The evaluation of airline service quality Using The Analytic Hierarchy Process (Ahp)

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ABSTRACT

This paper presents an application of the analytical hierarchy process (AHP) to determine service quality of airlines. This method adopts a multi-criteria approach that can be used for evaluating and comparing the service quality of various airlines. In this case study, the service quality of seven airlines servicing the Penang International airport was evaluated. Four criteria associated with service quality were considered: tangibility, reliability, responsiveness and assurance. While empirical data for this study were collected through a survey of airline passengers, we also used pre-processed data on airlines performance that are readily available on the Internet.

By applying pairwise comparison method in determining the criteria weights, we found that the most concerned criterion in airline service quality was reliability, followed by responsiveness, tangibility and assurance. The *Expert Choice* analysis of the ten sub-criteria also revealed that attributes such as accident rate of airlines, the courtesy of cabin crew, cabin safety procedure, efficiency of the crew, comfort and cleanliness, which occupied the top five positions, reflected safety and comfort as the main concerns among air travelers in determining the service quality of airlines.

Keywords: Analytic hierarchy process (AHP), airlines, service quality

INTRODUCTION

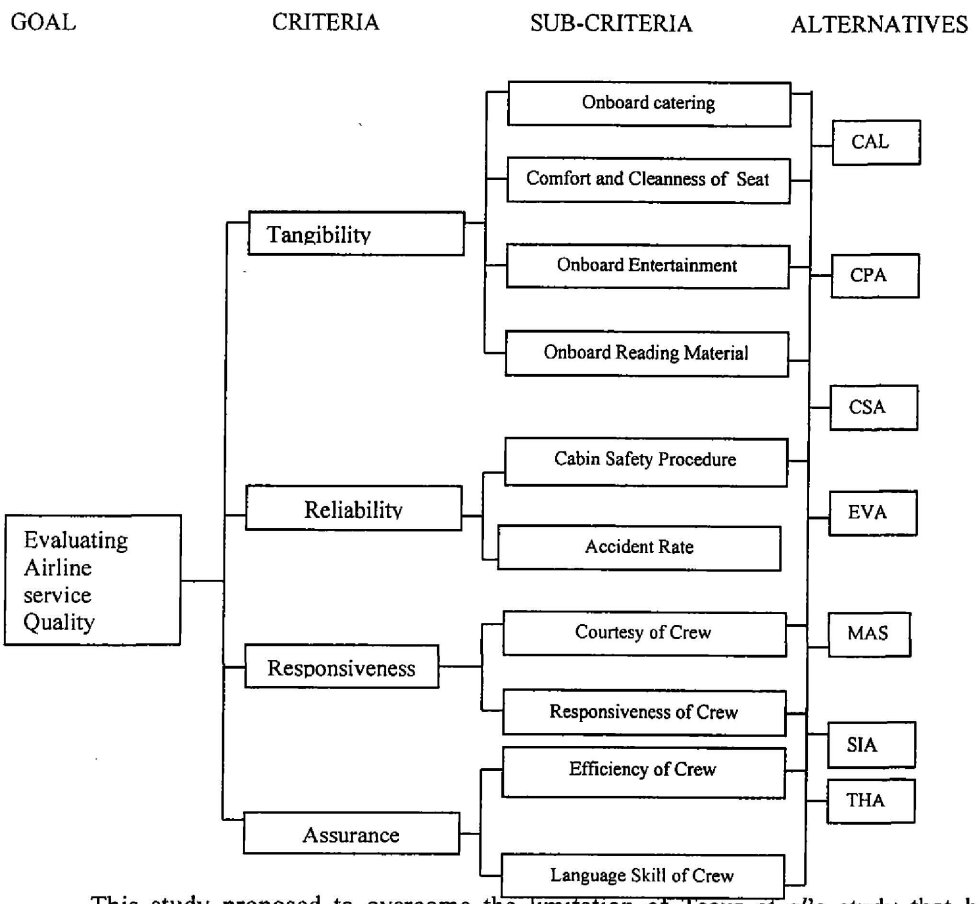
Competition in the air travel industry is very fierce. To gain competitive advantage airlines have resorted to various strategies such as intensive marketing, advertising and promotion as well as ticket price wars. These are not sufficient measures to remain competitive. Another important factor is improving service quality to their passengers. A study by Ostrowski et al (1993) shows that airlines could acquire and retain customer loyalty by continuing to provide perceived high quality services. Empirical studies of demand for airlines services show that service quality is central to the choice of airlines by passengers, both for business and leisure travel (Abrahams, 1983; Etherington and Var, 1984; Young et al, 1994). Thus, providing superior service quality should be the main agenda for all airlines in order to remain competitive.

