APPLYING MODIFIED DELPHI METHOD AND THE ANALYTIC HIERARCHY PROCESS TO INVESTIGATE THE FACTORS OF VEGETARIAN RESTAURANT MANAGEMENT IN MIAOLI COUNTY

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ABSTRACT
The study is designed to investigate the factors of vegetarian restaurant management in Miaoli County. Firstly, through the review of the present researches, it is able to organize the factors of vegetarian restaurant management in Miaoli County. Secondly, utilizing Modified Delphi Method, it can integrate the viewpoints of experts, and can construct an analytical hierarchy framework of the factors of vegetarian restaurant management in Miaoli County, including four facets, namely food quality, service quality, perceived value, restaurant location and nineteen evaluation criteria. Finally, through the result of the Analytical Hierarchy Process survey, it can analyze each evaluation criteria for constructing the system of the factors of vegetarian restaurant management in Miaoli County. The results of the study are threefold. Firstly, for consumers, food quality is the most critical factor of vegetarian restaurant management in Miaoli County. The influential degree of service quality and perceived value is not obvious. Restaurant location will affect minimum. Secondly, for consumers, the most important attribute of food quality is healthfulness, diversity and freshness. The most important attribute of service quality is reliability and tangibility. The most important attribute of perceived value is emotional facet and quality-function facet. The most important attribute of restaurant location is transportation. To sum up, the most critical factors of vegetarian restaurant management in Miaoli County are healthfulness, diversity, freshness and taste. The results of the study can be used as a reference of vegetarian restaurant management or provide a reference of vegetarian restaurant entrepreneur for his costs and benefits.

Key words: *food quality, service quality, perceived value, restaurant location.*

1. INTRODUCTION
According to the Almanac of Food Consumption Survey in Taiwan conducted by Food Industry Research and Development Institute (Taiwan), the population that followed vegetarian diets in Taiwan grew gradually between 2000 and 2006[1]. Moreover, there were about 6,000 vegetarian restaurants in Taiwan, 50% of which were located in the north of Taiwan. In 2009, Taipei and Taichung were rated by "Matador Trips", an international tourism website, as the third on the list of "Global Vegetarian-friendly Cities". This honor indicated that Taiwan also actively involved in the wave of enthusiasm for becoming vegetarian. And its power of "being vegetarian" was accepted and highly recognized internationally. By 2010, Taiwan's vegetarian population had exceeded 2.5 million, accounting for more than 10% of its entire population; the vegetarian market size was estimated to reach about TWD 59 billion [2].

Led by the vigorous trend of global vegetarianism, coupled with the great business opportunities and potentials possessed by vegetarian products, the vegetarian and related industries, theoretically speaking, should be ready to flourish. Restaurants play a key role in the numerous vegetarian-related industries. While vegetarian restaurants, compared with common ones and convenience stores, emphasize more on vegetarian food materials and provide a wider variety of vegetarian dishes. Nevertheless, as shown by the business registration situation of the vegetarian industry in Miaoli County, among the 85 records of business registration, 71 were restaurants, 28 of which were still in operation currently and 43 of which were out of business. So, vegetarian restaurants do not necessarily gain profits without suffering losses. Actually, their operation is also influenced by its structural factors.

2. LITERATURE REVIEW
2.1 FACTORS INFLUENCING VEGETARIAN RESTAURANT OPERATION
There are scanty studies on the factors influencing vegetarian restaurant operation. Some studied a certain vegetarian restaurant and focused on the single-factor or multiple-factor linear relationships. Some selected a vegetarian restaurant for a case study to explore the relationships between restaurant operation strategy and customer satisfaction, loyalty or repurchase intention. Some covered a certain area to investigate the purchase

decision of vegetarian restaurant consumers. In general, these researches can be summarized in the following aspects:

(1) Food quality
For the definition of food quality, this study adopted the six aspects presented by SooCheong, Jang and Young Namkung in 2007. They were visual presentation, variety, healthiness, taste, freshness and temperature, specifically introduced as follows:
1) visual presentation: it refers to the attractiveness of products perceived by consumers in terms of their decorations, colors and appearances.
2) variety: it refers to varieties and styles of cuisines offered by restaurants.
3) healthiness: it refers to how beneficial the food's nutritive values can be to health.
4) taste: it refers to consumers' experience of the taste, smell and mouthfeel of food.
5) freshness: it refers to the freshness of food judged by a time-based criterion.
6) temperature: it refers to the proper temperature of food that matches well with the mouthfeel, taste and visual appearance.

(2) Service quality
Service quality is different from product quality. Its measurement must entail the process and results that may vary according to multiple factors. As to the types of service quality, this study adopted the "PZB Service Quality Model" put forward by Parasuraman, Zeithmal and Berry, 1988[3]. They classified service quality into five aspects: tangibles, reliability, responsiveness, assurance and empathy. The detailed introduction is given below:
1) tangibles: it means the physical facilities for services, attendants' looks and such promotion materials as menus, etc.
2) reliability: it means attendants' capacity to correctly and reliably perform the services as promised.
3) responsiveness: it means attendants' willingness or readiness to provide good and prompt services and ability to respond swiftly to consumer needs.
4) assurance: it means that attendants are knowledgeable and courteous enough to win the trust of consumers when services are rendered.
5) empathy: it means that attendants care about consumers, keep ready to provide individual services, respect consumers' rights and interests, and make consumers feel cared for and respected.

