Enlisting the Airline Services Using Fuzzy Evaluation Approach in Indian Context

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Abstract:
Air transport plays a pivotal role in the development economy, stimulating exchanges between countries and facilitating international relations. Airline service quality is similar to an auction and makes chaos to passenger. Airlines use this information to make their own bid, setting a market price and providing high value to the passenger to sustain in future. Service quality is combing process both with tangible and untouchable imaginations. Though number of studies focuses on service quality, using fuzzy logic still its few and all are outside our country. It is the attempt to enlist various services of airlines in Indian context with a dissent approach. This study will exhibit empirically to different factors and prioritizing to the airlines services using linguistic variables. At last some new and interesting useful suggestions are given to airline service provider to improve further service quality.

Key words: Service quality, GDP, Aviation

1. Introduction

The economy of India is the tenth-largest in the world by nominal GDP and the third largest by purchasing power parity (PPP). The country is one of the G-20 major economies and a member of BRICS. The independence-era of Indian economy is based on mixed economy having capitalism and socialism, hence in an inward-looking, dominant policies and import-substituting economy, failed to take advantage of the post-war expansion of trade.

The overall trend of demand for air transport has been consistently increasing. In the 1950s and 1960s, annual growth rates of 15% or more. The U.S., Australia, Canada, Japan, Brazil, India and other markets have shown this trend. The industry has been observed to be cyclical in its financial performance. India aviation industry promises huge growth potential due to large and growing middle class population, favorable demographics, rapid economic growth, higher disposable incomes, The industry has grown at a 16% in passenger traffic terms over the past decade. With advent of LCCs and resultant decline in yields, passenger traffic growth which averaged 13% in the first half has increased substantially to 19% during 2006-2011, aspirations of the middle class, and overall low penetration levels. This paper proceeds with a literature review. Next, we explain our methodology and data. The fourth part of the paper discusses the empirical findings. The conclusions section offers policy implications.

2. Research Questions

With the certainty of overall, availed literature, the study is enabling to focus some questions which can be answered by this study. The research questions for this study can be framed as follows;

- Are the services offered customized?
- What is the difference between developed and underdeveloped country airfare?

3. Objectives

From the above research questions, the objectives of the study can be outlined as follows;

- To study the existing course of services, provided by the airlines.
- To know, the different further possible services can be offered with the same fare and, what is its trend.

4. Uniqueness of Air Transportation

Airlines can make unbroken journeys over land, sea, desert or mountains and without any hindrance from lakes, swamps or rivers. Delays, inconvenience and expense of transshipment are avoided and short direct routes can be substituted for tortuous ground routes. In the economic sphere it is basically determined by its two main economic characteristics like
It is greater speed and independence of the nature of the surface over which it operates

5. Reviewing the Literature

Indian aviation is the ninth largest market in the world, which has significant contribution to the business and tourism growth of our country. The irony of the sector, which serves the world's fastest growing economies and shows exceptional growth in traffic, is that almost all Indian carriers are in the commotion. The industry has high growth rates of all modes of transport with annual global growth were approximately 10% in the 1960s and 5% -7% in the 1990s. As of April 28, 2009 The Guardian article notes that, "the WHO estimates that up to 500,000 people are on planes at any time."

Indian airports handled 56 million passengers and 1.5 million tons of cargo in the year 2006-2007, an increase of 31.4% for passenger and 10.6% of cargo traffic over the previous year. The dramatic increase in air traffic for both passengers and cargo in recent years has placed a heavy strain on the country's major airports. Passenger traffic is projected to cross 70 million and cargo to cross 3.3 million tons by the year 2011.

Particulars	Units	International	Domestic	Total
Aircraft Movements	Nos.	3,00,197	10,93,663	13,03,860
Passengers Handled	Nos.	3,79,07,547	10,55,22,726	14,34,30,273
Cargo	Tones	14,96,239	8,52,194	23,48,436

Table 1: Traffic Handled During, 2010-11
Source: 16th Annual Report 2010-11

Measuring the Service Quality is one of the greatest challenges facing virtually every Organization. In this era of Total Quality Assurance, every organization must define and manage service quality. As the markets mature, service becomes a powerful competitive weapon, and indeed in some cases, the only form of differentiation.

