Evaluating Key Customer Value Factors for International Air Courier Service Providers

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Abstract: - Customer value has become the key to achieve customer satisfaction and loyalty in the future by the international air courier industry. The main purpose of this article was to apply the fuzzy analytic hierarchy process (AHP) method to study the key customer value factors for international air courier service providers based upon Taiwanese customers' perspective. At first, a hierarchical structure with four assessment aspects and twenty assessment factors was constructed. Then, the proposed fuzzy AHP method was to employ to measure the relative weights via the AHP experts' questionnaires for customer value factors. Finally, the empirical results showed that: (1) 'time' is the highest assessment aspect for customer value; and (2) the top six key customer value factors for international air courier service providers are 'inland transit time at both ends of the warehouse and the airport,' 'lower administrative processing time,' 'warehouse processing and handling time,' 'high accuracy,' 'fast turnover rate,' and 'high safety.' Furthermore, the first six factors are mainly distributed in 'time' and 'quality' value metrics. Hence, the international air courier industry should strengthen the related factors of 'time' and 'quality' value metrics, in order to provide customers with higher customer value.

Key-Words: - Customer value; Courier service provider; Fuzzy analytic hierarchy process (AHP)

1 Introduction

Air cargo transport services mainly include air mail, air freight, and air courier [1]. Air mail is used to mail general letter documents. Air freight is used to transport general cargo with all-cargo carriers. Air courier is used to carry small packages, commercial documents, and samples, as it can complete the delivery process with faster processing flow. In recent years, short and light products are especially suitable for air cargo transportation due to its fast changing business activities. Customer demands for a small number of diversified goods is increasing, and the exchange of international trade and various commercial activities have gradually increased. International air courier service providers have become important logistics providers in air cargo transportation under the concept of fast, economical, and perfect logistics professional services.

Due to customers' various interest measurements for speed (time), cost, service, and quality, as provided by the traditional international freight industry, the main service providers of the international air courier market have been born in succession [2], as the reliability and timeliness of these freight companies are unable to fully meet the needs of the international market. In addition, due to the continuous changes of global business activities, these providers must ensure that the delivery of various goods can be handled at a specified time. The rapid and reliable delivery services, as provided by the international air courier industry, can gradually meet the requirements of the operation and development of multinational enterprises.

Regarding marketing, good quality service, as provided by international air courier freight providers, is an important factor related to the shipper's repurchase or maintenance of customer loyalty [1, 3]. In order to win the favor of shippers, international air courier freight providers must provide the best service and quality to gain competitive advantages with the minimum time and cost to customers. Johansson et al. [4] suggested that enterprises are committed to customer service, improving customer value, and creating the joining

of new customers, in order to bring more revenue and profit for the enterprise, which is a very important part of business operations. Kotler [5] indicated that customer value is the main development core of the marketing theory and the concept of customer value, which has been widely used in various related service fields. Customer value is one of the important sources of competitive advantage, while mining and meeting customer value has become one of the important focuses of modern marketing. Therefore, how to provide specific elements to satisfy customer value will have positive significance [6] on the competition and development of the international air courier industry under such a competitive international air courier transportation market.

From the above point of view, customer value has become the key to achieve customer satisfaction and loyalty in the future by the international air courier industry in face of the increasingly competitive global air freight market [3]. In addition, providing the best customer value is one of the important topics of competitiveness assessment [7] in the international air courier industry, as well as one of the important reference indices for customer selection of consignment services. Therefore, this study aims to evaluate the key factors influencing customer value in the international air courier industry, in order to provide a reference for the international air courier industry to improve customer value.

Because the evaluation of customer value involves numerous assessment aspects and factors, the evaluation scope is very complex and extensive. The *Analytic Hierarchy Process* (AHP) [8] is one of the commonly used methods for systematizing complex problems. Hence, we use the AHP method to evaluate the relative importance for key customer value factors. In addition, the assessment factors of customer value have qualitative and ambiguous characteristics in this paper. Therefore, this study employs the fuzzy set theory [9] with the cooperation of the AHP method to construct a fuzzy AHP method to evaluate key customer value factors for international air courier service providers in Taiwan.

