EXPLORATORY FACTOR ANALYSIS OF SERVICE QUALITY FACTORS FOR THAI LOW-COST AIRLINE INDUSTRY

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Introduction

Low-cost airline refers to an airline that generally has lower fares and operation under the policy to reduce unnecessary costs (Pels, 2008). After open sky policy, low cost airlines have become consistently more competitive in order to gain market share in the domestic airline industry, especially in Singapore Malaysia Indonesia and Thailand (Connell and Williams, 2005; Sengpoh, 2015).

Under this circumstance, Airlines are not only attempt to establish more convenient routes, but also introduce more promotional incentive. Nevertheless, the marginal benefits of marketing strategies gradually reduce because most of the airlines act similarly (Chang and Yeh, 2002). Price is also initially used as the primary competitive weapon. However, airlines soon realize that competition on price alone represents a no-win situation in the long term (Tsaur et.al., 2002). To deliver superior service quality from customer expectation understanding is a key of success and survival in the very hectic and competitive environment of airline industry (Gilbert and Wong, 2003). Furthermore, It is commonly believed that the higher service quality can lead to a customer's higher overall satisfaction and a long-term competitive advantage (Chen, 2008).

Therefore, this study acknowledges the importance of high quality service that has powerful effect on airline performance by analyzing those factors to measure the service quality towards focused three low-cost airlines; Nok Air, Air Asia and Thai lion air. The purpose of this study aims to categorize service quality factors for performance measurements of Thai low-cost airlines industry. Besides, to perform an effective quality assessment, Jomnonkwao and Ratanavaraha (2016) stated that evaluators must discern factors which have the greatest influence towards quality perception. Also Exploratory Factor Analysis (EFA) is the statistical methods widely used for group categorization that can be applied in this case. Despite, the Analytic Hierarchy Process (AHP) is used to evaluate the weighted factors by pairwise comparison.

Service quality in the airline industry

In general, service quality is defined as the overall satisfaction of the customer whom associated with the service organization performance (Prak et al., 2004; Liou et al., 2011). To deliver a better service for the airline, the organization should understand the passenger expectations and perceptions (Chen, 2008). The extensively used measure of service quality is SERVQUAL and divided them into five dimensions such as tangibles, responsiveness, reliability, assurance and empathy (Parasuraman et al., 1988).

Among the relevant studies found in the literature, this SERVQUAL model is mostly used statistical techniques to test the hypotheses or monitor the service levels of the airlines (Liou et al., 2010). According to Chang and Yeh (2002), the airline service quality can be measured by distinguishing between the service expectations and perceptions. Likewise, many researchers tried to compare the differences between passenger expectations and perceptions about the service quality from the airline (Prak et al., 2004; Gilbert and Wong, 2003; Chu and Kou 2009). In research of Leong et al., (2015), SEM was taken to determine the impact of SERVPERF dimension in customer satisfaction in order to build up a loyalty in the airline industry. In addition, Milioti et al. (2015) conducted a survey of traveler's perception about factors that are important to the choice of airline services by applying Multivariate Probit Model.

Moreover, Multiple-criteria decision-making (MCDM) monitors the airline service levels and point out the necessary of service improvement (Liou et al., 2010). This MCDM has been applied with

Fuzzy Set Theory to get the weight factors and/or the alternative ranking (Chou et al., 2011; Chang and Yeh, 2002; Tsaur et al., 2002; Nejati et al., 2009). As Liou et al. (2011), both modification method of Grey relation and the modified VIKOR were applied to evaluate the airline services. Originally, these two methods were adapted from the MCDM traditional airlines in order to prioritize strategy services. In addition, the services quality was ranked and improved by the concept of a novel interval-valued fuzzy MCDM (Kuo, 2011). Also Wang et al. (2011), DEMATEL and Fuzzy set were combined to define the service quality features of the airline properly.

Factor analysis

Factor analysis is a statistic technique that reduces a set of variables to lessen a number of the new variables. It provides the tools for analyzing the structure of the interrelationships (correlations) among a large number of variables (e.g., test score, test items, questionnaire responses) by defining sets of variables that are highly interrelated, known as factors (Joseph et al., 2010).

