the garden design (A6, 0.003), catering service and quality (B3, 0.006), and using non-toxic paint (A2, 0.006) were among low-ranking criteria. With regard to the key aspects, the panel took homestay operation and management (D; 0.329) most seriously, while service quality (B; 0.248) remained second, followed by homestay geist and community co-prosperity (E; 0.229) and surroundings of the building and features (A; 0.135). Homestay facilities (C; 0.059) was ranked last. Subsequently, according to the experts' evaluation, the alternatives were ordered by closeness coefficient calculated by fuzzy TOPSIS, that is, the larger the closeness coefficient, the better the performance of the alternatives. The alternative MS4 took the top spot, and MS3 remained second, followed successively by MS5, MS1, and MS2.

In line with extant literature, Janjua et al. (2021) confirmed that environmental sustainability was not adequately addressed, as scholars placed a greater emphasis on the social and economic pillars of sustainability [68]. Given the empirical findings, the degree of interaction between hosts and lodgers (E1) and the contribution to the living quality of the local community (E3) may be grouped into a social pillar, and the economic pillar involves operating income (D2) and overnight tourists (D1). Homestay service can be evaluated from the perspective of tourists [69], and service attitude (B1) has traditionally been always regarded as the most significant service quality criterion. The importance of service quality as a key performance criterion for tourism-related products is growing [39]. Hence, regarding the weakening of the weight of environmental and building factors, this means that the concept of homestay operation in China has therefore been changing, from focusing on the surrounding environment and interior decoration of the homestay product in the early days to consumer orientation and routine operation at present. Finally, the alternative can be thoroughly evaluated as the benchmark homestay by the optimal performance. Excellent service quality, significant financial growth, and harmonious community engagement are all necessary for this.

6. Conclusions

The present study filters out the optimal homestay from a performance perspective by combining CLFPR-based ANP and fuzzy TOPSIS in the Chinese context. Specifically, CLFPR-based ANP helped to obtain the priorities of each criterion. Subsequently, fuzzy TOPSIS ranked the alternatives by overall performance. The performance evaluation system suggested by Peng et al. (2022) is more appropriate from the perspective of a systematic and comprehensive performance of homestay operation. An actual performance evaluation of homestays has not yet been carried out; thus, their study merely highlighted the ways in which the many performance criteria of homestays interact with one another. Therefore, this study's uniqueness is an expansion on the earlier study. Moreover, the study assesses and analyzes the overall performance of the alternatives rather than just describing the ways in which the criteria relate to performance within the homestay. Additionally, in contrast to efficiency research, this study considers both financial and non-financial criteria.

The theoretical contributions of this study are as follows. First, this study is conducive to advancing further homestay research. Currently, homestay basic theory, homestay development, homestay management, tourism development of homestays, and tourist behavior at homestays have been research hotspots of homestays in China [70], but little attention has been paid to the research on homestay performance, including the operating efficiency of homestay businesses. Therefore, the study makes a worthwhile effort to evaluate the performance of the rural homestay business. Second, the MCDM combination of (fuzzy) AHP and (fuzzy) TOPSIS has also gained popularity, in which (fuzzy) AHP is used to determine the criteria weights, and (fuzzy) TOPSIS is used to rank the alternatives [71]. However, CLFPR-based ANP not only focuses on the internal network relationship of criteria but also provides evaluation consistency and prevents calculation complexity. Simultaneously, although decision-making scenarios faced by individuals are usually ambiguous, the application of fuzzy set theory can result in appropriate and high-quality decisions in a scenario [50]. Fuzzy TOPSIS produces satisfactory results for the alternatives regarding rationality and discriminatory ability [72]. Therefore, the results highlight the integration of the ANP and the fuzzy TOPSIS as a precise tool and offer efficient multi-attribute decision making for assessing the homestay's performance in an uncertain environment. Third, the analysis' findings are in line with pertinent study conclusions in which a business's size, management practices, and product characteristics, as well as the entrepreneur's personality or the entrepreneur's knowledge are likely determinants of performance [73]. Thus, these results substantively underpin the conclusion that performance (business efficiency) is closely related to sustainability and competitiveness [74].