(3) Perceived value
Perceived value is abstract, multi-faceted, and hard to measure. It can be regarded as the whole benefit produced by making a trade-off between and an overall evaluation of perceived payment and perceived acquisition. Regarding the assessment dimensions for perceived value, this study referred to the four aspects raised by Sweeney and Soutar in 2001 to measure perceived value[4]. They included emotional dimension, social dimension, quality/performance and price/value for money, introduced as follow:
1) emotional dimension: it refers to the ability or effect that can changes consumers' affections and emotions during the entire consumption of a product or service.
2) social dimension: it refers to consumers' perceptions about the social image of a product or service, namely they can feel, when using a product or enjoying a service, it consistent with the belief of the group they belong to or admire.
3) quality/performance: it refers to the quality to measure a product and the performance obtained, namely consumers can feel the functions and effects of a product or service during the whole consumption of such a product or service.
4) price/value for money: it refers to consumers' perceived value of their short-term or long-term monetary investment.

(4) Restaurant location
This study applied the five aspects generated by Tzeng *et al.* in 2002 to measure restaurant location[5]. They referred to transportation, commercial area, economic factors, competition and environment, defined as follows:
a. transportation: including the size of a restaurant's parking space, and the accessibility to mass transportation system, etc.
b. commercial area: including the size and pedestrian volume of the business circle where a restaurant is located, etc.
c. economic factors: including rent cost and transportation cost, etc.
d. competition: including number of competitors and the intensity of competition, etc.

    e.   environment: including convenience of garbage disposal, and sewage capacity for a restaurant, etc.

2.2 MODIFIED DELPHI METHOD
The Delphi method is a process that involves two or more rounds of communication and opinion expression in writing for a panel of experts to converge unanimously towards the same view. However, minor revision or deletion is always necessary during the process due to factors like time, human resources and funds so that the target research can go on smoothly, which is called the "modified Delphi method". There are two common ways of revision, shown as follows:

    a.   The step of open consultation in the first round is omitted. The open-ended questionnaire is not used any more to consult the experts. Items are first designed based on related research results or researchers' experience. Then the experts are requested to express their personal opinions based on these items.

    b.   The research processes of the third and fourth rounds are combined so that the whole process is limited to three stages. The results of the second round are sorted out and sent to the experts who then need to rate the items categorized by researchers by "importance" and "grade". In this way the experts have less chances to review their opinions again. As pointed out by Lanford (1972), in the researches that were conducted with the modified Delphi method, an obvious phenomenon of expert opinion convergence usually occurred between the first and second rounds [6]. So the modified Delphi method needs to go through at least two rounds of investigation. But within four rounds at most, the experts can reach a consensus or achieve the stability of opinions.

2.3 ANALYTIC HIERARCHY PROCESS (AHP)
The analytic hierarchy process can be implemented as follows [7]:

(1) Describing questions and analyzing influencing elements
By brainstorming, the Delphi method or literature collection, the opinions of experts and scholars can be sorted out, factors that may influence research questions or alternative solutions can be listed, and research objectives can be determined.

(2) Building an AHP hierarchy
    The following key points should be noted when an AHP framework is constructed:

      1) the top level represents the final goal of the evaluation process
      2) elements with similar importance should be placed on the same level
      3) it is appropriate that there are seven or less elements to be evaluated in the hierarchy
      4) the elements to be evaluated in the hierarchy should be independent
      5) the bottom level contains the alternatives for evaluation.

(3) Questionnaire design and investigation
The questionnaire is prepared by pairwise comparisons of the elements on all levels. According to the measurement scale proposed by Saaty (1990), it is suggested to adopt a nine-point rating scale which is consisted of five main grades and four threshold grades [8].

(4) Creating a pairwise comparison matrix
Based on the data collected through questionnaire, a pairwise comparison matrix "A" is created by the method of computing the population geometric mean.

(5) Computing eigenvalues and eigenvectors, and obtaining relative weights among all elements
The eigenvalues and eigenvectors of the pairwise comparison matrix "A" are computed using the theoretical principle of eigenvectors to obtain the relative weights among all elements. Therefore, this study calculates the eigenvalues by the method of normalizing the vector averages.

(6) Consistence test
Saaty suggested testing the consistence of the pairwise comparison matrix with the consistence index (C.I.) and consistence ratio (C.R.), specified as follows:

a. getting the consistent vector: the consistent vector and its arithmetic mean λ must be acquired before getting the C.I. value.
b. calculating the consistence index: in principle, "C.I.=0" indicates the complete consistency between the previous judgments and subsequent judgments; "C.I. > 0" implies the inconsistency between the previous judgments and subsequent judgments. But Saaty stated that "C.I. ≅ 0.1" could be considered an admissible error.
c. computing the consistence ratio: the different consistence index, produced in a different order of the positive reciprocal matrix created from the evaluation scale, is called the random index (R.I.). And the ratio of C.I. to R.I. is referred to as the consistence ratio (C.R.). When C.R. ≅ 0.1, the consistence of the matrix can be regarded satisfactory; otherwise, it needs to be assessed again.

