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# Evaluation of customer perceptions on airline service quality in uncertainty

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## Abstract

The industries and academics have used various evaluating tools to evaluate the service quality of airline companies in decades due to the various differences emphasized in the outcomes of Multiple Criteria Decision Making, the results have been dissatisfactory to many people. It is urgent and important to clarify the process by which consumers evaluate airline companies. In literature review, there are criteria were used to evaluate the criteria of service quality in the airlines. The purpose sampling method was used to collect effective questionnaire data provided by 145 customers from China Airlines and EVA Airways. The decision-making trial and evaluation laboratory was used to test the cause effect relations and degree of relation among the various evaluation criteria. The research results and managerial implications provided as references to airline companies.

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*Keywords:* service quality, evaluation criteria, DEMATEL, fuzzy set theory

## 1. Introduction

It has become difficult for communication and transportation systems in Taiwan to overcome the easy congestion of highway systems and inefficiency of railway services. The development of industries and commerce has forced Taiwanese to give more importance to time and efficiency, thereby; the airline industries can highlight their timely and rapid service characteristics (Chen, 1997; Chang et al., 1998). Moreover, as the Taiwanese economy prospers, the income of the people also increases day by day, and tourism becomes the daily norm, thereby, causing the domestic land transport to become increasingly saturated. In recent years, Taiwan has actively advanced into Asia's operating center and has caused the competition in the international airline market in Taiwan to reach a climax. Facing the demand and supply of the market mechanism, these airline companies must improve their service quality, so as to strive for bigger market identification.

The airline industry plays an important role in the service sector itself, as well as contributes significantly to other industries through the ability to transport passengers to their required locations all over the globe (Rhoades and Waguespack, 2008). It is suggested that probably the three fundamental factors that affect passenger demand in the airline industry are income, fares and service levels (Hanlon, 1999). The service quality of the airline companies

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have affected the goodwill and consumer satisfaction of the companies and have determined the key factors of their operating costs and profitability. Service quality is usually regarded as the customer's impression of the relative inferiority/superiority of a service provider and its services (Bitner and Hubert, 1994; Tsoukatos and Rand, 2006) to its competing alternative, and is often considered similar to the customer's overall attitude towards the company (Parasuraman et al., 1988). In the past, the researches related to improving the service quality of airline companies is mostly about the PZB service quality model (Berry et al., 1985; Parasuraman et al., 1985), and the PZB service quality expansion model or the basis of SERVQUAL service quality evaluation scale (Parasuraman et al., 1988), to prove the differences between the service quality. This research uses the PZB service quality expansion model as the basis and applies statistical testing to study the differences between the recognition of service quality by customers, managers and service providers. The objective is to understand the determining factors and estimation structure of service quality (Chang, 1998; Gourdin and Kloppenborg, 1991; Hopkins et al., 1993), or to use statistical t testing and ANOVA analysis, ANOVA analysis, Important- Performance Analysis (IPA), or linear structural relations (LISREL) model to recognize the factors or influencing factors of the differences between the service quality, so as to confirm the evaluation criteria of the service quality as well as set the estimation structure (Lin, 1996; Chang, 1997; Gilbert and Wong, 2003). SERVQUAL service quality evaluation scale can also be used to lock in the measures of service quality and through the statistical significant test; the service quality can be estimated (Lin, 1996, Cao and Huang, 1996; Tsai and Hsu, 1997; Fick and Ritchie, 1991; Gourdin and Kloppenborg, 1991; Young et al., 1994; Pakdil and Aydin, 2007). Tsaour et al. (2002) used the fuzzy model to combine AHP and TOPSIS to study the priority order of the various service quality evaluation criteria.

The above two types of researches used statistical test methods to confirm the significance of the various evaluation criteria in the service quality evaluation scale, then, based on the significant difference of the items, strategies are suggested or the evaluation structure of the service quality is further analyzed, so as to provide references to airline companies to improve their service quality. However, Hess (2008) is skeptical about the accuracy of the above methods and these methods cannot control the order of the various factors that influence the service quality of the airline companies, or find out the degree of relations of the various evaluation factors of the overall structure. Therefore, it is difficult to provide specific and complete suggestions on the influences derived from the various factors of quality evaluation criteria, as well as the priority order of follow-up improving measures. The decision making trial and evaluation laboratory (DEMATEL) can make up for the inadequacy of these research methods. Besides the fact that the complex relations of the various criteria influence the strategic quality, fuzzy situations and linguistic uncertainties are also other problems during the strategy process (Lin and Wu, 2004; Wang, 2011).

This research combines the DEMATEL method and fuzzy linguistic method to accurately determine the characteristics of various situations in the contrived strategic process and appropriately describe the various evaluation criteria, so as to study the service quality connotations and the cause-effect relations and degrees of association among the various evaluation criteria of an ideal airline company. In short, the research objectives of this study include:

- (1) To study the service quality evaluation criteria connotations of airline companies.
- (2) To study the relations among the various evaluation criteria.
- (3) To study the influencing relations among the various evaluation criteria.

From the above research objectives, the connotations of service quality evaluation criteria of airline companies in the hearts of consumers can be understood. The key attributes that affect the service quality of airline companies can be conformed, which would help airline companies to look after their businesses as well as customer needs under limited resources and effectively control the main points and properly develop effective cases to improve the service quality of airline companies.

## 2. Literature Review

The service quality not only influences the goodwill and consumer satisfaction of airline companies, but also determines the key factors of their operating costs and profitability. Not only can airline companies with good service quality retain their original customers, but word-of-mouth communication can increase their customer sources and improve internal operating achievements, thereby, strengthening their competitive advantage in the markets. In the past, related researches did not have a deep study of the relations among the various factors of service quality. This can be compensated by the effective use of decision making trial and evaluation laboratory (DEMATEL) method used in the study of social sciences. The following related literatures on the service quality of

airline companies and DEMATEL method can be reviewed and the discussions of scholars can be generalized to structure the connotations of the service quality evaluation criteria of airline companies.

### **2.1 Literature review of the service quality of airline companies**

Service quality has received much importance because of its ability to sustain as a source of competitive advantage. Service quality has been defined in many different ways by researchers. Kasper et al. (1999) defined service quality as “the extent to which the service, the service process and the service organization can satisfy the expectations of the user”. Parasuraman et al. (1988) defined service quality as “a function of the difference between service expected and customers’ perceptions of the actual service delivered”. Gronroos (1978) suggested that service quality is made of two components – technical quality and functional quality. Technical quality refers to what the service provider delivers during the service provision while functional quality is how the service employee provides the service. Customers are the sole judges of service quality. They assess service quality by comparing what they want or expect with what they perceive they are getting.

With regards to the studies of service quality of airline companies, many international and domestic scholars have studied it on the basis of PZB service quality model and PZB service quality expansion model or SERVQUAL service quality evaluation criteria, aiming to carry out empirical research on the differences in the service quality. The research of Young et al. (1994) used the measuring methods of SERVQUAL and traditional industries as the basis to estimate and identify service quality. The research results showed that some items of the service quality evaluation criteria in the SERVQUAL and industrial basis will positively influence the consumers on their recognition of the overall service quality and their intentions to repurchase. On the other hand, Lin (1996) carried out an empirical study on the managers, service providers and customers of domestic airline companies, so as to understand the customers’ recognition of the service quality evaluation criteria of the domestically flying airline companies, as well as a deeper study on the differences caused during the transferring process of service quality and the influences of these differences on the current management situations of airline companies and the methods they use to improve. The research results showed that the main reason for the differences in the service quality was caused by the difference in the service known to the service providers and the real service standards received by the customers. This difference was the main reason for the apparent difference in the customers’ expectations and the real service they get.