The taxes, fees and charges imposed on air travel are constantly changing and can be imposed after the date of ticket issuance. If a new tax, fee or charge is imposed even after ticket issuance or there is an increase in a tax, fee or charge shown on the ticket, passengers will have to pay it. Applicable taxes, fees and charges imposed by governments or other authorities or by the operator of the airport will be in addition to the otherwise applicable fares and shall be payable by the passenger to the extent they are not already included in the fare.

Service is an organized system of labour and material aids used to supply the needs of the public. "Customer service is a series of activities designed to enhance the level of customer satisfaction – that is, the feeling that a product or service has met the customer expectation."[9]. A service is any actor's performance that one party can offer to another that is essentially in intangible and does not result in the ownership of anything. Its production may or may not be tied to physical product [4]. Service quality can thus be defined as the difference between customer expectations of service and perceived service. If expectations are greater than performance, then perceived quality is less than satisfactory and hence customer dissatisfaction occurs ([6, 7]).

Gronroos postulated that two types of service quality exist: technical quality, which involves what the customer is actually receiving from the service, and functional quality, which involves the manner in which the service is delivered [3].

Wei and Hansen (2006) classify the passengers' benefits resulting from airport capacity expansion into two categories: direct benefits and indirect benefits. Indirect benefits are obtained through airlines' adaptation and service improvements after expansion.

Figure 1
Source: Global Commercial Airline Industry outlook, June 2013 –IATA

Figure 2
Source: CAPA, AAI

6. Research Design and Analysis

The first part of the study will be based on available secondary data, from journals and annual reports of IATA, ICAO, ATAG, Flight global data, Ministry of Civil Aviation & DGCA-Govt. of India. The second part of the study, where analysis will be, based on primary data collected from the Hyderabad City only. Each research methodology has its own relative weakness and strength [11]. There are different methods to be followed according to the kind of study and data to be analyzed.

Different aspect of passenger usually concerned to three parts like service on airport, in side airline and the service related to the booking, information related to before boarding, and others. For this study 39 variables considered from 160 items which were collected from the existing literature. The basic structured questionnaires are about 5- point Likert scale and having two sections, like section-A is for service related variables whereas section-B for demographic profiles of the passenger. The study is explorative [8] though the first part is descriptive in nature.

The data were collected across the Hyderabad city which contributes more than-3% of passengers to the total population. Purposive sampling is an approach whereby the researcher selects a non-probability sample they believe is representative of the population as a whole [14]. The researcher has visited the concerned airport frequently and consulted for respective official also accessed the passengers. The proposed sample is based upon 95 percent confidence level and 5 percent sampling error [5]. As far as the geographical locations are concerned all the Passengers, airports and airlines are basis wise exploited to study the potential service quality for the entire airlines service supply chain.

Using the passenger aspects as subjected to study, this paper attempts to determine the different services perceived by the passenger and its impact towards the airlines and airports and to find any possibility to offer more value. Aggregate behavior aspects of the passenger is assumed to be a function of airport related services, services offered by the concerned airlines and other direct and indirect services. This relationship can be modeled as;

"Passenger aspect = f (Xi, Yi')"   (1)

Where Xi= airport services   i = 1-17s

Yj = airline services   j = 1-18s

But airport related services will continue till the passenger enplaned inside the aircraft. For this study it is with more than seventeen important and effective variables are considered, while 18 variables considered for service provided by airline.

Service quality is diverse activities both tangible as well as intangible which unlike to product features. The intangible which is subjectivity like comfort, experience, softness and safety etc. makes difficulties to quantify for the study. There is no any confining measurement scale to ascertain. It is different to, people to people, service provider to medium. Different service characteristics like intangible, perisahability, heterogeneity and inseparability makes more confusion, vague and imprecise. Though there is lots of literature available to study about service quality in airlines, most of them based on statistical methods. But, when the word like satisfied, fair, good, poor, agreed will come across compelled us towards the vague or imprecise conclusion.

With these pitfalls, many pioneers and scholars came with a solution called as fuzziness. The fuzzy set theory was introduced by Zadeh (1965). Fuzzy numbers are a subset of real numbers and extension of the crispy function, with expansion of the confidence interval. Even though there was strong resistance to fuzzy logic, many researchers around the world became Zadeh's followers. Important concepts introduced by by Zadeh during this period include multistage decision-making, fuzzy similarity relations, fuzzy restrictions and, linguistic hedges. Later on, Bellman, Lakoff, Goguen, Kohout, Gains, Chang, Bezdek's work were most considerable [12].