Two types of factor analysis

- Exploratory Factor Analysis (EFA) is used to determine the appropriate number of common factors that are needed to explain the correlations among a set of observed variables.
- Confirmatory Factor Analysis (CFA) is used to confirm the relationship between a set of observed variables and a set of common factors or latent variables

Regarding Liou et al. (2010), the research was applied factor analysis to extract factor and Dominance-based Rough Set Approach (DRSA) to determine the airline strategy. Similarly, many researchers used the factor analysis to categorize the inputs of the service quality survey from airline passengers (Pakdila and Aydın, 2007; Erdila et al., 2011; Jager et al., 2012). Besides, Basfrinci and Mitra, (2015) studied the impact of customer satisfaction in the context of social culture by Factor Analysis and Kano model.

The Analytic Hierarchy Process (AHP)

The AHP is a Multiple-Criteria Decision-Making (MCDM) approach developed by Thomas L. Saaty in 1970s. AHP is the theory of measurement through pair-wise comparisons and relies on the expert judgments to derive priority scales. The pair-wise comparisons technique uses a scale from 1-9 (1=equally important…9= extremely important) (Saaty, T.L. 2008; Singh and Nachtnebel, 2016). The AHP weighting factor was calculated as Esq. (1), (2) (3) and (4) respectively.

The research of the AHP involves the estimation of priority weights of a set of criteria or alternatives from a square matrix of pair-wise comparison A= [a_{ij}], which is positive. If the paired comparison judgment is perfectly consistent, it is reciprocal, i.e., a_{ij}= 1/aji for all a_{ij}=1,2,3,.., n.

The final normalized weight, w_i, is given by

$$w_i = \left(a_{ij} / \sum_{k=1}^{n} akj \right) \quad \forall = 1,2,\ldots . n \tag{1}$$

The error on the judgment is unavoidable. The suggestion of Eigen value method computes w as the principal right Eigen value of the matrix A or w satisfies the following system of n linear equations: Aw= λmax$w$, where max is the maximum Eigen value of A. This is to say that

$$w_i = \frac{\sum_{j=1}^{n} a_{ij} w_j}{\lambda max} \quad \forall = 1,2,\ldots . n \tag{2}$$

The natural measurement of inconsistency or deviation from consistency, called consistency index (CI) is defined as

$$CI = \frac{\lambda max - n}{n - 1} \tag{3}$$

The consistency index of a randomly generated reciprocal matrix from scale 1 to 9, with reciprocals forced, for each size of matrix called random index (RI).

Consistency ratio $CR = CI/RI$ (4)

RI is function of matrix size and $CR < 0.1$ is as an acceptable limit, otherwise it need to be revised and adjusted accordingly.

Another task in the hierarchy is the synthesis of the judgments throughout the hierarchy in order to compute the overall priorities of the alternatives with respect to the goal. The weights are created by summing the priority of each element according to a given criterion by the weights of that criterion.

Methodology

The study included both exploratory and conclusive phases; exploratory phase was primarily used as background study and questionnaire development, whereas conclusive study was dealt with data collection from actual respondents through a structured questionnaire.

Designing of research instrument

The airline service quality attributes were collected and defined by a cumulative frequency from the research during the year 2000 to 2015. As a result, over 33 interesting attributes were found. By Pareto diagram, these attributes were screened and remained only 18 important attributes. Then they were consulted by experts who had experienced in airline industry. Those experts recommended to detect or add the attributes into the initial list. For instance, flight safety was disregarded because it was basic requirement that all airlines must have. On the other hand, the comfort and cleanness of seat was expanded to two parts which are the comfort of seat and the cleanness of seat. The experts refined the list to 18 airline service quality attributes for performance measurements of Thai low-cost airlines industry. Then the initial draft of questionnaire was test-checked by a sample of 35 respondents about appropriateness in terms of wording and sentence structure. The final outcome of this phase showed that the research instrument contained 18 vital attributes (variables) to check Thai low-cost airline passenger′s responses on airline service quality. All attributes were scored by a 5-point Likert′s scale (a score of 1 indicated least important, whereas the score of 5 indicated most important).