Moreover, considering the intangibility characteristic of service, when travelers estimate service quality, there is fuzziness on the recognition of some linguistic variables. Cao and Huang (1996) implemented the fuzzy theory into the calculation of the value criteria performance, and then used the AHP method to obtain the criteria weights. The multiple criteria decision making method was then combined to carry out the estimation of service quality of airline companies. The research results showed that travelers gave the most importance to the tangible structure of the service quality estimation dimension and the least importance to the emotional dimension. The service quality evaluation criteria that travelers gave the most importance to are called the “friendly service attitude” and “flight safety”, rather than “extended services to the travelers” and “provision of books, newspapers and entertainment programs”. In short, related domestic researches lay particular emphasis on the overall structure of service quality. For instance, Chang and Yeh (2002) used the PZB theoretical structure to measure the merits of service quality. Tsai and Hsu (1997) used the fuzzy linguistics questionnaire to estimate the service quality of various airline companies. Chang (1997) studied the theoretical model of the service quality of airline companies. Not many researches were done on the effective evaluation criteria connotations of the service quality of airline companies and relationship of the direct and indirect influences among them are still unknown.

### **2.2 Service quality evaluation criteria connotations of airline companies**

The related research methods and objectives of service quality of airline companies are different among different scholars. For example, Chang and Yeh (2002) aimed at the influencing factors of the service quality of airline companies and used the PZB theory as the structure and used the importance-performance analysis to plot the attribute diagram for further analysis, so as to measure the merits of the service quality. Hsu et al. (2009) used PZB to provide the differences between the recognized service and the expected service. Fuzzy linguistics questionnaires were used to estimate the evaluation of service quality attributes of various airline companies. Chang (1997) used the PZB model and service quality expansion model as the basis of the theory and studied the influences on the conceptual model of the service quality of airline companies. White and Yu (2005) used the issue of the differences in the customers’ recognition of service quality of airline companies and carried out interviews with the representative customers and managers of airline companies and used the factor analysis method to generalize the estimated dimension of the service quality.

Scholars have different views regarding the use and settings of the service quality evaluation criteria of airline companies. Su (1995) aimed at the airline companies used by people and sorted out 30 items such as the flight safety, airplane repair capacity, pilot skills, on-time flights, ideal ticket prices, etc. that influenced the corporate image. Lin (1996) aimed at the domestic routes and suggested 19 items of service quality characteristics of airline companies and also suggested that “service providers should have the zeal to serve, good manners and a smile” and “low rates of flight breakdown and accidents” had the highest degree of influence on the overall service quality standards. Huang (1996) pointed out that the series of service quality evaluation criteria highly valued by travelers include friendly service attitude, flight safety and clean and comfortable cabins. The least important ones include extended travel services, provision of books, newspapers and entertainment programs and neat and tidy apparel and appearance. Hsu et al. (2009) used the fuzzy theory to establish an effective service quality management model and pointed out that the importance given by consumers on safety was higher than that of comfort, convenience and service attitudes, whereas, passengers gave priorities to flight safety, manners and service attitudes of flight attendants, convenience of purchasing tickets. Yeh (2003) pointed out that the sequence of airline service quality items that passengers give importance to include flight safety, customer rights, ideal ticket prices, on-time flights. Lin (1997) also pointed out that the airline service quality that travelers gave much importance to include flight safety, on-time flights, and convenient selections of flight time. Huang et al. (2000) carried out an empirical study on the service quality of airline companies and found out that the 9 variables that influenced the overall service quality standards of airline companies include flight meals, flight safety, seat reservation procedures, on-time flights, appearances of flight attendants, comfortable seats, professional capabilities of flight attendants, advertisement contents, rates of flight breakdowns, etc. Chang and Chang (2000) carried out an empirical study on airline companies and pointed out that there were differences in the degree of importance given by the airline companies and customers on the service quality dimension and the implementation of service quality improves the marketing strategies. This is helpful in the overall service quality ranking of airline companies.

Domestic researches on airline quality lay particular stress on the service quality model, service transferring processes, differentiation of consumers, or a further study on the concepts at the managerial and consumer levels. For example, Sasser et al. (1978) pointed out the service standards integrated model, Gronroos (1984) emphasized the service blueprint model, Albrecht (1985) used the triangular model of service strategies, systems and personnel, Parasuraman et al. (1985) used the inadequacy model and expansion model (Parasuraman et al., 1988). The research focus of the above methods pointed out a complete concept; however, they were unable to explain the relationships among the various influencing factors. In other words, among the various influencing service quality factors, it was difficult to recognize which ones were the casual factors, which ones were the effect factors, and under these limitations of human resources and resources, it is difficult to effectively control and further solve the key factors. This research uses the service quality requirements of Parasuraman et al. (1988) as the basis and collected literatures that confirmed to the current situations of domestic airlines and set 10 items of service quality evaluation criteria of airline companies, which is shown in table 1. This is used as the demand items that were needed to be considered when customers evaluate the service quality of the airline companies.

Table 1 Service quality evaluation criteria of airline companies

Quality Dimension	Quality Evaluation Criteria	Scholars (Time)
Reliability	C1. Flight safety	Su (1995); Huang (1996); Lin (1997); Yeh (2003); Tsai and Hsu (1997); Huang, Kung and Yu (2000); Liou, Tzeng and Chang (2007); Liou, Yen and Tzeng (2008)
Care and concern	C2. On-time flights	Su (1995); Yeh (2003); Lin (1997) ; Huang, Kung and Yu (2000)
	C3. Arrangement of flight time	Lin (1997); Liou, Yen and Tzeng (2008)
Tangibility	C4. Internal decorations and cleanliness of flight cabins	Disney (1999)
	C5. Comfortable seats in the cabins	Huang (1996); Tsai and Hsu (1997)
	C6. Books, newspapers and entertainment programs on the flight	Huang (1996)

C7. Convenience of baggage check-in and check-out	Tsai and Hsu (1997)
C8. Provision of flight meals	Disney(1999); Huang, Kung and Yu (2000)

Table 1(cont'd)

Assurance	C9. Professional training of flight attendants	Lin (1996); Lin (1997); Huang, Kung and Yu (2000) ; Chang and Chang (2000) ; Liou, Yen and Tzeng (2008)
	C10. Apparel and appearance of the flight attendants	Lin (1996); Huang (1996); Huang, Kung and Yu (2000)
	C11. Service attitude of check-in attendant (ticket reservations and sale)	Lin (1997); Disney (1999); Liou, Yen and Tzeng (2008)
Reaction	C12. Active and rapid response to passenger needs	Chang and Chang (2000)
	C13. Accuracy of various operations	Chang and Chang (2000)
	C14. Initiatively providing the needs of passengers	Disney(1999); Tsai and Hsu (1997); Huang (1996); Chang and Chang (2000)
	C15. Handling of passenger complaints	Tsai and Hsu (1997); Huang (1996); Lin (1997)
Reliability	C16. Flight attendants are able to initiatively take care of passenger needs	Disney(1999); Tsai and Hsu (1997); Huang (1996)
	C17. Truly providing committed services	Huang (1996); Chang and Chang (2000)
Reaction	C18. Seat (designation) and easy booking processes	Huang, Kung and Yu (2000); Tsai and Hsu (1997); Lin (1997)
Care and concern	C19. Rational ticket prices	Su (1995); Yeh (2003)