Lingual expressions like fair, good, poor satisfied etc. are regarded as the natural expression of the preference or judgment. These characteristics indicate the applicability of fuzzy set theory to measure the decision maker's specificity. Fuzzy set theory aids in measuring the ambiguity of concepts that are associated with human being's subjective judgment. Since the evaluation results from the different evaluator's view of linguistic variables, its evaluation must therefore be conducted in an uncertain, fuzzy environment [10]. Linguistic variable we mean a variable whose values are words or sentences in a natural or artificial language. For example, Age is a linguistic variable if its values are linguistic rather than numerical, i.e., young, not young, very young, quite young, old, not very old and not very young, etc., rather than 20, 21, 22, 23. Various ratings are based on subjective judgments, so it is inherently imprecise, when one deals with qualitative data. Hence at best, it may be available in terms of linguistic labels like good, fair, poor [13].
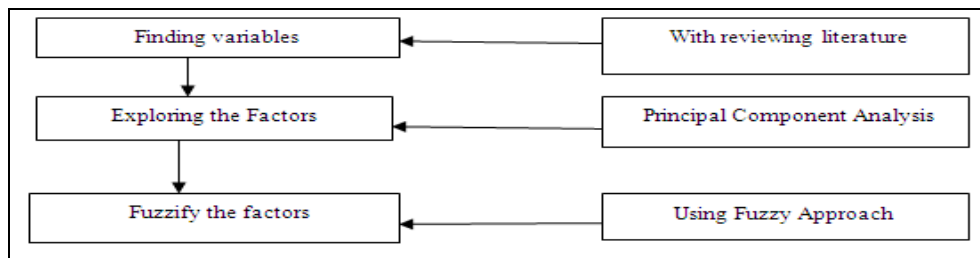

Figure 3

7. Empirical Results

Reliability is the degree to which a test consistently measures whatever it measures. In this study the value of Chronbach Alpha is .895 that means it is ensured that to be best suited as 89 percent. It was tested both internal as well as external validity like construct, converge validity etc.

The study was conducted exploratory factor analysis to extract different aspects of the passenger which influenced level of service quality. Before factor analysis, the study should ensure the enough samples, i.e. sample adequacy otherwise the study will not give proper result. Therefore as a principal component analysis (PCA) was conducted with 41 (and +15) items with orthogonal rotation called as varimax. The KMO measure was verified the sampling adequacy for the analysis with value, KMO = .745 (should be above .5) and all KMO values for individual items are > .56 which is above the accepted limit of 0.5. Again the relative Bartlett's Test of Sphericity - χ^2 (703) = 12087.93, and p = .000 < .001 shows that the correlations between items are sufficiently large for PCA.

		Component Matrix[a]						
Sl. No.	Variables	Components						
		1	2	3	4	5	6	7
1	Availability of escalators	.782						
2	Security system of airport	.797						
3	Courteous of Security Staff	.682						
4	Airport Waiting Facilities	.630						
5	Good Announcement System	.683						
6	Electronic display board	.790						
7	Retail outlets	.611						
8	Restaurants	.678						
9	Convenient Exit system	.622						
10	Good toilet facilities	.627						
11	Airport staff courteous	.779						
12	Premises of the airport as clean	.858						
13	portal user friendly		.408					
14	Quality Eatables		.408					
15	Functionality of Laptop and Mobil chargers		.391					
16	Provision of physical disabled passengers		.702					
17	courteous of supporting staff before boarding		.668					
18	Interior cleanness of Aircraft		.683					
19	Various magazines offered by Airline		.761					
20	Fare of airline was reasonable		.747					
21	Charge for overweight baggage was reasonable		.751					
22	Good solution was provided for missing baggage		.889					
23	Message was sent to passenger's mobile about journey related information		.768					
24	variety of eatables by airline			.559				
25	Quality eatables by airline			.773				
26	Airline made u feel safe			.512				
27	Airline provide promised services			.411				
28	space for Passenger's Queue				.366			
29	Level of your satisfaction that was handled				.575			
30	It was easy to contact the staff for any problem				.459			
31	In flight services of aircraft was up-to-date				.674			
32	Up to and accurate information and					.498		
33	Appearance of Airline employees					.364		
34	Adequacy of staff number					.400		
35	Flight arrived in time as promised					.436		
36	If yes, then it was how					.473		
37	Friendliness of staff to passengers						.525	
38	useful documents regarding services which will be performed						.444	
39	Informing to passengers about when service to performed						.527	
40	Availability of Carrier wheels							.530
41	Aircraft has comfortable seats							.529
	Extraction Method: Principal Component Analysis. Items-39							