(7) Measuring the relative weights of all elements
   If the matrix "A" and the overall hierarchy meet the standard of the consistence test, the relative weights of the elements on all levels can be further calculated to set the priorities of these elements.

(8) Calculating the overall weights of the AHP hierarchy
   After the requirement of consistence is met, the overall weights of the hierarchy are measured. The obtained overall weights of all elements under the final goal are used to determine their priorities.

(9) Selecting the most appropriate alternative
The overall weights of all elements, as a reference for analysis, can be provided for decision makers to select the most appropriate alternative.

3.   RESEARCH METHOD
3.1 RESEARCH SUBJECT AND SAMPLING METHOD
The subjects of this research mainly included two groups: one was a panel of experts who received the expert-targeted questionnaire interview with the modified Delphi method; the other was a group of objects who responded to the questionnaire investigation with the AHP. Regarding the questionnaire based on modified Delphi method, this study invited 15 experts from the industry, the academic circle and government authorities respectively. The judgment sampling was adopted here. Five experts were invited for each category. The experts from the industry were sampled from the vegetarian restaurants that still currently operated their business in Miaoli County. Due to the factors of geographical location and time, five owners, whose vegetarian restaurants were still in stable operation in Zhunan Town and Toufen City, were selected as the representative experts. Five people, including the professor, associate professor and professional technician from related departments at universities, were chosen as the representative academic experts since the research topic involved the operation of vegetarian restaurants. The experts from government authorities were sampled from the unit in charge of inspecting restaurant operation. So five inspectors from the Food Hygiene Department, County Health Bureau were included as the representative experts.

For the questionnaire based on AHP, this study sampled the consumers of the vegetarian restaurants in Miaoli County as its respondents. Therefore, the snowball sampling, rather than the random sampling, was adopted here, on one hand to ensure the subjects had complete experience in dining in a vegetarian restaurant, and on the other hand to reduce the error between the consumption situations in vegetarian restaurants in Miaoli County and other counties or cities.

3.2 RESEARCH PROCEDURES

Step 1: The preliminary formulation of influencing aspects and assessment criteria through literature review
The previous research results related to vegetarian restaurant operation were too limited to generalize the factors that affected vegetarian restaurant operation. So this study worked out the influencing aspects and assessment criteria (Table 1) of the factors that impacted the vegetarian restaurant operation in Miaoli County by combining the research achievements related to the operation of different-type restaurants. Every influencing aspect and assessment criterion were independent of each other.

Table 1：Influencing Aspects, Assessment Criteria and Definitions for Vegetarian Restaurant Operation

First Level	Second Level	Third Level	Introduction
Goal	**Primary Criteria (Influencing Aspects)**	**Secondary Criteria (Assessment Criteria)**	**(Definition or Explanation of Assessment Criteria)**
Factors Influencing Vegetarian Restaurant Operation in Miaoli County	A.　Food quality	A1. Visual presentation	It refers to the attractiveness of products perceived by consumers in terms of their decorations, colors and appearances.
		A2. Variety	It refers to varieties and styles of cuisines offered by restaurants.
		A3. Healthiness	It refers to how beneficial the food's nutritive values can be to health.
		A4. Taste	It refers to consumers' experience of the taste, smell and mouthfeel of food.
		A5. Freshness	It refers to the freshness of food judged by a time-based criterion.
		A6. Temperature	It refers to the proper temperature of food that matches well with the mouthfeel, taste and visual appearance.
	B. Service quality	B1. Tangibles	It means the physical facilities for services, attendants' looks and such promotion materials as menus, etc.
		B2. Reliability	It means attendants' capacity to correctly and reliably perform the services as promised.
		B3. Responsiveness	It means attendants' willingness or readiness to provide good and prompt services and ability to respond swiftly to consumer needs.
		B4. Assurance	It means that attendants are knowledgeable and courteous enough to win the trust of consumers when services are rendered.
		B5. Empathy	It means that attendants care about consumers, keep ready to provide individual services, respect consumers' rights and interests, and make consumers feel cared for and respected.
	C. Perceived value	C1. Emotional	It refers to the ability or effect that can changes consumers' affections and emotions during the entire consumption of a product or service.
		C2. Social	It refers to consumers' perceptions about the social image of a product or service, namely they can feel, when using a product or enjoying a service, it consistent with the belief of the group they belong to or admire.
		C3. Quality/value	It refers to the quality to measure a product and the performance obtained, namely consumers can feel the functions and effects of a product or service during the whole consumption of such a product or service.
		C4. Price/value	It refers to consumers' perceived value of their short-term or long-term monetary investment.
	D. Restaurant location	D1. Transportation	Including the size of a restaurant's parking space, and the accessibility to mass transportation system, etc.
		D2. Commercial area	Including the size and pedestrian volume of the business circle where a restaurant is located, etc.
		D3. Economic factors	Including rent cost and transportation cost, etc.
		D4. Competition	Including number of competitors and the intensity of competition, etc.
		D5. Environment	Including convenience of garbage disposal, and sewage capacity for a restaurant, etc.