Sources: Summary of this research

### 2.3 Multiple-criteria decision making (MCDM)

Kaliszewski (2000) pointed out that there is still a big room for development of related researches of multiple-criteria decision making, such as problems solved by some non-existing analytical method or undiscovered analytical method, or even though appropriate calculating methods do exist, but there is the problem of the limitation of time during the calculating process. In other words, if appropriate calculating methods cannot be found, then the calculating efficiency of information technology is far from the calculating capability of men, and can only obtain satisfactory, but poor calculations.

There are many types of multiple-criteria decision making methods. Hwang and Yoon (1981) divided the multiple-criteria decision making methods into three categories with a total of 13 methods, based on whether they can evaluate accurate information to strategists. The widely used methods include Simple Additive Weighting (SAW), Analytical Hierarchy Process (AHP), Technique for Order Preference by Similarity to Ideal Solution method (TOPSIS) and Elimination Et Choice Translating Reality method (ELECTRE), etc.

In the real world, “the complex problems of the multiple-criteria decision making of unknown objectives” and the traditional AHP has limited feasible cases. The best case can be selected among the feasible ones through a set of selective process estimations of various relatively important attributes (Saaty, 1980). At the same time, these limited feasible cases are known beforehand and are often of discrete nature. In short, when the number of strategically feasible cases is too many and causes “complexity”, then the above strategic analyses will be unable to obtain the cause-effect relations of the various evaluation criteria and also limits the evaluation criteria as to which ones should be prioritized to solve first. Therefore, the DEMATEL method came into existence.

## 2.4 Literature review of DEMATEL

DEMATEL originated in 1971 at the Battelle Association research center in Geneva. It was used in the research and solving of globally complex and difficult problems, such as ethnicity, hunger, environmental protection, energy, etc. (Fontela and Gabus, 1976; Gabus and Fontela, 1973). In recent years, since the DEMATEL method can effectively understand complex cause-effect relations structures, viewing the degree of influence between two criteria, and uses matrix and related mathematical theories to calculate the cause-effect relations and strength of influence among the criteria, therefore, it is widely preferred in Japan. This method has shown excellent performance in other professional domains and has received general affirmation (Hori and Shimizu, 1999; Sankar and Prabhu, 2001; Chiu, 2006; Seyed-Hosseini et. al., 2006; Liou and Tzeng, 2007; Lin and Wu, 2004). The related application of the DEMATEL method includes business planning and strategies, city planning and design, geographical and environmental estimations, analysis of global problem groups, etc. Yamazaki et al. (1997) used the DEMATEL method to analyze the hindering factors of social benefits, Hori and Shimizu (1999) used the DEMATEL method to design and estimate the software structures of managerial systems, Tamura et al. (2003) used the DEMATEL method to study the social safety factors, Hu (2003) studied the complexity of business problems, Lin (2005) studied the cause-effect relations of managerial problems and established a model analysis, Liou et al. (2007) used the DEMATEL method to analyze the safety measures model of airline companies and later on obtained the cause-effect relations model on safety criteria. Wu and Lee (2007) also used the DEMATEL method to analyze the competencies of global managers and established the criteria of cause-effect relations model and group strategies of these competencies. Wu (2007) used the DEMATEL method under fuzzy circumstances to select among many evaluation criteria and established appropriate knowledge management strategic mechanisms. Tzeng et al. (2007) also used DEMETLAL analysis to generalize many mutually influencing factors, so as to find out which factors truly possess strategically key factors during the digital learning process. In short, the DEMATEL method has received affirmation from scholars of social science studies and also possesses research efficiencies. Therefore, this study uses the DEMATEL to study the cause-effect strategic criteria of service quality evaluation criteria of airline companies and understand the direct and indirect influencing relations among them. The results can be used as references for follow-up researchers.

## 3. Research Design

The study generalized the results of the above literatures and designed “service quality questionnaires of airline companies”. After item analysis and reliability and validity testing, the service quality evaluation criteria of airline companies were established. Then data was formally collected and analyzed. The calculating process infuses the fuzzy concept into the criteria performance value and obtained the weights and fuzzy performance value of the various criteria to integrate the strategic matrices obtained. Fuzzy DEMETAL was then used to estimate the sorting of the different choices of cases in the service criteria of the overall airline company. The related research methods, research tools, research targets and formal measures of this study are explained as follows.

### 3.1 Research Methods

The cause and effect of any matter are the most interesting research topic of discussion for strategists (Lin and Wu, 2008) and selecting the appropriate methods is an important key. Since strategies involve various complex situational factors, therefore, this study combined the fuzzy linguistic method and experimental research method to study the relationships of the various factors of service quality evaluation criteria of domestic airline companies.

#### A. Fuzzy linguistics method

Whether it is from the point of view of airline company businesses, managers, or consumers, even research instructions, most research objectives attempts to describe the items that are needed to be given attention and improved in the service process of airline companies. These items and names are influenced by research objectives and the individual verbiage differences of scholars, thereby, causing a chaotic situation. In order to avoid the problems caused by synonyms and the needs for follow-up analysis, the study integrated the various factors so as to establish a common terminology. Moreover, during the strategic process, people are influenced by past experiences and knowledge on their thinking model and language expressions. Therefore, the 5 different degrees of linguistic variables in the fuzzy linguistic method are used to provide appropriate corresponding values to triangular fuzzy numbers, separately represented as strongly agree (VH), agree (H), slightly agree (M), disagree (L) and strongly disagree (VL).

The linguistic items of the questions in the questionnaires showed that the linguistic variables are systemized and transformed to form related fuzzy numbers. Chen and Hwang (1992) pointed out five types of linguistic scales and used the triangular and trapezoid fuzzy numbers to show the linguistic items, separately used in two to eleven different linguistic items, and provided the pairing method of fuzzy numbers and linguistic items. Zadeh (1975) considered that linguistic variables are used as value of variables in the terms or term groups of natural languages and not in the numerical values of variables. The fuzzy linguistic method has obtained importance and is used in various domains. Kacprzyk (1986) used the fuzzy linguistic majority concept to point out the solving method of group decision making. Delgado et al. (1992) pointed out the fuzzy linguistic strategic model. Herrera and Verdegay (1993), Herrera and Verdegay (1994) further developed the fuzzy linguistic study of group decision making. Herrera et al. (1996) also pointed out the fuzzy linguistic group decision analysis method of the consensus model. Chen et al. (2000) pointed out the estimation of fuzzy integration of membership value to reduce cost. Carlsson and Fuller (2000) studied the key factors of weighted aggregations and provided a feasible case during the weighted information process. Voxman (2001) divided the canonical representations of the dispersed fuzzy numbers into two kinds and separately pointed out their calculating method. Liu and Song (2001) pointed out the semantic proximity method and used linguistic similarities to estimate the basic concept of the fuzzy association degree. Matarazzo and Munda (2001) considered to limit the traditional linguistic strategies to triangular fuzzy numbers, and provided the integration method to calculate the scale of the fuzzy numbers. Chen (2001) developed a set of multiple criteria decision-making method based on ratings of each alternative and weight of each criterion and finally, estimated the values to decide the location of the distribution center. Herrera et al. (2001) studied the solving path of the linguistic decision model and pointed out that the semantic objectives appropriate for the function of genetic methods.