Table 2

An initial analysis was run to get Eigen-values for each component in the study. This can be shown detail in the above figure. From this analysis, 13-components have Eigen-values over Kaiser's criterion of 1 and that explained more than 81.7 of the variance. The Scree plot is little ambiguity shows inflections that will justify the retaining the 5th and 9th components. So it is confirmed that minimum 7 factors cane retained here. If we will give the large sample size and the convergence of the Scree plot and Kaiser- Criterion on seven components, that is the number of factors to be retained for the final analysis. The items that grouped on the components named as availability and facilities, cleanliness and hygiene, qualities before quantity, sincerity, luxurious and valued, courteous and friendly, appearance and adequacy, functionality, exactness and reliable, and spacious etc.

The evaluators were asked to give their judgments and each linguistic variable can be indicated by a triangular fuzzy number within the scale range 0 to 1. So the evaluators can subjectively assume their personal perception range of the linguistic variable to each item. According to the definition made by [2], those numbers that can satisfy these three requirements will then be called fuzzy numbers, and the following is the explanation of the features and the calculation of the triangular fuzzy number. For example a respondent give an expression to "satisfied", the membership functions of expression values can be indicated by triangular fuzzy number $\mu A(X) = (L, M, U)$ within the scale range of 0 to1 , so the respondent can subjectively assume his/ her range of linguistic variable $\mu A(satisfaction) = (0.2, 0.3, 0.4)$, which can be shown in the following figure:
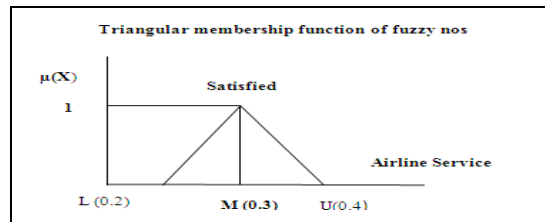

Figure 4

Algebraic operation of Fuzzy number
The basic arithmetic operations on fuzzy numbers have been proposed in different literatures. This can be discussed as follows. For example P and Q are two triangular fuzzy numbers.

I) The basic addition of fuzzy numbers:
$$P \oplus Q = (l1+l2, m1+m2, u1+u2) \quad (2)$$
Where, l1, l2, m1, m2, u1, u2 are real numbers.
II) The subtraction operation on P and Q
$$P - Q = (l1-l2, m1 -m2, u1-u2) \quad (3)$$

III) The division operation on P and any real number x
$$P/x = (l/x, m/r, u/r) \quad (4)$$
IV) Multiplication of triangular fuzzy number Θ
$$P \Theta Q = (l1 \Theta l2, m1 \Theta m2, u1 \Theta u2) \quad (5)$$

The above operations on fuzzy numbers will be applied to measure the service quality of airlines with this study. For instance, the subjective expression of a respondent is "satisfied" about the one item. The linguistic variable "satisfied" can be expressed in a triangular fuzzy number P= (0.2, 0.3. 0.4). And the subjective expression from another respondent is "very much satisfied". The linguistic variable "very much satisfied" can be expressed in a triangular fuzzy number Q = (0.3, 0.4, 0.5).

Hence from the above formula (2), the total subjective service quality for both the passengers we can get.

P $\square$ Q = (0.5, 0.7, 0.9).

Due to every respondent perceives differently to every attribute, so for the value of the linguistic variable varied among individuals. For this we can integrate or find the average of the overall fuzzy judgments by following equation [10].

AV1j = (1/n) Ө (P1j $\square$ P2j $\square$ P3j, ………, Pnj)   (6)

Where, n = no of respondent

j = for attribute or item or variable

For the above process the study has scaled in triangular format as below.

Linguistic Variables In Triangular Form	
Highly satisfied	(0.4, 0.5, 0.5)
Satisfied	(0.3, 0.4, 0.5)
Neither satisfied nor dissatisfied	(0.2, 0.3, 0.4)
Dissatisfied	(0.1, 0.2, 0.3)
Highly dissatisfied	(0.0, 0.1, 0.2)

Table 3

By considering the above table, the respondents' subjective valuation can be changed to triangular form and then we can find the average value of each of the attribute. Before going to reality of items we have to be profiled to the demographic variables which are used to validate the questionnaire. The study has taken more than 10 demographic questions, starting from name, gender, age to "reason for choosing the particular airline." The survey was conducted both online as well as offline. Around 300 questionnaires are sent to air passengers. Among the 300 questionnaires, 213 were returned with the rate of 71% as it is unexpected higher due to of judgment sampling techniques was followed. Out of that 80% are male, while only 20% female. From the passengers' point of view, 60% are age of 25-40, 20% of 41-65, 15% are of under the age 25 and 5% above of 65 of age.