The significant implications of the study are summarized below. First, facing COVID-19 and the current economic downturn, this study offers a way out of difficulties for the sustainable development of the rural homestay business. The priorities of service quality and homestay geist and community co-prosperity strongly imply customer orientation in the operation of homestay businesses, and they are viewed as competitive advantages in the market, particularly in rural tourism [75]. Tourist satisfaction is ensured when all operations are customer-oriented [76]. The better the profitability, the higher the sustainability practiced by the company [77]. Thus, firms that want long-term advantages consider sustainability as part of their core strategy [78]. Second, because overnight tourists and operating income somewhat directly represent the success of rural homestay businesses, the financial criteria of rural homestays should receive ongoing attention. Third, because the principle of sustainable development emphasizes the community approach [79], the sustainable development of homestays should be incorporated into the community's sustainable development through homestay geist and community co-prosperity. Likewise, corporate social and business activities complement each other and are compatible and, thus, should be embedded in business strategy [80].

This study also has some limitations. First, future work can apply different multi-criteria techniques to lessen the load of calculation and compare the findings, such as the best–worst method (BWM) and VIKOR. Second, to test the rationality of the ranking of the alternatives, future research could conduct a comparative analysis of the findings of methods for ranking alternatives. Third, a deeper discussion is worth advancing further in future studies.

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Appendix A

Table A1. Unweighted supermatrix.