Fuzzy linguistics method can effectively solve different targets of data interpreting results under fuzzy situations and confirms to the psychological property of respondents. Estimators must carry out comparison estimations on the performance and the weighted attributes of various evaluation criteria. Traditional method involves estimators combining proved results with past experiences and setting a value for them. Since human thoughts and behaviors are expressed through linguistic, in other words, good and very good are not numerical values, therefore, when estimators are asked to set a numerical value to the various decisional attributes, their psychological influences and pressure may cause the inability to give an appropriate linguistic value, therefore, this research generalizes the above researches and uses the fuzzy linguistics method to show the importance weight values of the evaluation criteria, as show in table 2.

Table 2 Linguistic scales for the importance weight of criteria

Linguistic variable	Corresponding triangular fuzzy number
No influence	(0.0, 0.1, 0.3)
Slight influence	(0.1, 0.3, 0.5)
Influence	(0.3, 0.5, 0.7)
Large influence	(0.5, 0.7, 0.9)
Direct influence	(0.7, 0.9, 1.0)

Resource: Wang and Chang(1995)

This study uses the set five grades of linguistic variables in table 2: strongly disagree, disagree, slightly agree, agree, and strongly agree, to calculate the importance of the criteria and the scale of this estimation use the corresponding triangular fuzzy as the basis of “importance of criteria. In view of the overall fuzzy linguistic questionnaire, these fuzzy numbers can be used to explain the relationship of potential and linguistic membership terms.

#### B. DEMATEL implementing steps

After the questionnaires in this study were filled in by 145 airline flight passengers, the filled in data was collected and separately entered and the direct/indirect relation matrices of the various evaluation criteria were calculated and finally, a casual diagram was plotted. The DEMATEL implementing steps are explained as follows:

(1) Define criteria and produce direct-relation matrix: If the number of criteria is  $n$ , then the influencing relationship and degree of pair comparison of the criteria is set, obtaining  $n \times n$  matrix, and is known as direct-relation matrix

and represented by  $Z$ . The  $Z_{ij}$  in the matrix represents the degree of influence of the criterion  $i$  on criterion  $j$ , and the diagonal element  $Z_{ij}$  is set as 0.

This step mainly collects related data and defines 19 items of evaluation criteria, so as to conveniently satisfy the service quality requirements of the passengers of airline companies.

(2) Calculating standardized direct-relation matrix: Let  $\lambda = \frac{1}{\max_{1 \leq i \leq n} (\sum_{j=1}^n z_{ij})}$ , then the element in the overall matrix is

$\lambda$ , then  $X = \lambda \cdot Z$ , then the standardized direct-relation matrix **X** can be obtained.

The objective of step two lies in calculating the standardized direct-relation matrix, so as to develop the evaluation criteria and tools. This development occurs when there is a mutual influence between the criteria; therefore, this step is increasingly important. As mentioned above, this process already carries out a detailed explanation of the linguistics in the various evaluation criteria. The respondents can aim at the mutual influences among the criteria and fill in the five types of degrees, 0-4 based on past experiences (0 represents “no influence”, 1 represents “slight influence”, 2 represents “influence”, 3 represents “large influence”, and 4 represents “direct influence”). The focus of step 2 is to effectively obtain the implementing results so as to calculate the mutual relationships and the effective bases of influencing directions of the criteria.

(3) Calculating direct/indirect matrix: Since  $\lim_{k \rightarrow \infty} X^k = O$ , therefore, direct/indirect matrix T can be obtained from equation (1), among which O is the zero matrix and I is the single unit matrix.

$$T = \lim_{k \rightarrow \infty} (X + X^2 + \dots + X^k) = X(I - X)^{-1} \dots\dots\dots(1)$$

Using equation (1) in the above standardized direct-relation matrix, the calculated results are shown in details in Appendix 3.

(4) Plotting the casual diagram: Row and column calculations are done on the direct/indirect relation matrices, and  $D + R$ ,  $D - R$  are the coordinates of the diagram: Let  $t_{ij}(i, j = 1, 2, \dots, n)$  be the element T. Total row and total column are represented as  $D_i$  and  $R_j$ , respectively. From equations (2) and (3), the following is obtained:

$$D_i = \sum_{j=1}^n t_{ij} \quad (i = 1, 2, \dots, n) \dots\dots\dots(2)$$

$$R_j = \sum_{i=1}^n t_{ij} \quad (j = 1, 2, \dots, n) \dots\dots\dots(3)$$

$D_i$  shows that element  $i$  is the cause and its total influences the other elements, including direct and indirect influences.  $R_j$  shows that the element  $j$  is the effect and its total is influenced by the other elements.  $(D + R)$  is the prominence, obtained from  $D_k$  and  $R_k$ . This shows that through the total degree of cause and effect of these elements, the prominence of the problem group of these elements can be shown.  $(D - R)$  is the relation and is obtained from  $D_k - R_k$ . If  $(D_k - R_k)$  is positive, these elements deviate to the lead type. If  $(D_k - R_k)$  is negative, these elements deviate to the influence type. The casual diagram is paired as  $(D_k + R_k, D_k - R_k)$ , with the horizontal axis as  $(D + R)$  and the vertical axis as  $(D - R)$ .

The row and column calculations of the direct/indirect relation matrices are calculated and  $D + R$  and  $D - R$  are used as the coordinates of the casual diagram: Let  $t_{ij}(i, j = 1, 2, \dots, n)$  be the T element. The total of rows and columns are represented by  $D_i$  and  $R_j$ , respectively. From equations (2) and (3),  $D_i$  shows that element  $i$  is the cause and its total influences the other elements, including direct and indirect influences.  $R_j$  shows that the element  $j$  is the effect and its total is influenced by the other elements. The casual diagram can simplify the casual relation into an easily understandable structure, which can deeply understand the problem, so as to provide the



solution. Besides, from the assistance of the casual diagram, decision makers can plan appropriate strategies based on the lead or influencing types of the criteria.