Sampling and data collection

Population for this research was defined as a domestic passengers who had travelled at least two airlines or only one airline (In this case, the respondents should have the travel experience on that airline at least 3 times.) from three low-cost airlines in Thailand. Primary data was gathered directly from these passengers. The survey was conducted in the middle of May 2016 and over 308 sets of questionnaires were distributed to the passengers as well.

Data Analysis and extraction of factors

Data collected from 308 respondents were subjected to data reduction by using Exploratory Factor Analysis (EFA). The analysis was involved with the use of scores which attained from 18 airline service quality attributes to conduct group classification. This study used principal component analysis for factor extraction and varimax rotation with Kaiser Normalization through SPSS ver. 22.0.

Factor weighting by AHP method

The factors were derived from Exploratory Factor Analysis (EFA) and then calculated weight factors by primary experts who involved with airline industry through pair-wise comparisons. Then the result will be used in further study.

Results and Discussion

Checking suitability of data for factor analysis

1. Sample size

As the general rule, the minimum sample should consists of the observations at least five times over the number of variables to be analyzed, however, the more acceptable sample size should have a 10:1 ratio (Joseph et al., 2010). In this study, the sample were appropriated by samples and variables ratio (Sample= 308 and variables= 18).

2. Kaiser-Meyer-Olkin (KMO) and Bartlett's test of Sphericity (Wadkar et al., 2016).

- The Kaiser-Meyer-Olkin is the measure of sampling adequacy which varies between 0 and 1. The values that are closer to 1 regarded as better value and the value of 0.6 is the suggested minimum.
- The Bartlett's Test of Sphericity is the test for null hypothesis that the correlation matrix has an identity matrix.

H_o: There is no statistically significant interrelationship between variables.

H_1: There is statistically significant interrelationship between variable

As demonstrated in table 1, KMO value found that the sample was adequate for the analysis (KMO = 0.891). Bartlett's test of sphericity (Chi-Square= 2480.454, df= 153 and p= 0.000), we therefore reject the null hypothesis (H_o) and accept the alternate hypothesis (H_1). There is a statistically significant interrelationship between variables. It also implies that the correlation coefficients among all the variables are suitable to do EFA.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.891
Bartlett's Test of Sphericity	Chi-Square	2480.454
	df	153
	Sig.	0.000

Table 1. Result of KMO and Bartlett's Test

Demographic Information

Regarding to Questionnaire survey, the percentage of those respondents were 34.70% Male and 65.30% female passengers. Almost 59.10% of the respondents aged between 21-30 years old. The occupation of passengers were mainly students, 37.40%. Furthermore, the salary of passengers were almost 52.60% less than 577 USD (20,000 Thai Baht). In term of annual travel frequency, the percentage was mostly 61.80% less than or equal to 5 times. By the way, the Demographic Information was shown in table 3.

Results of Exploratory Factor Analysis

Exploratory Factor Analysis condensed 18 variables into four factors. Besides, all factor loadings were greater than 0.50 and they were considered as practically significant. In addition, these four factors had eigenvalues higher than 1, explaining 62.196% of the variance together. The eigenvalue and the percentage of explained common variance were represented in Table 2, whereas the results of EFA were exposed in table 5.

Factor 1- Cabin crew service. This factor was comprised of seven variables (attributes) and explained as 24.668% of total variance. These variables were consisted of individual attention to passenger, crew's willingness to help, solve unexpected situation, crew's response, courteous of crew, professional skill of crew and crew's personality. Since all these variables pointed to airline passenger's service expectation from Cabin crew, therefore, it was labelled as "cabin crew service".