Step 2: Designing the expert questionnaire based on the modified Delphi method
This study planned two rounds of expert questionnaire investigation based on the modified Delphi method, specifically introduced as follows:

(1)The first round of expert questionnaire investigation based on the modified Delphi method
This questionnaire investigation was conducted by email, by post and on site. The questionnaire content was divided into three parts. Part 1 was the basic information about experts. Part 2 was the instruction about assessment criteria. Part 3 was the main body. The semi open-ended scoring on the five-point Likert scale was adopted to evaluate the primary criteria, namely influencing aspects. The five grades included: "Very Important" (5 points), "Important" (4 points), "Moderately Important" (3 points), "Unimportant" (2 points) and "Very Unimportant" (1 point).

(2)The second round of expert questionnaire investigation based on the modified Delphi method
The ways of questionnaire investigation and scoring were the same as the those adopted in the first round. But differently the questionnaire content in the second round was divided into four parts, listing the statistical results of the first round apart from the basic information about experts, instruction about assessment criteria and main body. Moreover, the second round adopted the closed-ended scoring.

Step 3: Drafting the schedule of expert questionnaire investigation based on the modified Delphi method
As planned by this study, the first and second rounds of expert questionnaire investigation based on the modified Delphi method would be finished within 15 to 20 days respectively.

Step 4: Setting the criteria for analyzing and evaluating the expert questionnaire data
With regards to the criteria for questionnaire data analysis and evaluation, this study mainly used the mean and standard deviation as the test standards. The details were shown as follows:

(1)   Mean
Chen and Chen (2011) once pointed out in the *Journal of Humanities and Social Sciences* that the average scoring result of "3" on a five-point Likert scale indicated "a moderate opinion" or "no opinion"[9]. To integrate the overall level of expert agreement with the target items, if the average result for each primary or secondary criterion was higher than 3.5 in the first round of expert questionnaire investigation, it meant that the panel of experts had reached a consensus, namely the level of agreement was 70% and this primary or secondary criterion should be retained. Otherwise, it would be deleted.

As to the standard for the mean of the second round, the opinions of experts, according to Hung (2000), converged towards a consensus, and the importance of all assessment criteria should exceed 70% [10]. So this study set "3.75" as the standard for the mean of the second round, namely the level of agreement was 75%.

(2)   Standard deviation
This value represented the amount of dispersion of the experts' opinions concerning all primary and secondary criteria of the factors that influenced vegetarian restaurant operation in Miaoli County. The larger the standard deviation was, the more greatly the expert opinions differed. This study used "1" as the criterion to evaluate the standard deviation.

Step 5: Sorting out the statistical results of expert questionnaire investigation based on the modified Delphi method
This study carried out two rounds of expert questionnaire investigation based on the modified Delphi method. The final results were illustrated as follows:

(1)The statistical results of the first round
For the four influencing aspects, food quality, service quality, perceived value and restaurant location, all their means were larger than 3.5, percentile ranks higher than 70% and standard deviations smaller than 1. The selection standard was met. Meanwhile, the 20 assessment criteria also met the selection standard: their means larger than 3.5, percentile ranks higher than 70% and standard deviations smaller than 1, and were thus listed into the second round as well.

(2)The statistical results of the second round
All the four influencing aspects, food quality, service quality, perceived value and restaurant location, with their means larger than 3.75, percentile ranks higher than 75% and standard deviations smaller than 1, still met the selection standard. However, among the 20 assessment criteria, the one for visual presentation in the food quality influencing aspects, with its mean of 3.667 and percentile rank of 73.34%, failed to meet the selection standard of 3.75 for the mean and 75% for the percentile rank. Consequently, this assessment criterion was deleted.

Step 6: Making the AHP framework for the factors that influenced vegetarian restaurant operation in Miaoli County
Based on the results of the two rounds of expert questionnaire investigation, the AHP hierarchy for the factors that influenced vegetarian restaurant operation in Miaoli County was generated, mainly including four influencing aspects and 19 assessment criteria. The AHP hierarchy was shown in Figure 1.

Step 7: Designing the AHP questionnaire and setting the questionnaire evaluation scale
The questionnaire content and evaluation scale were introduced as follows:

(1)The AHP questionnaire
This questionnaire was targeted at the consumers with consumption experience in vegetarian restaurants in Miaoli County. It comprised four parts: Basic Information, Questionnaire Framework, Instruction and Questionnaire Content

(2)The questionnaire evaluation scale
This questionnaire, according to the measurement scale put forward by Saaty (1990), adopted the nine-point rating scale, including five main grades and four threshold grades. The five main grades were: "Absolutely Important" (9 points), "Highly Important" (7 points), "Quite Important" (5 points), "Slightly Important" (3 points) and "Equally Important" (1 points). The four threshold grades lied between two of the main grades and were given a quantitative value respectively, 8, 6, 4 and 2 points.