The tools required in this study are the questionnaires used during the implementation of the DEMATEL method. The objective of developing these questionnaires is to use the data collected from these questionnaires to analyze the related information of the service quality evaluation criteria of airline companies and also uses the DEMATEL method to look for an association among the criteria. The questionnaires are developed by three airline business personnel (manager of the human resource department, assistant manager of the customer service department and receptionist) and three college teachers. After the expert meeting, the reliability and validity of contents of the service quality evaluation criteria are determined. The experts are the expert personnel from the related domains of tourism and possess adequate knowledge, skills and practical experiences (Muralidharan et al., 2002, Tseng et al., 2009, Tseng 2010a,b,c, Cheng et al. 2010, Wu et al., 2010, Lin et al., 2010; Wang, 2011). The process is through brain storming methods and discusses the key service quality evaluation criteria and structural names of the attributes of airline companies and defines the connotations of the various criteria in details. The development process of the questionnaires includes developing research items, collecting data and carrying out reliability and validity analyses. The study ensures the quality of the research tools by these processes. The development process of the questionnaires is explained as follows:

#### A. Developing the research items

Six experts (three airline company personnel and three college teachers of the departments of tourism) were invited to discuss each question, so as to determine the appropriateness of the contents of the various topics.

#### B. Data collection

In order to ensure the reliability and validity of the questionnaires, after completing the reliability and validity of the questionnaires, a pilot test was first carried out. The targets of the pilot test include staff and passengers of the China and EVA airline companies. The pilot test was conducted from January 1, 2008 to January 31, 2008. A total of 400 questionnaires were sent and the effective questionnaires retrieved were 134 and the effective retrieval rate was 33.5%.

#### C. Reliability analysis

Reliability is the consistency or stability of the results measured from the questionnaires (Cooper and Emory, 1995). This study uses the Cronbach  $\alpha$  coefficient to measure the reliability, empathy, tangibility, guarantee and reaction. The  $\alpha$  coefficient of the reliability, empathy, tangibility, guarantee and reaction of the analyzed results are 0.72, 0.71, 0.82, 0.79, and 0.87, respectively. The  $\alpha$  coefficient of the whole questionnaire is 0.89 and the Cronbach's  $\alpha$  coefficient of the various structures is higher than 0.7. This shows that the questionnaires possess a higher degree of internal consistency (Nunnally and Bernstein, 1994).

#### D. Validity analysis

Validity points at that the questionnaires can accurately obtain the properties and functions of the study and can achieve the efficiency of the measuring goals. This study uses the factor analysis to obtain the factor structural matrix of the various items of the scales and through the factor loadings size of the matrix, the efficient application of the structure can be determined. The questions with loadings greater than 0.3. Chang (2001) are reserved to be used as the basis of the criteria, so as to ensure the validity of the questionnaires. The factor loadings of the pilot tested items were greater than 0.3 and the number of questions in the various structures was about 3-5 questions, therefore, all the questionnaires were retained.

### 3.2 Research survey

The objective of this study is to study the service quality of airline companies, therefore, the passengers boarding the international airline flights of the two domestic airline companies are selected as the research targets. The reasons for selected the targets and the survey time are explained as follows:

#### A. Selecting the measuring targets

The German Aviation Magazine (AERO International, 2006) compiled statistics based on the number of crashed aircrafts, number of deaths caused by aviation accidents and number of flight accidents of various global airline companies. The results showed that EVA airlines is in the above ten globally (ranked 9<sup>th</sup>), and China Airlines is in the above fifty. At the same time, this study considered the rate of market share of the present domestic airline companies (Civil Aviation Authority, Department of Transport, 2007), among which, EVA and China airlines have the highest scope, therefore, purposive sampling was used to select the passengers of the international flights of these two airline companies as the measuring targets, so as to increase the representativeness of the samples.

#### B. Investigative methods

The investigative methods point at the use of purposive sampling. The reason for using purposive sampling is based on the data provided by the Civil Aviation Authority of the Department of Transportation (2007). China and EVA airlines rank second in the market load factor in the domestic airline companies, therefore, the random sampling method in the immigration lobby was not used, but a goal oriented sampling method was used, so as to effectively collect the required data and reduce human resources cost.

C. Place of investigation

Since the purposive sampling method was used and the research targets have been selected, the two airline companies were requested to pass out the questionnaires. The study agreed that the operations of the two airline companies were given the first priority. The questionnaires were passed out in the immigration reception and international flights of the two airline companies at Taoyuan International Airport. The questionnaires were retrieved as soon as they were completed.

D. Implement periods

There were two periods of sampling time provided by the researchers (February 1, 2010 – March 31, 2010 and March 1, 2010 – April 30, 2010) for the two airline companies to select. Finally, the two airline companies agreed to pass out the flyers from March 1, 2010 – April 30, 2010 at the same time and 450 questionnaires were sent to the two airline companies on February 25, 2010. The survey time ended on May 8, 2010 and the survey results were sent back to China and EVA airlines on May 10, 2010 by post. A total of 145 effective samples were retrieved and the effective retrieval rate was 32.2%.

3.3 Study Measures

A. Explanation of the measures

In order to allow the targets understand the questionnaires and also increase their efficiency, the first page of the questionnaires explained clearly the related rules and explanations. Firstly, the questionnaires explain the definitions of the various criteria and use the pair comparison method to request respondents to fill in the degree of influence of some criteria on the other criteria (five types of linguistic variables) as “no influence”, “slight influence”, “influence”, “large influence” and “direct influence”. The implementers show the degree of mutual influence based on the size of the numbers. The form of the questionnaires are shown in table 3.

Table 3 DEMATEL questionnaires

Criteria	C1.	C2.	C3.	C4.	C5.	C6.	C7.	C8.	C9.	C10.	C11.	C12.	C13.	C14.	C15.	C16.	C17.	C18.	C19.
C1. Flight Safety	N																		

B. Data Analysis

After receiving the samples from the two airline companies, effective samples were randomly selected and data was recorded and analyzed. Moreover, in order to keep into consideration whether there were any differences in the passengers’ recognition of the service quality of the two airline companies; t-test was done to test their differences. The results showed that there were no differences ( $p$  value = .829 > .05). After making clear that the passengers’ recognition of the service quality was consistent, this study used Microsoft Excel to statistically analyze the calculations and examine the view of service quality evaluation criteria of present domestic airline companies by the passengers of China and EVA Airlines.

4. Discussion and Conclusion

This study analyzed the DEMATEL questionnaires after data collection and used the original evaluation of the various items to establish a direct-relation matrix, then the value-relation matrix was standardized to obtain the total effect-relation matrix and further carry out row and column statistics, thereby, obtaining the related values of the cause (D) and result (R) of the various items. The DEMATEL calculating steps and research findings are explained as follows:

The study added up the total row and total column and obtained D+R (prominence). When the value of D+R (prominence) is higher, then the importance of the evaluation criteria on the entire evaluation factor is higher. When the value of D+R is greater than the total mean (8.0771), it shows that the evaluation criteria have more influence on the service quality of airline companies. The results showed that there were 9 evaluation criteria, sorted as: “C17.

Truly providing committed services”, “C9. Professional training of flight attendants”, “C13. Accuracy of various operations”, “C16. Flight attendants are able to initiatively take care of passenger needs”, “C14. Initiatively providing the needs of passengers”, “C12. Active and rapid response to passenger needs”, “C15. Handling passenger complaints”, “C18. Seat (designation) and easy booking processes”, “C11. Service attitude of check-in attendant (ticket reservations and sale)” (Table 4).