Triangular Fuzzy number and their ranks							
Variables	Fuzzy form	Average	Rank	Variables	Fuzzy form	Average	Rank
V1	(.27, .37, .45)	0.36	17	V21	(.13, .22, .41)	.25	35
V2	(.16, .26, .36)	0.26	34	V22	(.25, .31, .50)	.35	18
V3	(.36, .42, .49)	**0.42**	5	V23	(.22, .34, .45)	.33	24
V4	(.26, .32, .38)	0.32	25	V24	(.12, .29, .31)	.24	36
V5	(.19, .28, .47)	0.31	29	V25	(.38, .41, .49)	**.42**	6
V6	(.30, .39, .50)	.39	11	V26	(.13, .21, .33)	.22	37
V7	(.32, .42, .49)	**.41**	7	V27	(.12, .22, .34)	.22	38
V8	(.33, .49, .50)	**.44**	2	V28	(.10, .21, .32)	.21	40
V9	(.38, .45, .49)	**.44**	3	V29	(.28, .38, .46)	.37	15
V10	(.35, .46, .50)	**.43**	4	V30	(.22, .34, .45)	.33	23
V11	(.21, .42, .49)	.37	16	V31	(.29, .39, .47)	0.38	12
V12	(.13, .29, .44)	.28	32	V32	(.31, .42, .49)	.37	14
V13	(.31, .47, .50)	**0.41**	8	V33	(.12, .23, .31)	.22	39
V14	(.22, .34, .48)	.34	19	V34	(.21, .32, .41)	.31	28
V15	(.12, .33, .41)	.28	31	V35	(.24, .33, .45)	.34	19
V16	(.24, .33, .42)	.33	21	V36	(.21, .32, .41)	.31	27
V17	(.18, .29, .41)	.29	30	V37	(.33, .41, .50)	**.41**	9
V18	(.21, .31, .48)	.33	22	V38	(.23, .34, .41)	.32	26
V19	(.18, .25, .38)	.27	33	V39	(.31, .42, .49)	**.40**	10
V20	(.23, .42, .49)	.38	13	V40	(.41, .44, .50)	**.45**	1
				V41	(.32, .42, .47)	**.40**	10

Table 4

Note: Vi = variables of service quality, i = 1 to 41

The ranks 2 & 3; 5&6; 7, 8 &9; 12&13; 14, 15 & 16; 19 & 20; 21, 22, 23& 24; 25& 26; 27, 28& 29; 37, 38 & 39 are having the same rank.

From the above fuzzy table, airlines have to improve as earlier as to top ten service variables like availability of sufficient carrier wheels, good restaurants, Courteous of Security Staff, Retail outlets, Convenient Exit system, Good toilet facilities, portal user friendly, Quality eatables by airline, Friendliness of staff to passengers, Informing to passengers about when service to perform, Aircraft has comfortable seats etc. The interesting finding is that it gives a little different with Eigen values which were in factors analysis in the table -2. Though the clearest results can be found through the regression analysis, the fuzzy logic gives more accuracy without any standard error. Since human judgments and preference are often vague and cannot estimate his preference with an exact numerical value. Thus, fuzzy set theory is an appropriate method for measuring passenger's perception [1].

8. Conclusion

This study has attempted to explore the different services of airlines to passengers before low cost carrier. The finding, suggests that airfare mostly not much affects to sustain in business of competitive edge in case of business class but it is effects of economy class. This study was based upon the economy class and it can be implemented in the business class. So that it should be strategic and empirically justified, otherwise the investor will loss of second to opportunities. Though the market is very complex and volatile related to services, optimal benefit should be appreciated. This study is having some limitations. The survey was conducted only on the Hyderabad city with limited sample size. It is focused to rank the variables not to factors though these were extracted and it has not compared with the regression analysis. The study follows with a simple average to make it ranks after generating the triangular fuzzy numbers for each variable. But it can be measured after making the defuzzifying the triangular numbers.

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