Step 8: Formulating the AHP questionnaire investigation schedule
The research subjects were selected from the consumers who once dined in vegetarian restaurants in Miaoli County by the snowball sampling to avoid error during the sampling process and ensure the sampled respondents really dined in vegetarian restaurants in Miaoli County before. 60 copies of AHP questionnaires were to be distributed. A one-month period was set for the investigation from the questionnaire preparation to collection.
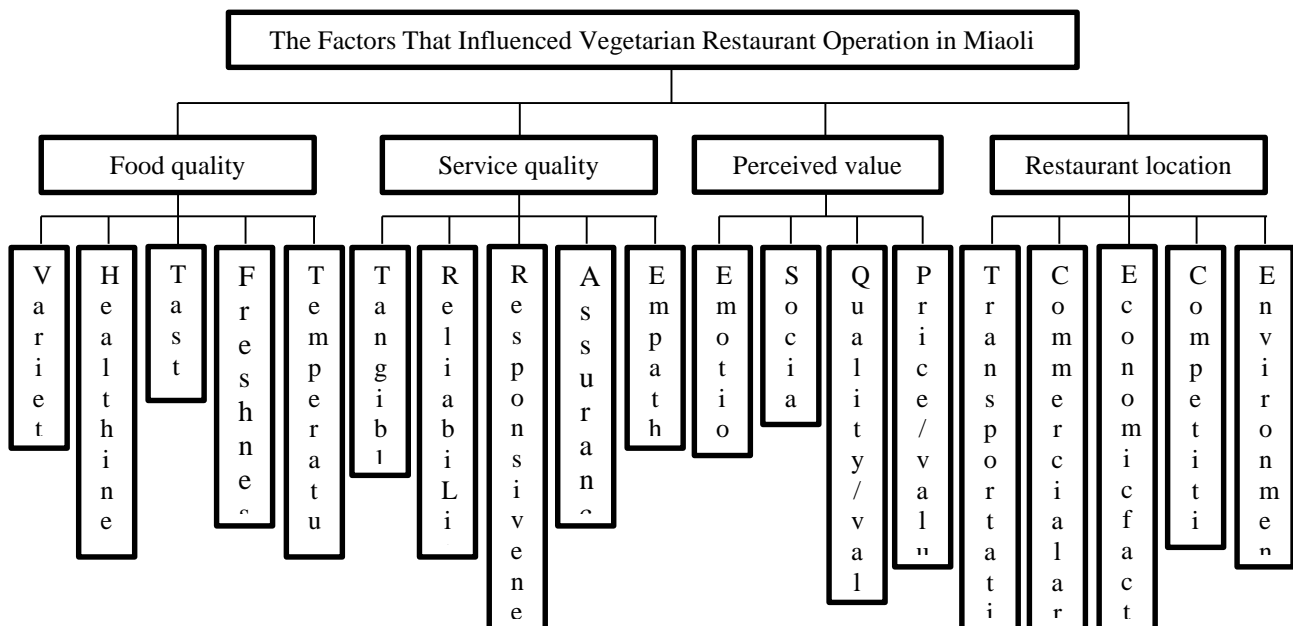

Figure 1：The AHP Hierarchy for the Factors That Vegetarian Restaurant Operation in Miaoli County

4.　EMPIRICAL ANALYSIS

A total of 60 AHP questionnaires were handed out. 59 copies were collected. 8 copies were invalid because they were not fully completed. Therefore, there were 51 valid questionnaires with a collection rate of 85%.Among the respondents of the 51 valid questionnaires, there were 10 "Male" and 41 "Female" by gender; 22 "30~39", 19 "40~49", 5 "20~29" and 5 "Above 50" by age; 30 "4~6", 18 "1~3", and only 3 "Above 7" by the number of family members; 41 "Married" and 10 "Unmarried" by marital status; 26 "Graduate School", 24 "University", and 1 "Below Junior High School" by education; 25 "Above 50,000", 18 "40,000~49,999", 3 "20,000~29,999", 2 "30,000~39,999", 2 "Wait for Employment" and 1 "Below 20,000" by monthly salary; 38 "1~4", 5 "5~9", 3 "15~19", 3 "Above 20" and 2 "10~14" by the number of times for dining in vegetarian restaurants in Miaoli County every month.

4.1 THE PAIRWISE COMPARISON MATRIX OF INFLUENCING ASPECTS (PRIMARY CRITERIA) AND CONSISTENCE TEST

First of all, the influencing aspects (primary criteria) of this study were analyzed to create the pairwise comparison matrix (Table 2).

Table 2：The Pairwise Comparison Matrix of Influencing Aspects (Primary Criteria) of This Study

Influencing aspects (Primary criterion)	A. Food quality	B. Service quality	C. Perceived value	D. Restaurant location
A. Food quality	1	5.118	4.895	4.736
B. Service quality	0.195	1	2.181	2.522
C. Perceived value	0.204	0.459	1	2.766
D. Restaurant location	0.211	0.397	0.361	1
Column subtotal	1.611	6.973	8.438	11.024