In summary, the main purpose of this article is to employ the fuzzy AHP method to evaluate key customer value factors for international air courier service providers. The first section provides background information concerning this issue, the following section describes the preliminary important customer value factors. The fuzzy AHP method is proposed in Section 3. The fourth section consists of an empirical study, and the final section presents conclusions.

2 Preliminary Important Customer Value Factors

What is the value required by customers? Consumers focus on the appropriate value combination [10] of proper price, good quality, timely delivery, good service, and suitable characteristics. Enterprise that can provide such combined values will be the best choice for customers, and they will be the real winner in the market. In essence, enterprises should provide customers with extraordinary customer values, making it become the first choice of the customer and facilitating it to stand out from a highly competitive environment under the dominant value choice of the customer.

Customer value is the total benefit and total reduced cost, as acquired by the customer according to their subjective perception after using the product or service, as well as the overall evaluation [11] for the utility of the product or service performed by the customer. The benefits are the product attributes, brand, and service quality, while the costs are time, money, and risk. Customer value is the overall evaluation formed by the customer after the continuous trade-off between interests and benefits. As a result, customer value will gradually increase as the customer's interest increases and / or the costs of the customer decreases [12].

The international air courier industry is a part of the air transportation industry. How to provide suitable value combinations to the customers, and which customer value criteria do they choose to select the best international air courier company? Johansson et al. [4] adopted four metrics - service, quality, cost, and cycle time - to evaluate value. They indicated that most company focus on enhancing service and quality, and at the same time decreasing cost and time to their customer. We therefore adopted the concepts of four value metrics to evaluate customer value in this paper. Based on a detail literature review [1, 2, 4, 7, 13-23] and comprehensive interviews (three major international air courier service providers in Taiwan) conducted by the authors, four assessment aspects with twenty assessment factors were finally suggested, and their code names were shown in the parentheses.

(1) Service (A_1). Experience shows that excellent service can achieve higher customer satisfaction, and can create more profit and greater market share. Five assessment factors can be

summarized to measure the 'service' aspect. They are 'high frequency rate of flights (F_{11}),' 'availability of intermodal transport system service (F_{12}),' 'diverse value-added services (F_{13}),' 'equipment facilities' availability and diversity (F_{14}),' and 'extensive marketing access network (F_{15}).'

(2) Quality (A_2). Providing the right quality is loved and accepted by customers. Consumers will pay attention to the clear quality of the product and compare it with competitors in the market. The 'quality' aspect can be measured by combining five assessment factors. They are 'high accuracy (F_{21}),' 'high safety (F_{22}),' 'fast response (F_{23}),' 'high emergency handling capability (F_{24}),' and 'comprehensive deepening of high quality (F_{25}).'

(3) Cost (A_3). Cutting costs to provide lower prices is a basic concept; therefore, lowering total logistics costs can create higher value and benefits for customers. The 'cost' aspect is measured by a combination of five assessment factors. They are 'low freight (F_{31}),' 'pricing flexibility (F_{32}),' 'clear price list (F_{33}),' 'lower operating costs (F_{34}),' and 'lower miscellaneous costs (F_{35}).'

(4) Time (A_4). Time-based competition has become an increasingly important issue in the international air courier freight service market. Consumers are becoming more and more sensitive to 'time' aspect, so time and speed create a differentiation between international air courier service providers. Five assessment factors are summarized to measure the 'time' aspect. They are 'lower administrative processing time (F_{41}),' 'warehouse processing and handling time (F_{42}),' 'air cargo delivery time (F_{43}),' 'fast turnover rate (F_{44}),' and 'inland transit time at both ends of the warehouse and the airport (F_{45}).'