Item	G	A	B	C	D	E	A1	A2	A3	A4	A5	A6	A7	A8	A9	B1	B2	B3	B4	B5	B6	B7	B8	C1	C2	C3	D1	D2	D3	D4	D5	D6	E1	E2	E3	E4	E5
G	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A	0.24	0.26	0	0	0	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B	0.24	0.23	0.45	0.42	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C	0.09	0.12	0	0.33	0.15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D	0.27	0.22	0.35	0.25	0.34	0.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0.17	0.18	0.2	0	0.22	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A1	0	0.1	0	0	0	0	0	0	0	0	0	0	0.04	0	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A2	0	0.1	0	0	0	0	0	0	0	0	0	0	0.03	0	0.02	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A3	0	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.11	0
A4	0	0.13	0	0	0	0	0	0	0	0	0	0	0.03	0.04	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.14	0.17
A5	0	0.12	0	0	0	0	0	0	0	0.10	0	0	0.04	0.04	0.02	0	0	0	0	0	0	0	0	0	0	0.08	0	0	0	0	0	0	0	0	0	0	0.17
A6	0	0.1	0	0	0	0	0	0	0.22	0.08	0	0	0	0.03	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.11	0
A7	0	0.12	0	0	0	0	0.20	0.45	0	0.09	0.21	0	0	0.04	0.03	0	0.08	0	0.5	0.5	0	0	0	0	0	0.12	0	0	0	0	0.09	0	0	0	0	0	0
A8	0	0.14	0	0	0	0	0.44	0.31	0.48	0.14	0.34	0.31	0.06	0	0.04	0.19	0.08	0	0	0	0	0	0	0	0	0.06	0	0	0	0	0.15	0	0.15	0	0	0	0
A9	0	0.13	0	0	0	0	0.36	0.24	0.30	0.11	0.45	0.19	0.05	0.06	0	0.14	0.04	0	0	0	0	0	0	0	0	0.08	0	0	0	0	0	0	0.19	0	0	0	0
B1	0	0	0.14	0	0	0	0	0	0	0	0	0	0	0.07	0	0	0	0.3	0	0	0	0	0	0	0	0	0.06	0.50	0.49	0.48	0	0	0.33	0	0	0	0
B2	0	0	0.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04	0	0	0	0	0.32	0	0	0	0	0
B3	0	0	0.11	0	0	0	0	0	0	0	0	0	0	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0	0	0	0	0	0	0.33	0	0	0
B4	0	0	0.14	0	0	0	0	0	0	0	0	0	0.05	0	0	0	0	0	0	0	0	0	0.10	0	0	0.11	0.06	0	0	0	0.06	0	0	0	0	0	0
B5	0	0	0.15	0	0	0	0	0	0	0	0	0	0.11	0	0	0	0	0	0	0	0	0	0.10	0	0	0.14	0.07	0	0	0	0.11	0	0	0	0	0	0
B6	0	0	0.11	0	0	0	0	0	0	0	0	0	0.09	0	0	0	0	0	0	0	0	0	0.05	0	0	0.08	0	0	0	0	0.09	0	0	0	0	0	0
B7	0	0	0.14	0	0	0	0	0	0	0	0	0	0	0.03	0.07	0	0.07	0	0	0	0.33	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0
B8	0	0	0.12	0	0	0	0	0	0	0	0	0	0	0.05	0.13	0	0.13	0	0.5	0.5	0	0	0	0	0	0	0.07	0	0	0	0	0	0	0	0	0	0
C1	0	0	0	0.23	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C2	0	0	0	0.32	0	0	0	0	0	0	0	0	0	0	0	0	0.06	0	0	0	0.17	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C3	0	0	0	0.45	0	0	0	0	0	0	0	0	0.24	0.19	0.20	0	0.09	0	0	0	0.17	0	0.25	0	0	0	0	0	0	0	0.24	0	0	0	0	0	0
D1	0	0	0	0	0.14	0	0	0	0	0	0	0	0.07	0.06	0.06	0.09	0	0.12	0	0	0.15	0	0.05	0.46	0.23	0.09	0	0	0.12	0.14	0.04	0.08	0.11	0	0.14	0.09	0.09
D2	0	0	0	0	0.2	0	0	0	0	0	0	0	0.05	0.04	0.04	0.05	0	0.10	0	0	0	0	0.03	0	0	0.07	0.04	0	0.07	0.08	0.05	0.06	0	0.33	0.17	0.11	0.11
D3	0	0	0	0	0.14	0	0	0	0	0	0	0	0.04	0.03	0.03	0.08	0	0.06	0	0	0.09	0	0.05	0.27	0.14	0.05	0.07	0	0	0	0.04	0.07	0.06	0	0.09	0.06	0.06
D4	0	0	0	0	0.16	0	0	0	0	0	0	0	0.04	0.03	0.03	0.08	0	0.06	0	0	0.09	0	0.05	0.27	0.14	0.05	0.07	0	0.11	0	0.04	0.07	0.06	0	0.09	0.06	0.06
D5	0	0	0	0	0.16	0	0	0	0	0	0	0	0.04	0.04	0.03	0.06	0	0	0	0	0	0	0.06	0	0	0.07	0.07	0	0.09	0.13	0	0.06	0	0	0	0	0
D6	0	0	0	0	0.21	0	0	0	0	0	0	0	0	0	0	0	0.20	0	0	0	0	0	0	0	0	0	0.09	0	0.13	0.17	0.07	0	0.11	0	0	0	0
E1	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0.06	0.20	0.33	0.13	0	0	0	0	0	0	0	0	0	0.33	0	0	0	0	0.11	0	0	0	0	0
E2	0	0	0	0	0	0.12	0	0	0	0	0	0	0	0.03	0	0	0.07	0.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.11	0	0
E3	0	0	0	0	0	0.24	0	0	0	0	0	0	0	0.05	0	0	0	0	0	0	0	0	0.16	0	0	0	0	0.20	0	0	0	0.09	0	0.33	0	0.33	0.34
E4	0	0	0	0	0	0.2	0	0	0	0.24	0	0.50	0	0.04	0	0	0	0	0	0	0	0	0.09	0	0	0	0	0.15	0	0	0	0.07	0	0	0.20	0	0
E5	0	0	0	0	0	0.2	0	0	0	0.24	0	0	0	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0.15	0	0	0	0.07	0	0	0.20	0	0

Table A2. Weighted supermatrix.