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.879	38.216	38.216	6.879	38.216	38.216	4.440	24.668	24.668
2	1.902	10.568	48.784	1.902	10.568	48.784	2.962	16.457	41.126
3	1.394	7.746	56.529	1.394	7.746	56.529	2.085	11.586	52.711
4	1.020	5.666	62.196	1.020	5.666	62.196	1.707	9.484	62.196

Table 2 Eigenvalues and Percentage of explained common variance

		Frequency	Percentage
Gender	Male	107	34.74%
	Female	201	65.26%
Age (year)	< 20	25	8.12%
	21-30	182	59.09%
	31-40	51	16.56%
	41-50	23	7.47%
	51-60	20	6.49%
	>61	7	2.27%
Occupation	Student	110	35.71%
	Business owner	36	11.70%
	Employee/Office worker	97	31.49%
	Government officer	43	13.96%
	State Enterprises	18	5.85%
	Other	4	1.30%
Salary (Baht)	< 20,000	162	52.60%
	20,001-30,000	77	25.00%
	30,001-40,000	36	11.69%
	40,001-50,000	17	5.52%
	50,001-60,000	9	2.92%
	> 60,000	7	2.27%
Annual travel frequency	≤ 5	190	61.69%
	6-10	73	23.70%
	11-15	29	9.42%
	>15	16	5.19%

Table 3. Demographic Information of Thai low-cost airline passengers.

Factor 2- Convenience to airline passengers. Factor number two composed of six variables and regarded as 16.547% of total variance. This factor included the cleanliness of seats, the comfort of seats, payment channel, Check-in channel, waiting time at check in service and baggage delivery. Each of these variables was a convenience or ease for the airline passengers. Therefore, it was labelled as “Airline convenience”.

Factor 3- Inflight Entertainment. This factor in this analysis regarded as 11.586% of the total variance and contained with two variables or airline service quality attributes. Variables in this factor were consists of Food & Drink and Magazine, labelled as “Inflight Entertainment’’.

Factor 4- Flight Scheduling. This factor comprised of three variables and explained 9.458% of total variance. The variables included with frequent flights, Direct flight and the punctuality of flights. This factor was labelled as flight scheduling because all variables were engrossed.

Reliability of factor out put

Reliability was established by estimating Cronbach's alpha for each factor, with values of 0.6 to 0.7 deemed the lower limit of acceptability (Joseph et al., 2010). According to Table 4, the results were shown that the alpha value for all the factors were above 0.65 indicating the reliable output.

Factor no.	Factor title	Cronbach's alpha
Factor 1	Cabin crew service	0.880
Factor 2	Airline convenience	0.813
Factor 3	In-flight Entertainment	0.778
Factor 4	Flight Scheduling	0.651

Table 4. Reliability and validity of EFA results

Factor no.	Factor title	Variables included	Factor loading
Factor 1	Cabin crew service	Individual attention to passenger	0.819
		Crew's willingness to help	0.769
		Solve unexpected situation	0.782
		Crew's response	0.765
		Courteous of crew	0.692
		Professional skill of crew	0.673
		Crew's personality	0.541
Factor 2	Airline convenience	The cleanliness of seat	0.711
		Payment channel	0.645
		Check in channel	0.642
		The comfort of seat	0.582
		Waiting time at check in service	0.552
		Baggage delivery	0.523
Factor 3	In-flight Entertainment (IFE)	Magazine	0.826
		Food and Drink	0.793
Factor 4	Flight Scheduling	Frequent flights	0.796
		Direct flight	0.684
		The punctuality of flights	0.530

Table 5. Results of Exploratory Factor Analysis (N=308)

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax rotation with Kaiser Normalization

Factor weighting

According to Figure 1, it was represented the relative weight of all service quality factors which were obtained by applying AHP. The weight for each of factor was flight scheduling (0.578), cabin crew service (0.201), convenience to airline passengers (0.155) and in-flight entertainment (0.078) respectively. Flight scheduling was found as the highest relative weight and the most important factor when airline service quality's performance measurement was conducted. Especially, the weight factors also described that flight scheduling is the most important concern towards experts. It expressed the reliance towards airlines which they can provide the service based on airline agreements, including the punctuality of flights, flights frequency and direct flight.