EVALUATION FRAMEWORK AND METHODOLOGY

Many empirical studies had tried to measure different dimensions of service quality of airlines. Gourdin (1988) categorized airlines quality into three aspects: price, safety and timeliness. Ostrowski, O'Brien and Gordon (1993) looked at timeliness, food and beverage quality, comfort of seat whereas Truitt and Haynes (1994) used the checking process, timeliness, cleanness of seat, food and beverage quality and customer complaints handling as the standards for measuring service quality. Other scholars such as Tsaur, Chang and Yen (2002), Gilbert and Wong (2003) have revised and adapted the five-aspect representation of service quality proposed by Parasuraman, Ziethaml and Berry (1985, 1989) which include tangibility, reliability, responsiveness, assurance and empathy.

Our study investigated four criteria of service quality, namely: tangibility, reliability, responsiveness and assurance. Tangibility refers to the physical service presentation such as onboard catering, comfort and cleanness of seat and onboard equipment. Reliability stands for how credible the airline is in terms of cabin safety and accident rate. Responsiveness aspect refers to how courteous and responsive the crew is in dealing with customers. Assurance represents the certainty that airlines provides customers in terms of efficiency and language skill of its crew.

Fig. 1. The model of airline service quality evaluation



This study proposed to overcome the limitation of Tsaur *et al*'s study that had required respondents to have traveled on all airlines under evaluation. This would have limited the number of airlines to be evaluated because it would be hard to get samples of respondents that have experienced traveling on all of them. In our study, the passengers only prioritised the criteria dimensions of service quality while secondary data about airlines

performances on each criterion were used to rank the airlines. Thus any number of airlines can be evaluated regardless of passengers' experiences.

Figure 1 shows the analytic hierarchy process (AHP) model used in this study to evaluate the service quality of seven airlines: China Airlines, Cathay Pacific Airways, China Southern Airlines, EVA Airways Corporation, Malaysia Airlines, Singapore Airlines and Thai Airways International.

A computerized implementation of the AHP methodology was done using the *Expert Choice* software which incorporated data from airline passengers surveyed and secondary data on airlines' performance on each criterion.

AN OVERVIEW OF THE ANALYTIC HIERARCHY PROCESS (AHP)

The AHP, introduced by Thomas L. Saaty , is a powerful and flexible decision making process to help people set priorities and make the best decision when both qualitative and quantitative aspects need to be considered (Saaty, 1980). It works on the basis of reducing complex decisions to a series of one-on-one comparisons, then synthesizing the results It has been applied widely in various fields including tourism, business, industry, government and military.

The AHP methodology involves modeling unstructured problems into hierarchy forms. A hierarchy is an abstraction of the structure of a system to study the functional interactions of its components and their impacts on the entire system. This abstraction can take several related forms, all of which essentially descend from an overall goal, down to the criteria which affect this overall goal and down to the sub-criteria which influence these criteria and finally the alternatives available to the problem.

The next stage of AHP methodology is to evaluate all elements in the model. This is done by a series of pair-wise comparison technique in which every attribute on each level is compared with its sibling in respect of their importance to the goal of the problem. If there are n evaluation attributes, then we will have to conduct $C(n,2) = n(n\text{-}1)/2$ pair-wise comparisons. The pair-wise comparison technique is done using a scale from 1-9. A value of 1 means that the two attributes being compared are of equal importance in achieving the desired goal. A value of 5 means that the first attribute is strongly favoured over the second whilst the upper end value of 9 means that the first attribute is of absolute importance relative to the second.

The outcome of the second stage is the pair-wise comparison matrix. The entries in the matrix are the value of comparison between row and column attributes, using the scale of relative importance from 1-9 discussed above. The entry for the i^{th} row and the j^{th} column gives the importance of that row's criterion relative to the column's criterion, which is represented as a_{ij}. An example of pair-wise comparison matrix is shown below.

$$A = \begin{bmatrix} 1 & a_{12} & \cdots & a_{1n} \\ 1/a_{12} & 1 & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ 1/a_{1n} & 1/a_{2n} & \cdots & 1 \end{bmatrix}$$

The relative weights of all attributes are then derived by using the eigenvalue method. The purpose of using the pair-wise comparison method is to determine a weight ($w_1, w_2, \ldots, w_n$) that represents the relative weight vector for attributes, hence there is a relation between the weights, w_i and the judgments a_{ij} and it is represented as

$$a_{ij} = w_i / w_j \qquad (\text{for } i, j = 1, 2, \ldots, n) \tag{1}$$

and

$$A = \begin{bmatrix} w_1/w_1 & w_1/w_2 & \cdots & w_1/w_n \\ w_2/w_1 & w_2/w_2 & \cdots & w_2/w_n \\ \vdots & \vdots & \ddots & \vdots \\ w_n/w_1 & w_n/w_2 & \cdots & w_n/w_n \end{bmatrix}$$

According to eigenvalue method, the relative weight can be calculated from

$$A \cdot w = n \cdot w \tag{2}$$

However, only a_{ij} is known when doing the pair-wise comparisons and w_i or w_j would not be known. Thus, matrix A consists inconsistency. Therefore, estimator for w can be derived from

$$A' \cdot w' = \lambda_{max} \cdot w' \tag{3}$$

where A' is a reciprocal matrix which is a perturbation of A and λ_{max} is the largest eigenvalue and it is used as the estimator for n in Eq. (2). Saaty has proved that λ_{max} is always greater or equal to n. When λ_{max} is close enough to n, the value gained from matrix A becomes consistent.