Table 4 Total effect-relation summary of service quality of airline companies

Rows and D		Columns and R		D + R		D - R	
Items	Values	Items	Values	Items	Values	Items	Values
C17	5.0475	C13	5.1197	<b>C17</b>	<b>9.9101 *</b>	C19	0.9727
C9	4.9843	C9	4.8686	<b>C9</b>	<b>9.8529 *</b>	C16	0.3358
C16	4.9383	C17	4.8627	<b>C13</b>	<b>9.5440 *</b>	C6	0.3274
C14	4.5802	C12	4.8243	<b>C16</b>	<b>9.5408 *</b>	C3	0.3117
C12	4.5150	C14	4.8057	<b>C14</b>	<b>9.3859 *</b>	C7	0.2363
C13	4.4242	C15	4.6919	<b>C12</b>	<b>9.3392 *</b>	C17	0.1848
C15	4.3765	C16	4.6025	<b>C15</b>	<b>9.0684 *</b>	C1	0.1363
C19	4.2023	C18	4.1728	<b>C18</b>	<b>8.1293 *</b>	C9	0.1156
C11	4.0716	C11	4.0526	<b>C11</b>	<b>8.1242 *</b>	C8	0.0225
C7	4.0476	C5	3.8515	C7	7.8589	C11	0.0189
C18	3.9565	C7	3.8113	C4	7.4898	C4	0.0048
C4	3.7473	C2	3.7880	C5	7.4327	C18	-0.2162
C5	3.5813	C4	3.7425	C19	7.4320	C2	-0.2176
C2	3.5704	C8	3.5124	C2	7.3584	C14	-0.2255
C8	3.5349	C1	3.3951	C8	7.0472	C5	-0.2702
C1	3.5314	C19	3.2297	C1	6.9265	C12	-0.3093
C6	3.4312	C10	3.1904	C6	6.5349	C15	-0.3155
C3	3.4190	C3	3.1073	C3	6.5264	C10	-0.4169
C10	2.7735	C6	3.1038	C10	5.9639	C13	-0.6955

Note: \* represents mean value greater than total mean 8.0771

The above research findings showed that Huang (1996), Chang and Chang (2000), Pakdil and Aydin (2007) emphasized the provision of committed service attitude and professionalism. Lin (1996), Lin (1997), Huang et al. (2000), Chang and Chang (2000), Pakdil and Aydin (2007) emphasized the professional training of flight attendants. Chang and Chang (2000), Pakdil and Aydin (2007) emphasized accuracy of operations. Disney (1999), Tsai and Hsu (1997), Huang (1996) emphasized taking care of customers initiatively. Disney (1999), Hsu et al. (2009), Huang (1996), Chang and Chang (2000) emphasized initiatively providing the needs of passengers. Chang and Chang (2000), Pakdil and Aydin (2007) pointed out the active and rapid response to passenger needs. These research findings were mostly similar to the research findings of this study. However, the research findings of Tsai and Hsu (1997) considered that passengers give more importance to safety than comfort, which is inconsistent to the research findings of this study. In other words, priority setting of the degree of importance on flight safety of this study is not similar to the research results of Su (1995), Huang (1996), Lin (1997), Yeh (2003), Tsai and Hsu (1997), Huang et al. (2000), Liou et al. (2007), Liou et al. (2008). In short, the study found that the passengers' recognition of service quality of the airline companies lies in the internal decoration and cleanliness of flight cabins, comfortable seats, followed by flight safety. Generalizing the research findings of this study, it can be known that the internal decorations, comfort and service of the airline companies are the service quality items that passengers are mostly

concerned of. Moreover, flight safety and ticket prices, schedules and on-time flights are important evaluation criteria.

**4.1 Discussions**

**A. Cause Relation (D - R)**

The value of D-R (cause relation) is obtained from total row minus total column. When the positive value of D-R (cause relation) is higher, it shows that the items easily have a direct influence on the other factors, thereby, showing that the evaluation standards are more important to the airline companies and the companies are willing to improve. However, when the negative value of D-R (cause relation) is higher, it shows that the items are easily influenced by the other factors, thereby, showing that the evaluation standards are less important to the airline companies and there is not much space for improvement for the companies. From the values of D-R, it can be seen that “C19. Rational ticket prices”, “C16. Flight attendants are able to initiatively take care of passenger needs”. “C6. Books, newspapers and entertainment programs on the flight”, “C3. Arrangement of flight time”, and “C7. Convenience of baggage check-in and check-out” are the important items (evaluation criteria) that influence the other factors. However, “C13. Accuracy of various operations”, “C10. Apparel and appearance of the flight attendants”, “C15. Handling of passenger complaints”, and “C12. Active and rapid response to passenger needs” are the main items (evaluation criteria) that are influenced by the other factors (Table 4). These results confirm to the research results of Chen and Wu (2009) and tickets prices have a direct influence on the airline service quality.

**B. Prominence (D+R)**

When D+R (prominence) is higher, it shows that the importance of the items (evaluation criteria) occupying the overall evaluation factors is higher. There are 9 items that select the value of D+R higher than the total mean (8.0771). This method can collect data and aim at sorting the important evaluation criteria of passengers and carry out improvement. These 9 evaluation criteria showed that customers are concerned about the committed service of airline company personnel, thereby, showing that the professional training, service attitude and the accuracy in carrying out the various operations. Moreover, the ability of service personnel of airline companies to handle customer complaints, actively respond to customer needs and initiatively provide the required service without the passengers’ requests, solve customer problems are the important evaluation criteria that forms the passengers’ service quality evaluation criteria of airline companies. From the total cause-relation matrix of the service quality of airline companies in table 4, the casual diagram of the service quality of airline companies were plotted based on the relation position of the various evaluation criteria (Fig. 1).

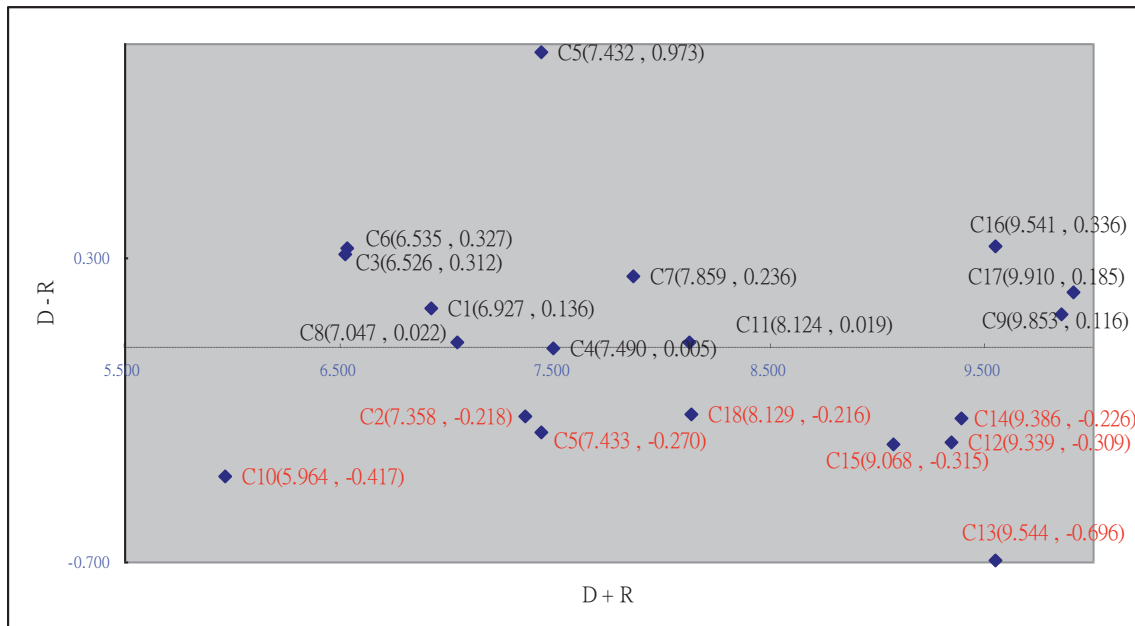


Figure 1 Casual diagram of the service quality evaluation criteria of airlines

In the evaluation factor structure that influences the service quality of airline companies, the first three items of D+R (prominence) include: “C17. Truly providing committed services”, “C9. Professional training of flight