Ranked by the weight, the top five sub-factors or attributes were the punctuality of flights (0.420), direct flight (0.091), flights frequency (0.067), professional skill of crew (0.044) and to solve unexpected situation (0.043). These results were as the preliminary stage and required more interviews with airline industry experts. Then all collected data will be analyzed in order to increase validity and reliability for a further study.

Conclusion

This study aims to categorize service quality factors for performance measurements of Thai low-cost airlines industry, focused three low-cost airlines. EFA was used in order to categorize the attributes into four groups with 18 attributes or variables, Cabin crew service (Factor 1), Convenience to airline passengers (Factor 2), Inflight Entertainment (Factor 3) and Flight Scheduling (Factor 4). All factor loadings scores were relatively high (>0.5), indicating that the variables had strong potential for service quality performance measurements of Thai low-cost airlines.

In addition, the weight factors from AHP through pair-wise comparisons represented that the primary experts were aware of airline flight scheduling as the most important factor and the least one as in-flight entertainment. Among the eighteen sub-factors or variables, the top five sub-factors were the punctuality of flights, direct flight, frequent flights, and professional skill of crew and solve unexpected situation.

In future study, the factor outputs from EFA will be examined the validity value. Likewise, the researcher will do interview with more experts who involved with airline industry in order to increase additional data validity and reliability of factor weighting in AHP.

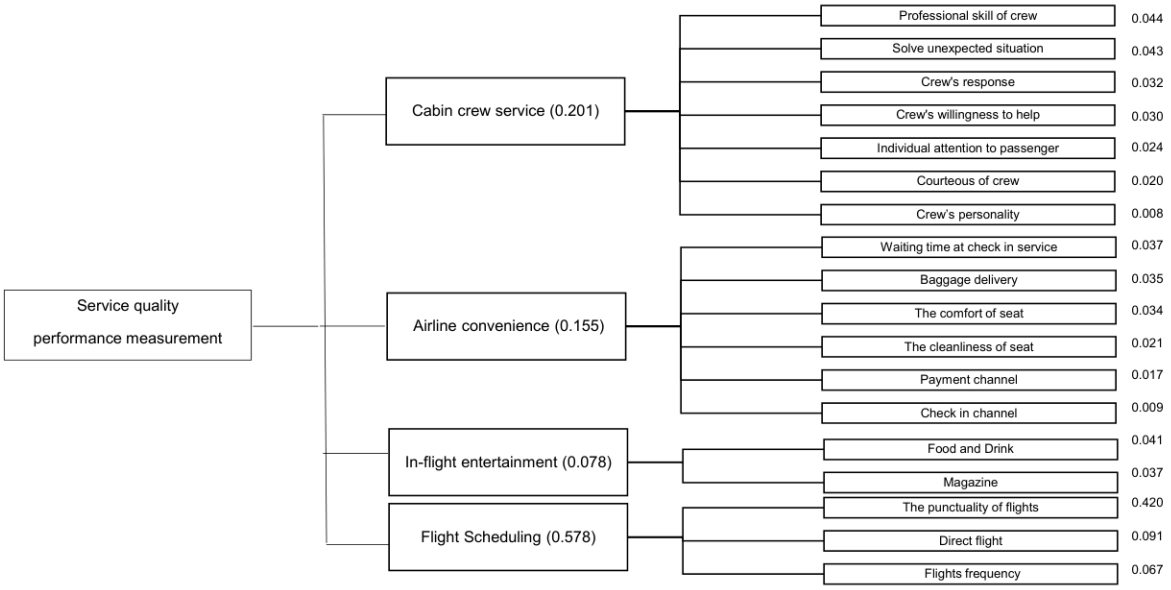

Fig. 1 Weighs of the factors

Research limitations/implications

In this study, flight safety was disregarded because it was basic requirement that all airlines followed by ICAO safety standard. Besides, the weighted factors were initially calculated by experts but required further data in order to increase additional data validity and reliability.

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