3 The Fuzzy AHP Method

The concepts of fuzzy numbers and the proposed fuzzy AHP method are briefly introduced in this section.

3.1 The concepts of fuzzy numbers

In a universe of discourse X, a fuzzy subset A of X is defined by a membership function $f_A(x)$, which maps each element x in X to a real number in the interval $[0,1]$. The value of function $f_A(x)$ represents the grade of membership of x in A.

A fuzzy number A [24] in real line $\Re$ is a triangular fuzzy number if its membership function $f_A : \Re \to [0,1]$ is

$$f_A(x) = \begin{cases} (x-c)/(a-c), & c \le x \le a \\ (x-b)/(a-b), & a \le x \le b \\ 0, & otherwise \end{cases}$$

with $-\infty < c \le a \le b < \infty$. A triangular fuzzy number can be denoted by (c, a, b).

In this paper, Zadeh's extension principle [9] is employed to perform algebraic operations involving fuzzy numbers. Let $A_1 = (c_1, a_1, b_1)$ and $A_2 = (c_2, a_2, b_2)$ be fuzzy numbers. The algebraic operations of any two fuzzy numbers A_1 and A_2 can be expressed as:

(1) Fuzzy addition, $\oplus$:

$$A_1 \oplus A_2 = (c_1 + c_2, a_1 + a_2, b_1 + b_2);$$

(2) Fuzzy subtraction, $\ominus$:

$$A_1 \ominus A_2 = (c_1 - b_2, a_1 - a_2, b_1 - c_2);$$

(3) Fuzzy multiplication, $\otimes$:

$$k \otimes A_2 = (kc_2, ka_2, kb_2), \quad k \in \Re, \ k \ge 0;$$

$$A_1 \otimes A_2 \cong (c_1c_2, a_1a_2, b_1b_2), \quad c_1 \ge 0, \ c_2 \ge 0.$$

(4) Fuzzy division, $\oslash$:

$$(A_1)^{-1} = (c_1, a_1, b_1)^{-1} \cong (1/b_1, 1/a_1, 1/c_1), \ c_1 > 0;$$

$$A_1 \oslash A_2 \cong (c_1/b_2, \ a_1/a_2, \ b_1/c_2), \quad c_1 \ge 0, \ c_2 > 0$$

3.2 Steps of fuzzy AHP method

Eight steps of the fuzzy AHP method are described below.

3.2.1 Step 1: Developing a hierarchical structure

This step employs the hierarchical framework diagram shown in Figure 1. In this framework, the research problems (goal) lie on the *Goal* layer. There are k assessment aspects on the *Aspects* layer, and $p + \cdots + q + \cdots + r$ assessment factors on the *Factors* layer.

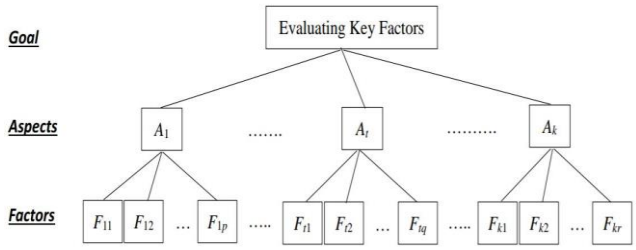

Figure 1. The hierarchy structure

3.2.2 Step 2: Collecting pairwise comparison matrices for decision attributes

We chose experts to compile pairwise comparison matrices for decision attributes, which represented the relative importance of each pairwise attribute.

(1) Let $x_{ij}^h \in [\frac{1}{9}, \frac{1}{8}, \ldots, \frac{1}{2}, 1] \cup [1, 2, \ldots, 8, 9]$, , $h = 1, 2, \ldots, n,$ be the relative importance given to assessment aspects *i* to assessment aspect *j* by expert *h* on the *Aspects* layer. Then, the pairwise comparison matrix is defined as $[x_{ij}^h]_{k\times k}$.