attendants”, and “C13. Accuracy of various operations”, thereby, showing that these are the three key evaluation criteria that passengers are most concerned about. In short, since the standard of living is increasing day by day, airline transportation has already replaced sea and land transportation methods, thereby, becoming the main choices for most people when they travel and with the common trend of long distance trips. When related service personnel show their professionalism and service attitude, or even are accurate in their operations and their ability to provide committed services become the important evaluation criteria viewed by customers of airline companies. These findings are considerably consistent to the results of the researches of Huang (1996), Chang and Chang (2000), Lin (1996), Huang et al. (2000).

However, the importance of “C10. Apparel and appearance of flight attendants” in the service quality of airline companies was different to the results of Lin (1996), Huang (1996), Huang et al. (2000). The importance of “C3. Arrangement of flight time” was also different from the results of Lin (1997). The importance of “C6. Books, newspapers and entertainment programs on the flight” in the overall service quality did not meet the research results of Huang (1996) as expected. Moreover, the importance setting of “C1. Flight safety” in the service quality of airlines was not as expected, thereby, showing that airline passengers have, to some extent, belief in flight safety, therefore among the 9 important items (mean > total mean 8.0771) in the evaluation criteria structure showed that the importance of “response” was more than “reliability” or “assurance”. Moreover, “C10. Apparel and appearance of flight attendants”, “C3. Arrangement of flight time”, and “C6. Books, newspapers and entertainment programs on the flight” were the last three items due to the sorting of their D+R (prominence) (Table 4). This shows that the importance of the evaluation factors of the three items were lower than the importance of the other factors, thereby, strategies to improve the service quality of airline companies can be found in the other factors.

## 4.2 Conclusions

Integrating the empirical results and discussions of the above, the service quality evaluation criteria of airline companies that are related to correct service and professional training include: “C17. Truly providing committed service”, “C9. Professional training of flight attendants”, “C13. Accuracy of various options”. Among which, “C19. Rational ticket prices” is the main cause factor, whereas the accuracy of the various operations, apparel and appearance of flight attendants and the handling of passenger complaints are the easily influenced factors. Besides verifying the contents of the literature review and the limitations on resources, the above research results can effectively control the main key evaluation criteria and understand the direct and indirect effect relations among the various factors. The research results, management implications, research limitations and future suggestions of the research conclusion are generalized into the following three parts:

The research results with the D+R value greater than the total mean (8.0771) showed that there was influence of these evaluation criteria on the service quality of airline companies, so as to differentiate the priority sorting of the various criteria. The importance of the nine items of evaluation criteria are sorted us: “C17. Truly providing committed services”, “C9. Professional training of flight attendants”, “C13. Accuracy of various operations”, “C16. Flight attendants are able to initiatively take care of passenger needs”, C14. Initiatively providing the needs of passengers”, “C12. Active and rapid response to passenger needs”, “C15. Handling of passenger complaints”, “C18. Seat (designation) and easy booking processes”, and “C11. Service attitude of check-in attendant (ticket reservations and sale)”. Moreover, “C10. Apparel and appearance of flight attendants”, “C3. Arrangement of flight time”, and “C6. Books, newspapers and entertainment programs on the flight” do not have much influence on the service quality of the airlines. In other words, the acceptance of using flights as their transportation tool has gradually increased. The airline companies must provide accurate operations procedures and professionalism in the entire service process, so that the passengers will enjoy comfortable and convenient flight service quality and can confirm to the customer needs on airline service quality. The connotations of the key evaluation criteria and the relations and influences among the factors are explained as follows.

### A. Connotations of the service quality evaluation criteria of airline companies

The contents analyzed from the literatures of this study, 19 items of service quality evaluation criteria were generalized and used the DEMATEL method to analyze the results. Among the nine items, the ones with the D+R value greater than the total mean (8.0771) showed that these nine items of evaluation criteria had influences on the service quality of airline companies and their importance are sorted as: “C17. Truly providing committed services”, “C9. Professional training of flight attendants”, “C13. Accuracy of various operations”, “C16. Flight attendants are able to initiatively take care of passenger needs”, “C14. Initiatively providing the needs of passengers”, “C12. Active and rapid response to passenger needs”, “C15. Handling of passenger complaints”, “C18. Seat (designation) and easy booking processes”, “C11. Service attitude of check-in accountant (ticket reservations and sale)”. “C7.

Convenience of baggage check-in and check-out” did not have much influence on the service quality of airline companies (Table 4). “C10. Apparel and appearance of the flight attendants”, “C3. Arrangement of flight time” and “C6. Books, newspapers and entertainment programs on the flight” were the last three among the evaluation criteria (Table 4). This shows that passengers considered that the importance of these three items of evaluation criteria of the service quality of the airline companies were not as expected, therefore, other more appropriate measures can be used to improve the corresponding practices of airline quality.

### **B. Relations among the service quality evaluation criteria of airline companies**

The analysis of this study generalized the service quality evaluation criteria of airline companies, among which, the cause evaluation criteria of the causal relations include: “C19. Rational ticket prices”, “C16. Flight attendants are able to initiatively take care of passenger needs”, “C6. Books, newspapers and entertainment programs on the flight”, “C3. Arrangement of flight time”, “C7. Convenience of baggage check-in and check-out”, “C17. Truly providing committed service”, “C1. Flight safety”, “C9. Professional training of flight attendants”, “C8. Provision of flight meals”, “C11. Service attitude of check-in attendant (ticket reservations and sale)” and “C4. Internal decorations and cleanliness of flight cabins”. “C18. Seat (designation) and easy booking processes”, “C2. On time flights”, “C14. Initiatively providing the needs of passengers”, “C5. Comfortable seats in the cabins”, “C12. Active and rapid response to passenger needs”, “C15. Handling of passenger complaints”, “C10. Apparel and appearance of the flight attendants”, and “C13. Accuracy of various operations” belong to the effect evaluation criteria of the casual relations. From the above data, it can be known that besides being concerned about the prices been rational, the passengers are also concerned about the convenience and comfort felt during the flight time. These have become the important service quality evaluation criteria of airline companies.