Assuming "Food Quality" as w_1, "Service Quality" as w_2, "Perceived Value" as w_3, and "Tourist Motivation" as w_4. The weights of all influencing aspects (primary criteria) were computed through the Eq. 2. The statistical process was demonstrated as follows:

$$\text{Food quality } w_1 \quad \frac{1}{4}\left(\frac{1}{1.611}+\frac{5.118}{6.973}+\frac{4.895}{8.438}+\frac{4.736}{11.024}\right)=0.591$$

$$\text{Service quality } w_2 \quad \frac{1}{4}\left(\frac{0.195}{1.611}+\frac{1}{6.973}+\frac{2.181}{8.438}+\frac{2.522}{11.024}\right)=0.188$$

$$\text{Perceived value } w_3 \quad \frac{1}{4}\left(\frac{0.204}{1.611}+\frac{0.459}{6.973}+\frac{1}{8.438}+\frac{2.766}{11.024}\right)=0.141$$

$$\text{Restaurant location } w_4 \quad \frac{1}{4}\left(\frac{0.211}{1.611}+\frac{0.397}{6.973}+\frac{0.361}{8.438}+\frac{1}{11.024}\right)=0.080$$

Furthermore, the assessment results must be tested for consistence in order to inspect the consistence of respondents' previous and subsequent judgments. While as suggested by Saaty, the consistence of the pairwise comparison matrix was tested with the C.I. and C.R. The steps were specified as follows:

(1)　Obtaining the consistent vector

The consistent vector V and its arithmetic mean λ must be acquired before getting the C.I. value. The computing process was as follows:

Food quality V_1= (0.591*1+0.188*5.118+0.141*4.895+0.080*4.736) /0.591=4.435
Service quality V_2= (0.591*0.195+0.188*1+0.141*2.181+0.080*2.522) /0.188=4.323
Perceived value V_3= (0.591*0.204+0.188*0.459+0.141*1+0.080*2.766) /0.141=4.055
Restaurant location V_4= (0.591*0.204+0.188*0.459+0.141*1+0.080*2.766) /0.080=4.112

It could be learned from the above-listed process that the average of the consistent vector λmax was (V_1+ V_2+ V_3+ V_4) /4, namely:

$$λmax= (4.435+4.323+4.055+4.112) /4=4.231$$

(2)　Consistence Index
Substituting the acquired λ value into the C.I. formula brings about the C.I. value. The statistical process was shown as follows:

$$C.I. = (4.231-4) / (4-1) =0.077$$

According to Saaty, in principle, "C.I.=0" indicated the complete consistency between the previous judgments and subsequent judgments; "C.I. > 0" implied the inconsistency between the previous judgments and subsequent judgments. But Saaty held that "C.I.$\cong$0.1" could be considered an admissible error. The computation above showed that the C.I. of this study's influencing aspects (primary criteria) was 0.077, smaller than 0.1, meeting the requirement for consistence.

(3)　Consistence Ratio
It could be found from the Random Index Table that the random index of this study's influencing aspects (primary criteria) was 0.9. The consistence ratio was computed via the Eq. 6, statistically shown as follows:

$$C.R. =0.077/0.9=0.086$$

The C.R. of this study's influencing aspects (primary criteria) was 0.086, smaller than 0.1, indicating that the level of its consistence was acceptable.

Table 3 summarized the above-mentioned statistical results. Both the C.I. (0.077) and C.R. (0.086) were smaller than 0.1, demonstrating the consistence of this study during the pairwise comparison of the influencing aspects (primary criteria). Moreover, among the factors that affected vegetarian restaurant operation in Miaoli County, the weight of Food Quality was 0.591, larger than that of Service Quality, Perceived Value and Restaurant Location. It meant that the consumers were most concerned about food quality.

Table 3：Importance Analysis of the Influencing Aspects (Primary Criteria) of Factors that Impacted Vegetarian Restaurant Operation in Miaoli County

Influencing aspects (Primary criterion)	A. Food quality	B. Service quality	C. Perceived value	D. Restaurant location	Weight	Order
A. Food quality	1	5.118	4.895	4.736	0.591	*1*
B. Service quality	0.195	1	2.181	2.522	0.188	*2*
C. Perceived value	0.204	0.459	1	2.766	0.141	*3*
D. Restaurant location	0.211	0.397	0.361	1	0.080	*4*
Column subtotal	1.611	6.973	8.438	11.024	1	
λmax=4.231, C.I.=0.077, C.R.=0.086, indicating the consistence of statistical results						

4.2 THE PAIRWISE COMPARISON MATRIX OF ASSESSMENT CRITERIA (SECONDARY CRITERIA) AND CONSISTENCE TEST

(1) Importance analysis of the assessment criteria (secondary criteria) of food quality

The assessment criteria (secondary criteria) of food quality included "Variety", "Healthiness", "Taste", "Freshness" and "Temperature". The analysis of their importance was shown in Table 4. The C.I. and C.R. equaled 0.082 and 0.073 respectively, both smaller than 0.1, indicating the consistence of this study during the pairwise comparison of assessment criteria (secondary criteria) of food quality. Besides, among the assessment criteria of food quality, the weights of "Healthiness", "Variety" and "Freshness" were 0.286, 0.250 and 0.231, larger than those of "Taste" and "Temperature". It reflected that regarding food quality, what the consumers cared about most were the healthiness, variety and freshness of food; comparatively they paid more attention to healthiness than variety and freshness.