(2) Let $x_{uv}^h \in [\frac{1}{9}, \frac{1}{8}, \ldots, \frac{1}{2}, 1] \cup [1, 2, \ldots, 8, 9]$, , $h = 1, 2, \ldots, n,$ be the relative importance given to assessment factor *u* in comparison with assessment factor *v* by expert *h* on the *Factors* layer. Then, the pairwise comparison matrix with respect to each assessment aspect is defined as $[x_{uv}^h]_{p\times p}, \cdots, [x_{uv}^h]_{q\times q}, \cdots, [x_{uv}^h]_{r\times r}$.

3.2.3 Step 3: Establishing triangular fuzzy numbers

To aggregate all information generated by different averaging operations [25], we use the grade of membership to demonstrate their strength after considering all approaches. Triangular fuzzy numbers characterized through use of min, max and geometric mean operations [8, 26] are therefore used to convey the views of all experts.

Let $x_{ij}^h \in [\frac{1}{9}, \frac{1}{8}, \ldots, \frac{1}{2}, 1] \cup [1, 2, \ldots, 8, 9]$, $h = 1, 2, \ldots, n,\ \forall i,\ j = 1, 2, \ldots, k$, be the relative importance given to assessment aspect *i* in comparison with assessment aspect *j* by expert *h* on the *Aspects* layer. After integrating the opinions of all *n* experts, the triangular fuzzy numbers can be expressed as

$$\tilde{T}_{ij}^A = (c_{ij}, a_{ij}, b_{ij}),$$

where $c_{ij} = \min\{x_{ij}^1, x_{ij}^2, \ldots, x_{ij}^n\}$, $a_{ij} = \left(\prod_{h=1}^{n} x_{ij}^h\right)^{1/n}$, $b_{ij} = \max\{x_{ij}^1, x_{ij}^2, \ldots, x_{ij}^n\}$.

We can integrate the views of all *n* experts on the *Factors* layer in the same way, so that the triangular fuzzy numbers can be expressed as

$$\tilde{T}_{uv}^F = (c_{uv}, a_{uv}, b_{uv}),$$
$$\forall u, v = 1, \ldots, p;\ \cdots;\ \forall u, v = 1, \ldots, q;\ \cdots;\ \forall u, v = 1, \ldots, r,$$

where $c_{uv} = \min\{x_{uv}^1, x_{uv}^2, \ldots, x_{uv}^n\}$, $a_{uv} = \left(\prod_{h=1}^{n} x_{uv}^h\right)^{1/n}$, $b_{uv} = \max\{x_{uv}^1, x_{uv}^2, \ldots, x_{uv}^n\}$.

3.2.4 Step 4: Building fuzzy positive reciprocal matrices

We use the integrated triangular fuzzy numbers to build fuzzy positive reciprocal matrices. For the *Aspects* layer, the fuzzy positive reciprocal matrix can be expressed as

$$T_k^A = \left[\tilde{T}_{ij}^A\right]_{k\times k} = \begin{bmatrix} \tilde{1} & \tilde{T}_{12}^A & \cdots & \tilde{T}_{1k}^A \\ 1/\tilde{T}_{12}^A & \tilde{1} & \cdots & \tilde{T}_{2k}^A \\ \vdots & \vdots & \ddots & \vdots \\ 1/\tilde{T}_{1k}^A & 1/\tilde{T}_{2k}^A & \cdots & \tilde{1} \end{bmatrix},$$

where $\tilde{T}_{ij}^A \otimes \tilde{T}_{ji}^A = 1, \quad \forall i,\ j = 1, 2, \ldots, k.$