In short, the commercial society emphasizes that time is money and customers used the various needs that were not satisfied by road transportation as references for the service quality evaluation criteria of airline companies. The waste of time and money on land transportation has become the basis of competitive advantage of flight services. When airline businesses consider improving their service quality, they must view the attributes as the evaluation criteria of cause and effect and implement the execution of the evaluation criteria. If the professional factor of the service personnel can be emphasized, then it is appropriate to arrange flight time and their professional service attitude can actively take care of the needs of the passengers by providing them with concern and comfortable service, thereby, naturally decreasing inadequate personnel professionalism and the loss caused by the complexities formed during the process and prevent mistakes in seat (designation) and sale operations, or flight delays and actively provide service required by the passengers, meeting their needs actively and rapidly, thereby, decreasing the rate of complaints and improve customer satisfaction and service quality of airline companies.

### **C. Effect analysis of the service quality evaluation criteria of airline companies**

From the D-R values in table 4, it can be seen that “C19. Rational ticket prices”, “C16. Flight attendants are able to initiatively take care of passenger needs”, “C6. Books, newspapers and entertainment programs on the flight”, “C3. Arrangement of flight time”, are the four important items of evaluation criteria that directly influences the other factors, whereas “C13. Accuracy of various operations”, “C10. Apparel and appearance of the flight attendants” and “C15. Handling of passenger complaints” are the evaluation criteria that are easily influenced by the other factors. In other words, the main key evaluation factor that influences the service quality of airline companies are “rational ticket prices” and “comfort and concern”. These can directly influence the recognition of passengers on the service quality of airline companies; whereas, “accuracy of various operations”, “apparel and appearance of flight attendants” and “handling of passenger complaints are among the service quality evaluation criteria where the evaluation factors are easily influenced and “rational ticket prices” and “comfort and concern” have a considerably high degree of importance on the service quality evaluation criteria of airline companies. In short, are passengers more concerned about the overpricing of tickets? Are the service personnel able to actively take care of the passengers? Do they provide better books, newspapers and entertainment programs? Do they provide more convenient flight rates? The accuracy of operations, apparel and appearance of flight attendants are influenced by the “C9. Professional training of flight attendants”.

They are also influenced by evaluation criteria C19, C16, C6, C3, C7, C17, C1, C9, C8, C11, and C4 and if the flight attendants can actively take care of the passengers (C16), then it will surely provide the committed service (C17), thereby, decreasing the complaints of the passengers. Finally, in view of the service quality of airline companies, rational ticket prices (C19), ability of flight attendants to initiatively take care of passengers (C16), provision of books, newspapers and entertainment programs (C6) have a direct influence and if these three items cannot confirm to the expectations of passengers, they easily influence the other evaluation criteria, thereby, causing

a negative impact, such as handling of passenger complaints (C15), which is shown in the negative evaluation criteria items of the D-R column in table 4 (C18, C2, C14, C5, C12, C15, C10, C13).

## 5. Managerial implications and limitations

The managerial implications of the research results lies in verifying that the operations of airline companies must especially give importance to the attainment of committed services, professional training of service personnel and accuracy of various operations. Even though flight safety is the basis that influences the service quality of airline companies, the research findings found that passengers did not especially emphasize flight safety in the overall performance of the service quality of airline companies, but paid attention to the accuracy and speed and professional training of personnel. The practical and academic contribution of the research results are explained as follows:

### A. Managerial practices

With the increasing trend of travelling in Taiwan, flying has become the transportation method for many people to save time and costs. Since most passengers purchase tickets through travel agents, in their view, time in the commercial society is money and since they are unable to schedule holidays, the accuracy of the various operations are apparently given much importance. When passengers plan their vacation, they already have in their minds which airline companies to choose based on flight schedule and committed services, therefore, whether airline companies can achieve their committed service quality, is one of the service quality evaluation criteria that passengers especially pay attention to and the achievement of these objectives must lie in the professional training of service personnel. Therefore, the accuracy of operations, provision of committed services and professional training of personnel are the important factors that influence the service quality of airline companies (Table 4). “C19. Rational ticket prices” is worth it to be paid much attention to by the airline business, since it is a directly influencing factor and before passengers experience the related service quality of airlines, most of them use “rational ticket prices” as the main consideration for choosing which airline to take. In other words, if the ticket price is unable to achieve the affirmation of the passengers, then the follow-up service quality becomes prattle. These results are consistent to the research findings of Chen and Wu (2009), Hess (2008), Gilbert and Wong (2003).

When customers select air transportation as their means of travelling, most of them trust the flight safety of the airline companies. Therefore, airline companies must provide a further direct and excellent interaction on the basis of the trust of passengers, such as actively taking care of them and providing them with the required service, simplifying the designation of seats and sale of tickets. When customers complain, they must actively and rapidly respond to passenger requests. Only when customers receive satisfaction every time, they would continue to enhance their trust and loyalty to the airline companies.

It is suggested that the managerial level of the airline companies must reconsider the simplification of the various operational processes and strengthen their requests on the service attitude and professional training of their personnel, so as to effectively enhance the overall service quality of the airline companies. The service attitude of the personnel is related to moral attributes; therefore, these attributes should be included in the screening test of selecting the personnel. The professionalism of the personnel must be provided by the opening up of appropriate educational training courses and strict requirements as well as specific implementation during the job processes.

### B. Academic theory

Besides verifying the five structures (tangibility, concern, reliability, response and assurance) of the service quality model of Parasuraman et al. (1985) on the application process of service quality in airline companies, the study also proved the important differences in the service quality model required by the airline companies. From tables 2 and 4, it can be seen that the service quality evaluation criteria of the airline companies showed that the important service quality requested by the passengers are concentrated on “C17. Truly providing committed services”, “C9. Professional training of flight attendants”, “C13. Accuracy of various operations”, “C16. Flight attendants are able to initiatively take care of passenger needs”, “C14. Initiatively providing the needs of passengers”, “C12. Active and rapid response to passenger needs”, “C15. Handling of passenger complaints”, “C18. Seat (designation) and easy booking processes”, and “C11. Service attitude of check-in attendant (ticket reservations and sale)”. The more important 9 items of the above evaluation criteria, there are five attributes that belong to two items of “response”, “reliability” and “assurance”, respectively. In other words, the service quality evaluation criteria that customers are concerned about are reflected in the original service quality model of Parasuraman et al. (1985) and are definitely different. These research results also confirmed to the theories of Gilbert and Wong (2003).

### C. Research limitations and future suggestions

The research is limited by the consideration of real needs and human resources costs and uses the purposive sampling method. The research targets are Taiwanese passengers and the research point is the study of the service quality of two international airline companies in the country. Foreign passengers and non-domestic airline companies are not in the scope of this study. Under the circumstances of different research targets, the validity of external inferences must be given careful considerations, thereby, forming the limitations of this study. Moreover, on the aspect of future studies, it is suggested that different research methods should be combined, such as hybrid qualitative and quantities research methods and use quality interview verification to carry out the appropriateness of questionnaire, so as to improve the validity of data content, or combine Grey theory to verify the conclusions of this study. On the aspect of research targets, it is suggested that the opinions of airline businesses and travel agents should be increased and the differences on the recognition of service quality by the passengers should be understood, or the targets should be expanded to international tourists, so as to understand the culture and nationality factors of different targets. This can create influences and differences in the service quality evaluation criteria of airline companies.

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