Item	A1	A2	A3	A4	A5	A6	A7	A8	A9	B1	B2	B3	B4	B5	B6	B7	B8	C1	C2	C3	D1	D2	D3	D4	D5	D6	E1	E2	E3	E4	E5
A1	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A2	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
A4	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10
A5	0.00	0.00	0.00	0.07	0.00	0.00	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
A6	0.00	0.00	0.17	0.05	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00
A7	0.18	0.42	0.00	0.06	0.19	0.00	0.00	0.03	0.02	0.00	0.04	0.00	0.39	0.39	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00
A8	0.46	0.34	0.52	0.12	0.37	0.25	0.04	0.00	0.03	0.12	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.10	0.00	0.10	0.00	0.00	0.00	0.00
A9	0.36	0.24	0.31	0.08	0.45	0.14	0.03	0.04	0.00	0.09	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00
B1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.49	0.45	0.44	0.00	0.00	0.37	0.00	0.00	0.00	0.00
B2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00
B3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00
B4	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.13	0.05	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00
B5	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.17	0.07	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00
B6	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00
B7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.08	0.00	0.08	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.11	0.00	0.12	0.00	0.61	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.13	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C3	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.22	0.21	0.00	0.10	0.00	0.00	0.00	0.18	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00
D1	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.06	0.06	0.09	0.00	0.12	0.00	0.00	0.15	0.00	0.05	0.44	0.22	0.09	0.00	0.00	0.10	0.12	0.04	0.08	0.11	0.00	0.13	0.10	0.09
D2	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.05	0.06	0.06	0.00	0.14	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.12	0.05	0.00	0.09	0.10	0.08	0.08	0.00	0.41	0.23	0.17	0.16
D3	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.03	0.03	0.07	0.00	0.07	0.00	0.00	0.09	0.00	0.05	0.26	0.13	0.05	0.06	0.00	0.00	0.00	0.04	0.07	0.06	0.00	0.09	0.06	0.06
D4	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.03	0.04	0.08	0.00	0.08	0.00	0.00	0.10	0.00	0.05	0.30	0.15	0.06	0.06	0.00	0.11	0.00	0.05	0.08	0.07	0.00	0.10	0.07	0.07
D5	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.04	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.09	0.06	0.00	0.09	0.13	0.00	0.07	0.00	0.00	0.00	0.00	0.00
D6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.16	0.21	0.10	0.00	0.17	0.00	0.00	0.00	0.00
E1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.26	0.42	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00
E2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.05	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00
E3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.11	0.00	0.35	0.00	0.43	0.42
E4	0.00	0.00	0.00	0.31	0.00	0.61	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.07	0.00	0.00	0.19	0.00	0.00
E5	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.07	0.00	0.00	0.19	0.00	0.00

Table A3. Limiting supermatrix.

Item	A1	A2	A3	A4	A5	A6	A7	A8	A9	B1	B2	B3	B4	B5	B6	B7	B8	C1	C2	C3	D1	D2	D3	D4	D5	D6	E1	E2	E3	E4	E5
A1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
A2	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
A3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
A4	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
A5	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
A6	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
A7	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
A8	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042
A9	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
B1	0.123	0.123	0.123	0.124	0.123	0.124	0.123	0.123	0.123	0.123	0.123	0.124	0.123	0.123	0.123	0.123	0.123	0.123	0.123	0.123	0.123	0.124	0.123	0.123	0.123	0.124	0.123	0.124	0.124	0.124	0.124
B2	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013
B3	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
B4	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018
B5	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026
B6	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
B7	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.015	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
B8	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038
C1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011
C3	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048
D1	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071
D2	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.069	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070
D3	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044
D4	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055
D5	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039
D6	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051
E1	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099	0.099
E2	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
E3	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060
E4	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
E5	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029

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