The equations of the fuzzy positive reciprocal matrices on the *Factors* layer can be denoted by

$$T_p^F = \left[\tilde{T}_{uv}^F\right]_{p\times p} = \begin{bmatrix} \tilde{1} & \tilde{T}_{12}^F & \cdots & \tilde{T}_{1p}^F \\ 1/\tilde{T}_{12}^F & \tilde{1} & \cdots & \tilde{T}_{2p}^F \\ \vdots & \vdots & \ddots & \vdots \\ 1/\tilde{T}_{1p}^F & 1/\tilde{T}_{2p}^F & \cdots & \tilde{1} \end{bmatrix},$$

where $\tilde{T}_{uv}^F \otimes \tilde{T}_{vu}^F = 1, \quad \forall u, v = 1, 2, \ldots, p.$

, ……,

$$T_q^F = \left[\tilde{T}_{uv}^F\right]_{q\times q} = \begin{bmatrix} \tilde{1} & \tilde{T}_{12}^F & \cdots & \tilde{T}_{1q}^F \\ 1/\tilde{T}_{12}^F & \tilde{1} & \cdots & \tilde{T}_{2q}^F \\ \vdots & \vdots & \ddots & \vdots \\ 1/\tilde{T}_{1q}^F & 1/\tilde{T}_{2q}^F & \cdots & \tilde{1} \end{bmatrix},$$

where $\tilde{T}_{uv}^F \otimes \tilde{T}_{vu}^F = 1, \quad \forall u, v = 1, 2, \ldots, q.$

, ……, and

$$T_r^F = \left[\tilde{T}_{uv}^F\right]_{r\times r} = \begin{bmatrix} \tilde{1} & \tilde{T}_{12}^F & \cdots & \tilde{T}_{1r}^F \\ 1/\tilde{T}_{12}^F & \tilde{1} & \cdots & \tilde{T}_{2r}^F \\ \vdots & \vdots & \ddots & \vdots \\ 1/\tilde{T}_{1r}^F & 1/\tilde{T}_{2r}^F & \cdots & \tilde{1} \end{bmatrix},$$

where $\tilde{T}_{uv}^F \otimes \tilde{T}_{vu}^F = 1, \quad \forall u, v = 1, 2, \ldots, r.$

3.2.5 Step 5: Calculating the fuzzy weights of the fuzzy positive reciprocal matrices

Let $\tilde{R}_i^A = \left(\tilde{T}_{i1}^A \otimes \tilde{T}_{i2}^A \otimes \cdots \otimes \tilde{T}_{ik}^A\right)^{1/k}$, $\forall i = 1, 2, \ldots, k,$ be the geometric mean of triangular fuzzy number of the i^{th} assessment aspect on the *Aspects* layer. The fuzzy weight of the i^{th} assessment aspect can then be expressed as

$$\tilde{W}_i^A = \tilde{R}_i^A \otimes \left(\tilde{R}_1^A \oplus \tilde{R}_2^A \oplus \cdots \oplus \tilde{R}_k^A\right)^{-1}$$

For convenience, the fuzzy weight is expressed as $\tilde{W}_i^A = (c_i^{Aw}, a_i^{Aw}, b_i^{Aw})$.

By the same concept, Let $\tilde{R}_u^F = \left(\tilde{T}_{u1}^F \otimes \tilde{T}_{u2}^F \otimes \cdots \otimes \tilde{T}_{up}^F\right)^{1/p}, \quad \forall u = 1, 2, \ldots, p,$ be the geometric mean of triangular fuzzy number of u^{th} factor on the *Factors* layer. Then, the fuzzy weight of u^{th} factor can be denoted by $\tilde{W}_u^F = \tilde{R}_u^F \otimes \left(\tilde{R}_1^F \oplus \tilde{R}_2^F \oplus \cdots \oplus \tilde{R}_p^F\right)^{-1}$, where the fuzzy weight is denoted by $\tilde{W}_u^F = (c_u^{Fw}, a_u^{Fw}, b_u^{Fw})$.

For saving space, the fuzzy weights of $[(p + \cdots + q + \cdots + r) - p]$ factors can be obtained by the above-mentioned method. For saving space, the equations of fuzzy weights are omitted to reason by analogy on the *Factors* layer.