Table 4：Importance Analysis of Assessment Criteria (Secondary Criteria) of Food Quality

Evaluation criterion (Secondary criterion)	A1. Variety	A2. Healthiness	A3. Taste	A4. Freshness	A5. Temperature	Weight	Order
A1. Variety	1	1.656	1.793	0.913	1.786	0.250	*2*
A2. Healthiness	0.604	1	3.378	1.433	3.393	0.286	*1*
A3. Taste	0.558	0.296	1	1.058	2.297	0.152	*4*
A4. Freshness	1.095	0.698	0.945	1	4.536	0.231	*3*
A5. Temperature	0.560	0.295	0.435	0.220	1	0.081	*5*
Column subtotal	3.817	3.944	7.551	4.625	13.011	1	
λmax=5.326、C.I.=0.082、C.R.=0.073,indicating the consistence of statistical results							

(2) Importance analysis of the assessment criteria (secondary criteria) of service quality

The assessment criteria (secondary criteria) of service quality included "Tangibles", "Reliability", "Responsiveness", "Assurance" and "Empathy". The analysis results of their importance were displayed in Table 5. The C.I. and C.R. were 0.038 and 0.034 respectively, both smaller than 0.1, indicating the consistence of this study during the pairwise comparison of assessment criteria (secondary criteria) of service quality. In addition, among the assessment criteria of service quality, the weights of "Reliability" and "Tangibles" were 0.276 and 0.236, larger than those of "Responsiveness", "Assurance" and "Empathy". It manifested that regarding service quality, the consumers were most interested in the reliability and tangibles of service; by comparison, they focused more on reliability than tangibles and freshness.

Table 5：Importance Analysis of Assessment Criteria (Secondary Criteria) of Service Quality

Evaluation criterion (Secondary criterion)	B1. Tangibles	B2. Reliability	B3. Responsiveness	B4. Assurance	B5. Empathy	Weight	Order
B1. Tangibles	1	1.197	1.136	1.571	1.321	0.236	*2*
B2. Reliability	0.836	1	2.129	1.764	1.996	0.276	*1*
B3. Responsiveness	0.880	0.470	1	1.641	1.500	0.193	*3*
B4. Assurance	0.636	0.567	0.609	1	2.089	0.167	*4*
B5. Empathy	0.757	0.501	0.667	0.479	1	0.128	*5*
Column subtotal	4.109	3.734	5.542	6.455	7.907	1	
λmax=5.153、C.I.=0.038、C.R.=0.034, indicating the consistence of statistical results							

(3) Importance analysis of the assessment criteria (secondary criteria) of perceived value

The assessment criteria (secondary criteria) of perceived value included "Emotional Dimension", "Social Dimension", "Quality/Performance" and "Price/Value for Money". Table 6 showed the analysis results of their importance. The C.I. and C.R. were 0.032 and 0.036 respectively, both smaller than 0.1, indicating the consistence of this study during the pairwise comparison of assessment criteria (secondary criteria) of perceived value. Additionally, among the assessment criteria of perceived value, the weights of "Emotional Dimension" and "Quality/Performance" were 0.335 and 0.301, larger than those of "Price/Value for Money", and "Social Dimension". It meant that regarding perceived value, the consumers were most concerned about the emotional dimension and quality/performance; by comparison, they focused more on the emotional dimension than

quality/performance.

Table 6：**Importance Analysis of Assessment Criteria (Secondary Criteria) of Perceived Value**

Evaluation criterion (Secondary criterion)	C1. Emotional	C2. Social	C3. Quality/ value	C4. Price/value	Weight	Order
C1.Emotional	1	2.372	1.265	1.288	0.335	*1*
C2.Social	0.422	1	0.755	0.806	0.169	*4*
C3.Quality/ value	0.791	1.325	1	2.309	0.301	*2*
C4.Price/value	0.777	1.240	0.433	1	0.195	*3*
Column subtotal	2.989	5.937	3.453	5.403	1	
λmax=4.097、C.I.=0.032、C.R.=0.036, indicating the consistence of statistical results						

(4)   Importance analysis of the assessment criteria (secondary criteria) of restaurant location

The assessment criteria (secondary criteria) of restaurant location included "Transportation", "Commercial Area", "Economic Factors", "Competition" and "Environment". Table 7 summarized the analysis results of their importance. The C.I. and C.R. were 0.061 and 0.054 respectively, both smaller than 0.1, indicating the consistence of this study during the pairwise comparison of assessment criteria (secondary criteria) of restaurant location. Moreover, among the assessment criteria of restaurant location, the weight of "Transportation" was 0.356, larger than those of other assessment criteria. It meant that regarding restaurant location, the consumers cared most about transportation.

Table 7：**Importance Analysis of Assessment Criteria (Secondary Criteria) of Restaurant**

Evaluation criterion (Secondary criterion)	D1. Transportation	D2. Commercial area	D3. Economic factors	D4. Competition	D5. Environment	Weight	Order
D1. Transportation	1	2.907	2.330	2.579	1.643	0.356	*1*
D2. Commercial area	0.344	1	1.878	2.200	1.365	0.210	*2*
D3. Economic factors	0.429	0.533	1	2.259	1.361	0.173	*3*
D4. Competition	0.388	0.454	0.443	1	1.358	0.121	*5*
D5. Environment	0.609	0.733	0.735	0.737	1	0.140	*4*
Column subtotal	2.769	5.627	6.386	8.775	6.727	1	
λmax=5.243、C.I.=0.061、C.R.=0.054, indicating the consistence of statistical results							

4.3 COMPREHENSIVE ANALYSIS OF THE FACTORS THAT IMPACTED VEGETARIAN RESTAURANT OPERATION IN MIAOLI COUNTY

After the related weights of all influencing aspects and assessment criteria were revealed, their overall weights were then measured, based on which their importance was further sequenced, as shown in Table 8.