The final step is to determine the best alternative relative to the goal by choosing the alternative that has the highest overall priorities.

As summarized by Vaidya and Kumar (2004, in press), the basic steps involved in AHP methodology are as follows:

1. State the problem
2. Broaden the objectives of the problem or consider all actors, objectives and its outcome.
3. Identify the criteria that influence the behaviour.
4. Structure the problem in a hierarchy of different levels constituting goal, criteria, sub-criteria and alternatives.
5. Compare each element in the corresponding level and calibrate them on the numerical scale. This requires $n(n-1)/2$ comparisons, where n is the number of elements with

the considerations that diagonal elements are equal or '1' and the other elements will simply be the reciprocals of the earlier comparisons.

6. Perform calculations to find the maximum Eigenvalue, consistency index CI, consistency ratio CR, and normalized values for each criteria/ alternatives.
7. If the maximum Eigenvalue, CI, CR are satisfactory the decision is taken based on the normalized values; else the procedure is repeated till these values lie in the desired range.

EMPIRICAL STUDY OF AIRLINE SERVICE QUALITY

The air travelers survey

One hundred questionnaires were distributed in 2003 to tourists who visited Penang and Malaysians who were frequent air travelers. Seventy one sets of completed questionnaires were collected and analysed. Out of these, 74.7% had traveled by air more than 21 times a year, 12.7% traveled between 11 to 20 times a year, 5.6% had traveled between 6 to 10 times a year while the remaining 7% had traveled fewer than 5 times a year.

The survey instrument used was a self-administered questionnaire which is composed of questions for evaluating the relative importance of the criteria they considered most important in considering service quality. The respondents were asked to make a pairwise comparison between two criteria at a time. Thus, they compared tangibility and reliability, tangibility and responsiveness, tangibility and assurance, reliability and responsiveness, reliability and assurance, responsiveness and assurance. They then compared two sub criteria at a time.

Airlines' performance data

In our study, we also used secondary data on airlines' performance (Skytrax Research of London, 2003) and Plane Crash Info.com (Kebabjian, 2004).The Skytrax data however had to be converted from the Star ranking system to a 1- 9 scale in order to use the AHP methodology of calculating relative weights and ranking.

The converting of the 5-star rating was done by determining the star difference of two airlines. If there was no difference between the two airlines, this means that both were equal in the performance of certain criteria which can be rated as 1 on the 1-9 scale. Table 1 shows the conversions.

Table 1

Conversion of star ranking to a 1 – 9 scale

Difference of star ranking	1 – 9 scale
★★★★	9
★★★	7
★★	5
★	3
0	1

Similarly, data on airlines ranking gathered from Plane Crash Info.com (Kebabjian, 2004) needed to be converted to a 1-9 scale because the website ranked each airline based on its accident rate. Therefore in order to evaluate the accident rate in our AHP model, we had to

recalibrate the range of ranking between two airlines. Table 2 shows the conversion of the different points into a 1-9 scale.

Table 2

Conversion of the different ranking points into a 1-9 scale

Difference of ranking points	1-9 Scale
≥65	9
57 – 64	8
49 – 56	7
41 – 48	6
33 – 40	5
25 – 32	4
17 – 24	3
9 – 16	2
1 – 8	1

The combined data from the survey and secondary data for all seven airlines were input into the *Expert Choice* software in order to calculate the relative weights of evaluation criteria and other respective calculations as dictated by the AHP methodology.

RESULTS

Fig. 2. shows the relative weights of all elements in our study. We found reliability has the highest relative weights (0.542) thus making it the most important criterion when evaluating an airline service quality. It is followed by responsiveness (0.217), tangibility (0.127) and assurance (0.114). The findings show that the travelers are more concerned about reliability of airlines which include safety issues when traveling by air. We assume air travelers still remember the September 11, 2001 incident. Parasuraman *et al.* (1985) also found reliability and responsiveness as the two most important criteria whereas Gilbert and Wong (2003) ranked them as the second and third most important dimensions.

The top five sub-criteria as ranked by the relative weights are accident rate (0.431), courtesy of crew (0.153), cabin safety procedure (0.110), efficiency of crew (0.092) and comfort and cleanness of seat (0.0740). They also reflected the findings of Tsaur et al.'s (2002) and Gilbert and Wong's (2003) study.