3.2.6 Step 6: Defuzzifying the fuzzy weights to obtain crisp weights

To perform defuzzification in an effective manner, the graded mean integration representation (GMIR) method proposed by Chen and Hsieh [27] is used to defuzzify the fuzzy weights.

Let $\tilde{W}_i^A = (c_i^{Aw}, a_i^{Aw}, b_i^{Aw})$, $\forall i = 1, 2, \ldots, k,$ be k triangular fuzzy numbers. The GMIR of crisp weights k can then be expressed as

$$G(\tilde{W}_i^A) = \frac{c_i^{Aw} + 4a_i^{Aw} + b_i^{Aw}}{6}, \ \forall i = 1, 2, \ldots, k.$$

The defuzzification of fuzzy weights on the *Factors* layer can be performed using an analogous method.

3.2.7 Step 7: Standardizing the crisp weights

To facilitate comparison of the relative importance of assessment aspects on different layers, the crisp weights are standardized and expressed as

$$CW_i^A = G(\tilde{W}_i^A) \Big/ \sum_{i=1}^{k} G(\tilde{W}_i^A)$$

3.2.8 Step 8: Calculating the integrated weights for each layer

Let CW_i^A and CW_u^F be the normalized crisp weights on the *Aspects* and *Factors* layers. Then,

(1) The integrated weight of each assessment aspect on the *Aspects* layer is

$$IW_i^A = CW_i^A, \ \forall i = 1, 2, \ldots, k.$$

(2) The integrated weight of each assessment factor on the *Factors* layer is

$$IW_u^F = CW_i^A \times CW_u^F, \ \forall i = 1, 2, \ldots, k;$$

$\forall u = 1, \ldots, p; \ \cdots; \ \forall u = 1, \ldots, q; \ \cdots; \ \forall u = 1, \ldots, r$.

4 Empirical Study

4.1 Data collection

In this section, the AHP expert questionnaire based on the four assessment aspects and 20 assessment factors was designed, and was applied to evaluate the relative weights of all assessment factors of customer value. To check whether the expressions were clear or important questions were missed, five operation managers and three scholars were invited to pre-test the questionnaire. Finally, two rounds of correction based on questionnaire design principles were carefully performed, and the final AHP questionnaire was completed.

The AHP questionnaires were distributed during a three-month period in 2018. We used the top 200 exporters and importers in Taiwan as the population, recorded in the '*Directory of Excellent Exporters and Importers in 2017, ROC*' (Ministry of Economic Affairs, 2018). The questionnaire was completed by export/import department of each company. The surveys were completed through e-mails, phone calls, and in-person interviews conducted by the authors. The returned questionnaires were checked to determine whether the consistency index (C.I.) of each matrix of every layer was lower than 0.1. When the C.I. value of a matrix is higher than 0.1, this implies that the respondent had made an inconsistent pair-wise comparison of two assessment aspects. To prevent the occurrence of errors, the authors helped such respondents to correct their judgments until the C.I. value of each matrix was lower than 0.1.

A total of 200 questionnaires were issued, of which 63 valid questionnaires were recovered, for an effective recovery rate of 31.5%. In view of Robinson's recommendation [28] that 5-7 experts ideally be enlisted in research on group decision-making problems, the 63 valid recovered questionnaires should be sufficient to provide a representative range of views. As a result, after the 63 questionnaires were checked for validity, the number of responses was deemed acceptable.

4.2 Results

In this case, there are five (1+4) pair-wise comparison matrices to collect. In this section, we used four assessment aspects (i.e., A_1 – A_4 on the *Aspects* layer shown in Figure 1) from the 63 valid questionnaires as an example to illustrate the computational procedures used in the fuzzy AHP

method. The other four pairwise comparison matrices are omitted by reasoning of analogy. The computational process and empirical results are shown as follows.