Table 8：**The Overall Sequence of Assessment Criteria for Vegetarian Restaurant Operation in Miaoli County**

Influencing aspects (primary criterion)	Primary criterion weights	Assessment criteria (secondary criterion)	Secondary criterion weights	Secondary criterion sequenced	overall weights	Overall Sequence
A. Food quality	0.591	A1. Variety	0.250	2	0.148	*2*
		A2. Healthiness	0.286	1	0.169	*1*
		A3. Taste	0.152	4	0.090	*4*
		A4. Freshness	0.231	3	0.136	*3*
		A5. Temperature	0.081	5	0.048	*6*
B. Service quality	0.188	B1. Tangibles	0.236	2	0.044	*8*
		B2. Reliability	0.276	1	0.052	*5*
		B3. Responsiveness	0.193	3	0.036	*10*
		B4. Assurance	0.167	4	0.032	*11*
		B5. Empathy	0.128	5	0.024	*14*
C. Perceived value	0.141	C1. Emotional	0.335	1	0.047	*7*
		C2. Social	0.169	4	0.024	*15*
		C3. Quality/ value	0.301	2	0.043	*9*
		C4. Price/value	0.195	3	0.027	*13*
D. Restaurant location	0.080	D1. Transportation	0.356	1	0.028	*12*
		D2. Commercial area	0.210	2	0.017	*16*
		D3. Economic factors	0.173	3	0.014	*17*
		D4. Competition	0.121	5	0.010	*19*
		D5. Environment	0.140	4	0.011	*18*

Firstly, sequenced by the overall weights of the four influencing aspects (primary criteria) and nineteen assessment criteria (secondary criteria), "Healthiness" (0.169), "Variety" (0.148), "Freshness" (0.136) and "Taste" (0.090), ranked first, second, third and fourth respectively, accounting for approximately 54.3% of the total weights. Besides, they all fell into the category of food quality factors. This result indicated that as for the consumers, the factors that impacted vegetarian restaurant operation in Miaoli County centered on food quality.

Secondly, "Reliability" (0.052), "Temperature" (0.048), "Emotional Dimension" (0.047), "Tangibles" (0.044) and "Quality/Performance" (0.043), ranked fifth to ninth respectively, taking up about 23.4% of the total weights. In terms of the overall weights, these five assessment criteria did not differ much from each other. This sequence may vary according to the different basic information about respondents. Moreover, "Temperature" belonged to the food quality factors. "Reliability" and "Tangibles" were among the factors influencing service quality. "Emotional Dimension" and "Quality/Performance" pertained to the perceived value factors.

Thirdly, "Responsiveness" (0.036), "Assurance" (0.032), "Transportation" (0.028), "Price/Value for Money" (0.027), "Empathy" (0.024) and "Social Dimension" (0.024), ranked tenth to fifteenth respectively, occupying around 17.1% of the total weights. Similarly, these six assessment criteria did not differ much from each other in their overall weights. However, the consumers seemed to attach more importance to the quality of services provided by vegetarian restaurants than their personal experience in consumption.

Lastly, "Commercial Area" (0.017), "Economic Factors" (0.014), "Environment" (0.011) and "Competition" (0.010) ranked sixteenth to nineteenth respectively, accounting for about 5.2% of the total weights. These four assessment criteria were not that different from each other and belonged to the same category of restaurant location factors. As indicated by this result, except "Transportation", other assessment criteria of restaurant location exerted little influence on the vegetarian restaurant operation in Miaoli County.

5.   CONCLUSION
This study developed an AHP hierarchy based on four influencing aspects (primary criteria) and nineteen assessment criteria (secondary criteria). The AHP questionnaire investigation and statistical analysis led to the following three results:

(1) According to the related weights of influencing aspects (primary criteria), as far as the consumers were concerned, "Food Quality" was the most critical factor that impacted vegetarian restaurant operation in Miaoli County; the influence of "Service Quality" and "Perceived Value" did not differ much; "Restaurant Location" exerted minimal impact.

(2) According to the related weights of assessment criteria (secondary criteria) under the categories of all influencing aspects, the attributes of "Food Quality" that the consumers were most concerned about were "Healthiness", "Variety" and "Freshness"; the attributes of "Service Quality" that the consumers attached most importance to were "Reliability" and "Tangibles"; the attributes of "Perceived Value" the consumers emphasized most were "Emotional Dimension" and "Quality/Performance"; the attribute of "Restaurant Location" the consumers cared about most was "Transportation".

(3) According to the overall weights of all assessment criteria (secondary criteria), the "Healthiness", "Variety", "Freshness" and "Taste" under "Food Quality" were the key factors that influenced vegetarian restaurant operation in Miaoli County.

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