Table 3 shows the final ranking of service quality of all airlines in this study.

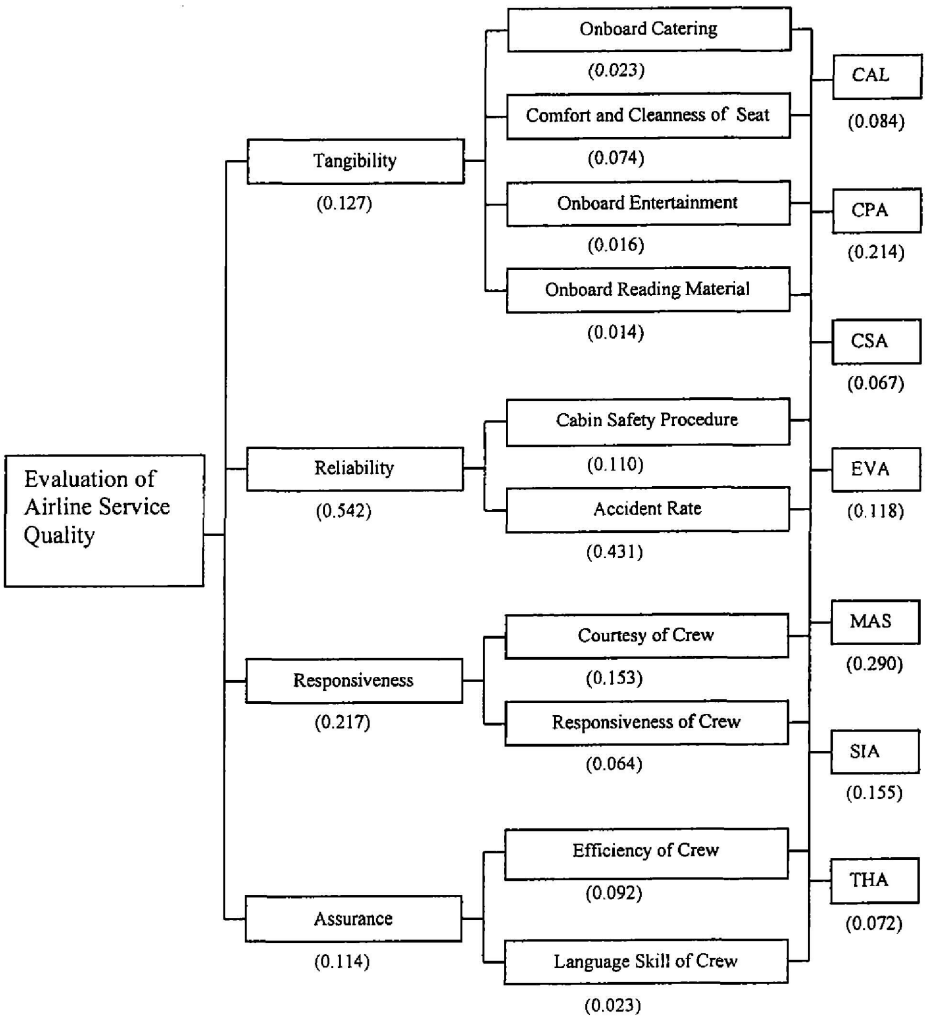
Table 3

Final ranking of service quality of all airlines

Ran	Airlines	Relative Weights

k		
1	Malaysia Airline System	0.290
2	Cathay Pacific Airways	0.214
3	Singapore Airlines	0.155
4	Eva Airways Corporation	0.118
5	China Airlines	0.084
6	Thai Airways International	0.072
7	China Southern Airlines	0.067

Fig. 2
Weights for all elements



CONCLUSIONS

This paper has illustrated the application of an Analytic Hierarchy Process (AHP) methodology in the evaluation of airlines service quality in Penang, Malaysia. A pair-wise comparison method was used to calculate the weight for each criteria based on data gathered from the respondents comprising air travellers. In order to measure the service quality performance corresponding to each criteria for each airlines, data from the Skytrax (Skytrax Research of London, 2003) and Plane Crash Info.com (Kebabjian, 2004) websites were also used.

There are some important perspectives that we found from this study. Most of the customers emphasized the importance of reliability aspect and they were less anxious of assurance aspect. Among the 10 sub-criteria in our model, the most concerned sub-criteria was the accident rate of an airline followed by courtesy of crew, cabin safety procedure, efficiency of crew and comfort and cleanness of seat. From the results, the airlines could know what the customers desire and hence could provide better service for them.

The final ranking shows that Malaysia Airline System has the best airlines quality service among the seven airlines evaluated in this study. It is followed by Cathay Pacific Airways, Singapore Airlines, EVA Airways Corporation, China Airlines, Thai Airways International and China Southern Airlines.

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