Step 1. Building fuzzy positive reciprocal matrix

We used relative importance data from the 63 valid questionnaires to compile a pairwise comparison matrix, and then transformed this data into triangular fuzzy numbers through geometric mean method. We then employed these triangular fuzzy numbers to construct a fuzzy positive reciprocal matrix. The fuzzy positive reciprocal matrix for the assessment aspects layer ($A_1 - A_4$) is shown as Table 1.

Table 1. The fuzzy positive reciprocal matrix of four aspects

	A_1	A_2	A_3	A_4
A_1	(1, 1, 1)	(0.250, 0.634, 1)	(0.50, 0.907, 6)	(0.250, 0.511, 2)
A_2	(1, 1.577, 4)	(1, 1, 1)	(0.50, 1.079, 3)	(0.333, 0.886, 2)
A_3	(0.167, 1.103, 2)	(0.333, 0.927, 2)	(1, 1, 1)	(0.50, 0.871, 2)
A_4	(0.50, 1.957, 4)	(0.50, 1.129, 3)	(0.50, 1.148, 2)	(1, 1, 1)

Step 2. Calculating the fuzzy weights of fuzzy positive reciprocal matrix

In keeping with Step 5 of the fuzzy AHP method, the geometric means of the triangular fuzzy number ($\tilde{R}_i^A$) and the fuzzy weights ($\tilde{W}_i^A$) of four assessment aspects are as shown in Table 2.

Table 2. The geometric mean of triangular fuzzy number and the fuzzy weights

	$\tilde{R}_i^A$	$\tilde{W}_i^A$
$i = A_1$	(0.420, 0.736, 1.861)	(0.053, 0.181, 0.903)
$i = A_2$	(0.639, 1.108, 2.213)	(0.080, 0.272, 1.073)
$i = A_3$	(0.408, 0.971, 1.682)	(0.051, 0.238, 0.816)
$i = A_4$	(0.595, 1.262, 2.213)	(0.075, 0.309, 1.073)

Step 3. Defuzzifying the fuzzy weights and standardizing the crisp weights

Using Step 6 of the fuzzy AHP method, the fuzzy weights can be defuzzified by the GMIR method to obtain the crisp weights ($G(\tilde{W}_i^A)$). Then, using Step 7 of the fuzzy AHP method, we can obtain the normalized weights (CW_i^A). The results are as shown in Table 3.

Table 3. The defuzzified and standardized weights of four aspects

	A_1	A_2	A_3	A_4
$G(\tilde{W}_i^A)$	0.2796	0.3734	0.3033	0.3976
CW_i^A	0.2065	0.2758	0.2240	0.2937

Step 4. Calculating the integrated weights

For saving space, we used the same computational process of the fuzzy AHP method for each assessment factor to obtain the standardized weights. Then, the results of the integrated weights can be shown as Table 4.

The findings of the fuzzy AHP survey were as follows:

(1) Time is the most important aspect of customer value based on the Taiwanese customers' perspective. Quality and cost are ranked in the second and third places. Service is the lowest ranked. Four assessment aspects are very close with the values of importance weights of 0.2937, 0.2758, 0.2240, and 0.2065. This indicated that four assessment aspects are almost equally important in this research. However, these values of importance weights maybe widely different among various industries.

(2) For 'service' aspect, 'high frequency rate of flights' is the most important customer value factor. For 'quality' aspect, 'high accuracy' is the most important customer value factor. For 'cost' aspect, 'low freight' is the most important customer value factor. For 'time' aspect, 'inland transit time at both ends of the warehouse and the airport' is the most important customer value factor.
(3) Daniel believes that most industries have two to six key factors that determine success [29], and a company that hopes to succeed must pay special attention to these key success factors. Hence, the results show that the top six key customer value factors for international air courier service providers in Taiwan are 'inland transit time at both ends of the warehouse and the airport,' 'lower administrative processing time,' 'warehouse processing and handling time,' 'high accuracy,' 'fast turnover rate,' and 'high safety.'

Table 4. The standardized weights and integrated weights

Assessment aspects	Standardized / Integrated weights (x)	Assessment factors	Standardized weights (y)	Integrated weights (z)=(x)*(y)
Service (A_1)	0.2065 (4)	High frequency rate of flights (F_{11})	0.2148 (1)	0.0443 (13)
		Availability of intermodal transport system service (F_{12})	0.1781 (5)	0.0368 (20)
		Diverse value-added services (F_{13})	0.2020 (3)	0.0417 (17)
		Equipment facilities' availability and diversity (F_{14})	0.1964 (4)	0.0405 (19)
		Extensive marketing access network (F_{15})	0.2088 (2)	0.0431 (16)
Quality (A_2)	0.2758 (2)	High accuracy (F_{21})	0.2138 (1)	0.0590 (4)
		High safety (F_{22})	0.2093 (2)	0.0577 (6)
		Fast response (F_{23})	0.2031 (3)	0.0560 (7)
		High emergency handling capability (F_{24})	0.1928 (4)	0.0532 (9)
		Comprehensive deepening of high quality (F_{25})	0.1810 (5)	0.0499 (10)
Cost (A_3)	0.2240 (3)	Low freight (F_{31})	0.2212 (1)	0.0496 (11)
		Pricing flexibility (F_{32})	0.1949 (3)	0.0437 (14)
		Clear price list (F_{33})	0.2088 (2)	0.0468 (12)
		Lower operating costs (F_{34})	0.1939 (4)	0.0434 (15)
		Lower miscellaneous costs (F_{35})	0.1812 (5)	0.0406 (18)
Time (A_4)	0.2937 (1)	Lower administrative processing time (F_{41})	0.2026 (2)	0.0595 (2)
		Warehouse processing and handling time (F_{42})	0.2018 (3)	0.0592 (3)
		Air cargo delivery time (F_{43})	0.1872 (5)	0.0550 (8)
		Fast turnover rate (F_{44})	0.1982 (4)	0.0582 (5)
		Inland transit time at both ends of the warehouse and the airport (F_{45})	0.2102 (1)	0.0617 (1)

5 Conclusions

This study found that customer value is the utility obtained by customers after purchasing products or services, and the impression left from the service process, as well as the good or bad inner feelings of the customer, which formulate the overall evaluation for the product or service according to value cognition. Good customer value, as provided by international air courier freight providers, has become an important factor related to repurchase or

maintaining customer loyalty by the shipper, and is one of the sources of competitive advantages in the international air courier freight industry, as compared to other industries. Therefore, the ability to provide better customer value has become an important factor in the competitive power of the international air courier industry, as well as an important reference index for the customer to choose consignment service in the face of the increasingly competitive global air freight market.

The main purpose of this paper is to employ the fuzzy AHP method to study the key customer value factors for international air courier service providers in Taiwan. The empirical results mainly find the following. First of all, time is the most important assessment aspect influencing the customer value in Taiwan. The top six key customer value factors are 'inland transit time at both ends of the warehouse and the airport,' 'lower administrative processing time,' 'warehouse processing and handling time,' 'high accuracy,' 'fast turnover rate,' and 'high safety.' Finally, the first 10 factors are mainly distributed in two key value metrics - Time and Quality - among which 4 key customer value factors fall in the 'Time' aspect; 2 key customer value factors fall in the 'Quality' aspect; the remaining customer value factors of the 7-10 places also fall in these two value metrics. Therefore, the international air courier industry should strengthen the related factors of Time and Quality value metrics, in order to provide customers with higher customer value.

Furthermore, this paper with its methodologies developed can be employed as a practical tool for various business applications. Also, an alternatives layer can be added to Figure 1 as a complete hierarchy in the future research, so that we can compare the decision value (performance value) to evaluate the attractiveness of alternatives.

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